SOUTH COUNTY REGIONAL WASTEWATER AUTHORITY

Santa Clara Valley Water District

2015 South County Recycled Water Master Plan Update

FINAL | May 2016

AKEL ENGINEERING GROUP, INC.

MWH

BUILDING A BETTER WORLD

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The *2015 South County Recycled Water Master Plan Update* presents a strategy for expanding use of recycled water in South Santa Clara County over a 20-year planning horizon. The following organizations and individuals provided key contributions to the development of this Master Plan Update.

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Acronyms and Abbreviations

2004 Master Plan	*South County Recycled Water Master Plan* (completed in 2004)
2010 EA	Final Environmental Assessment Recover Act Funding for the Short Term Phase I Component of the South County Recycled Water Master Plan Project
2011 PEIR	Final Program Environmental Impact Report for 2004 South County Recycled Water Master Plan
2015 Master Plan Update	*2015 South County Recycled Water Master Plan Update*
AACE International	Association for the Advancement of Cost Engineering, formerly American Association of Cost Engineers
ADD	average day demand
adj RNa	adjusted SAR
ADWF	average dry weather flow
AF	acre-foot
afy	acre-feet per year
AG	agricultural
AGR	agricultural water supply
AOP	advanced oxidation processes
AWPF	advanced water purification facilities
AWWA	American Water Works Association
B	boron
BOD	biochemical oxygen demand
Cax	bicarbonate/calcium ratio
CCQCB	Central Coast Regional Water Quality Control Board
CEO	Chief Executive Officer
CEQA	California Environmental Quality Act
CIP	Capital Improvement Program
Cl	chloride
CWC	California Water Code
DBPs	disinfection byproducts
DDW	State Water Resources Control Board Division of Drinking Water
District	Santa Clara Valley Water District
DPH	Department of Public Health
DPR	direct potable reuse
dS/m	deci Siemens per meter
DWP	Drinking Water Program
EA	Environmental Assessment
EBDA	East Bay Discharge Authority
EC	electrical conductivity
EIR	Environmental Impact Report
ENR-CCI	Engineering News-Record Construction Cost Index
FAT	full advanced treatment
fps	feet per second

ft	feet
ft^3	cubic feet
ft/kft	feet per 1,000 feet
Gilroy	City of Gilroy
gpm	gallons per minute
GRRP	groundwater replenishment reuse project
HGL	hydraulic grade line
IPR	indirect potable reuse
IS/MND	Initial Study/Mitigated Negative Declaration
kW	kilowatt
LF	leaching fraction
M&I	municipal and industrial
MBR	membrane bioreactor
MCL	maximum contaminant level
MDD	maximum day demand
MF	microfiltration
MG	million gallon
mgd	million gallon per day
µg/L	microgram per liter
mg/L	milligram per liter
MGM	million gallon per month
MH	Morgan Hill
mL	milliliter
MMD	maximum month demand
Morgan Hill	City of Morgan Hill
MPN	most probable number
MUN	municipal and domestic water supply
N	nitrogen, combined nitrogen
Na	sodium
ND	not detectable
NDMA	N-Nitrosodimethylamine
NEPA	National Environmental Policy Act
NH_4	ammonia
NO_3	nitrate
NPDES	National Pollutant Discharge Elimination System
NPR	non-potable reuse
NTU	Nephelometric Turbidity Unit
NWRI	National Water Research Institute
O&M	operations and maintenance
PEIR	Program Environmental Impact Report
ppb	parts per billion
PHD	peak hour demand
PRC	Public Resources Code
psi	pounds per square inch

Reclamation	U.S. Department of the Interior, Bureau of Reclamation
Regional Water Board	Regional Water Quality Control Board
RO	reverse osmosis
RWC	recycled wastewater contributions
RWF	Wastewater Facility
SAR	sodium adsorption ratio
SAT	soil-aquifer treatment
SBWR	South Bay Water Recycling
SCADA	supervisory control and data acquisition
SCRWA	South County Regional Wastewater Authority
SCVWD	Santa Clara Valley Water District
SF	San Francisco
South County	South Santa Clara County
SVAWPC	Silicon Valley Advanced Water Purification Center
SVCW	Silicon Valley Clean Water
SWRCB	State Water Resources Control Board
TDS	total dissolved solids
THMs	Trihalomethanes
Title 22	California Code of Regulations, Title 22, Division 4, Chapter 3, Sections 60301 through 60355
TM	Technical Memorandum
TMs	Technical Memoranda
TOC	total organic carbon
TSS	total suspended solids
TX	Texas
UNFI	United Natural Foods, Inc.
UF	ultrafiltration
UV	ultraviolet
VFD	variable frequency drive
WDR	Waste Discharge Requirements
WRRF	WateReuse Research Foundation
WWTP	wastewater treatment plant

Executive Summary

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EXECUTIVE SUMMARY

INTRODUCTION AND BACKGROUND

The Santa Clara Valley Water District (SCVWD or District), the South County Regional Wastewater Authority (SCRWA), the City of Gilroy (Gilroy), and the City of Morgan Hill (Morgan Hill) are partnered to ensure the continued utilization of recycled water in the southern portion of Santa Clara County and to promote the expansion of recycled water in the region. Recycled water is a reliable source of water for landscape irrigation, agriculture, and industrial applications that can contribute to the long term water security of the region. This report supports the goal of continuing and expanding recycled water use by providing an update to the initial *South County Recycled Water Master Plan* (2004 Master Plan). This report – the *2015 South County Recycled Water Master Plan Update* (2015 Master Plan Update) – includes an updated capital improvement program (CIP) and associated costs for the recycled water system expansion preferred alternatives. Additionally, this Master Plan evaluates the feasibility of emerging uses including indirect potable reuse (IPR) and direct potable reuse (DPR).

The study area for this 2015 Master Plan Update is southern Santa Clara County, in particular, the Cities of Gilroy and Morgan Hill. In this region, wastewater is collected and transported to the SCRWA Wastewater Treatment Plant (WWTP). Wastewater entering the WWTP is treated to different standards depending on the fate of the wastewater. All wastewater undergoes secondary treatment which allows it to be discharged to onsite percolation ponds in accordance with the National Pollution Discharge and Elimination System (NPDES) requirements. Some portion of the secondary effluent is diverted to tertiary treatment facilities, where additional treatment, including granular media filtration and chlorine disinfection, makes the wastewater compliant with California Title 22 Recycled Water Regulations for tertiary disinfected effluent. This recycled water is then used as utility water at the WWTP and delivered to the existing recycled water distribution system.

The existing recycled water system currently supplies 11 users in Gilroy and the surrounding area with recycled water for applications that include: landscape irrigation, agricultural, and industrial. During the 2014 calendar year, 1,995 acre-feet of recycled water were used, which corresponds to an average daily flow of 1.8 million gallons per day (mgd). This report recommends a 20-year, $98 million CIP that will result in greater utilization of recycled water as well as increased reliability of the recycled water system.

MARKET ASSESSMENT

Expanding the use of recycled water in South Santa Clara County (South County) depends on identifying additional users that could benefit from utilizing recycled water in lieu of potable water. A market assessment was thus performed to identify potential recycled water users in both Gilroy and Morgan Hill. These potential users were prioritized based on the following criteria:

- Year-round versus seasonal use
- Proximity to existing distribution system

- Desired use quantity
- Implementation factors
- Preliminary environmental factors

80 potential recycled water users were identified in Gilroy and an additional 79 potential recycled water users were identified in Morgan Hill. The users were categorized based on their recycled water use types, including:

- Landscape and irrigation
- Municipal and industrial
- Agricultural
- IPR
- DPR

The recycled water quality, quantity, and distribution system improvements differ based on the usage types. Disinfected tertiary effluent is sufficient for most landscape and irrigation, municipal and industrial, and agricultural applications, while additional treatment will be required for DPR and IPR.

Recycled water demand for the potential future recycled water users was then quantified based on year round versus seasonal use, and their annual average recycled water demand was estimated. The most viable potential recycled water users where then selected based on the previously described criteria and based on their proximity to the existing recycled water system and to other potential recycled water users. These selections guided the development of the most economical project alternatives.

PROJECT ALTERNATIVES

The 2015 Master Plan Update identifies recycled water system alternatives that would both expand the use of recycled water in southern Santa Clara County and mitigate deficiencies of the existing recycled water system. These alternatives are categorized as either expansions of the existing non-potable reuse (NPR) distribution system or emerging recycled water technologies. The analysis considered both expansions of the recycled water system within Gilroy and initiation of a recycled water system in Morgan Hill. The potential project alternatives are categorized as City of Gilroy Alignments, City of Morgan Hill Alternatives, and emerging technologies.

The first step in identifying the project alternatives was to evaluate the existing system. The existing system is composed of the WWTP facilities, recycled water distribution system, and customer connections. This evaluation utilized current recycled water demands in conjunction with a hydraulic model of the recycled water distribution system. This evaluation found deficiencies in the capacity of the recycled water system to meet peak hour and peak day demands. The next step was identifying recycled water system expansion alternatives that could be implemented to address the system deficiencies and expand the use of recycled water.

City of Gilroy Alignments

The Gilroy alternatives include five alignments that would address system deficiencies and expand recycled water to identified potential recycled water users in Gilroy and surrounding area. These alignments include:

- **Baseline Alignment:** This alignment would extend service westward from the WWTP along Luchessa Avenue through the Glen Loma Development to the Zone 2 Pump Station in Christmas Hill Park, from Christmas Hill Park to Santa Teresa Boulevard, and continue northwest through the Meritage Development. The Baseline alignment is similar to the recommended alignments in the 2004 Master Plan. The 2004 Master Plan alignments were revised based on the imminent roadway and utility infrastructure improvements planned for the Glen Loma and Meritage Developments, easement acquisitions, and completed projects.
    - **Advantages:** Increases system reliability, mitigates system deficiencies, lowest cost supply ($/acre-foot (af)), peak demand projections greater than existing treatment capacity.
    - **Disadvantages:** No Morgan Hill recycled water service except for potential fill station at the WWTP.

- **First Street Alignment:** This alignment would build off the Baseline Alignment and expand the recycled water system to potential customers in northwest Gilroy along First Street and Santa Teresa Boulevard.
    - **Advantages:** Expansion of recycled water services in western Gilroy
    - **Disadvantages:** Requires completion of Gilroy Baseline Alignment, high cost supply ($/af)

- **Lake Kathryne Alignment:** This alignment would build off the Baseline Alignment and extend westward from the Meritage Development to Lake Kathryne to service the existing nurseries in western Gilroy. This alignment is similar to the proposed Hecker Pass extension improvements in the 2004 Master Plan to bring service to the users in western Gilroy.
    - **Advantages:** Expansion of recycled water service in western Gilroy, potentially serving two customers with large annual demands
    - **Disadvantages:** Requires completion of Gilroy Baseline Alignment, new pump station required to lift recycled water to Lake Kathryne

- **High Speed Rail Alignment:** This alignment would extend service along the future High Speed Rail easement along Monterey Road to service potential customers in central Gilroy.
    - **Advantages:** Expansion of recycled water service in central Gilroy
    - **Disadvantages:** Requires completion of Gilroy Baseline Alignment, land and easement acquisition tied to future railroad project

- **Cameron Boulevard Alignment:** This alignment would extend service along Cameron Boulevard in eastern Gilroy to serve customers in central Gilroy similar to the High Speed Rail Alignment.
    - **Advantages:** Expansion of recycled water service in eastern and central Gilroy
    - **Disadvantages:** Requires completion of Gilroy Baseline Alignment, high cost supply ($/af)

City of Morgan Hill Alternatives

The existing distribution system does not provide recycled water to Morgan Hill. The 2015 Master Plan Update evaluated three recycled water alternatives to provide recycled water service to Morgan Hill.

- **Alternative 1 – MH High Speed Rail Transmission Main:** This alignment would extend a pipeline along the future High Speed Rail easement along Monterey Road to convey recycled water from the WWTP in Gilroy to Morgan Hill and service potential customers in Morgan Hill.
    - **Advantages:** Service to Morgan Hill, dual use opportunity for NPR/IPR
    - **Disadvantages:** Highest cost supply ($/af), land and easement acquisition tied to future railroad project

- **Alternative 2 – Joint Trunk Transmission Main:** This alignment would extend a pipeline parallel to existing joint sewer trunk line to convey recycled water from the WWTP in Gilroy to Morgan Hill and service potential customers in Morgan Hill.
    - **Advantages:** Service to Morgan Hill, dual use opportunity for NPR/IPR, potential for joint construction with Morgan Hill sanitary sewer project
    - **Disadvantages:** Highest cost supply ($/af)

- **Scalping Plant:** This alignment would construct a satellite WWTP in Morgan Hill to divert flow from the sewer system and treat it to recycled water quality standards for use in Morgan Hill.
    - **Advantages:** Service to Morgan Hill, dual use opportunity for NPR/IPR
    - **Disadvantages:** Higher cost supply ($/af) than Baseline Alternative, inability to meet existing customer demands due to reduced SCRWA WWTP influent during peak demand periods, inadequate flow in sewer collection system could create odor and clogging problems, resulting sludge loading and reduced flow could substantially change composition of SCRWA WWTP influent potentially leading to compliance issues.

Emerging Technologies

Improvements in advanced water treatment technologies and likely regulatory changes have created new opportunities for wastewater reuse. In addition to the NPR alternatives presented above, the 2015 Master Plan Update provides an assessment of emerging technologies to expand uses including IPR and DPR. This report evaluates regulatory and technical challenges

associated these forms of potable reuse. California Title 22 Recycled Water Regulations provide the regulatory framework for IPR groundwater replenishment projects. There are currently no established regulations in California for DPR projects.

The 2015 Master Plan Update evaluated the feasibility of implementing a groundwater replenishment IPR project in southern Santa Clara County. This alternative may be attractive because it could potentially allow recycled water to be utilized all year long, and specifically, during times when other demands for recycled water were low. The feasibility of a groundwater replenishment IPR project would have to be further evaluated, including an assessment of the need for additional South County recharge and the capacity of the aquifer to accept additional water. This assessment would require water supply system and groundwater modeling. In addition, geochemical compatibility and the potential to remobilize soil nitrate by resaturating the vadose zone would need to be evaluated.

Challenges identified for this alternative include additional treatment that would likely include reverse osmosis (RO) processes. RO treatment processes produce high-salinity brine, referred to as RO concentrate, which requires special disposal considerations. Additionally, the high density of potable supply wells in the region could pose a challenge for finding a suitable groundwater recharge location. Should the use of DPR be approved in California in the near future, other opportunities for recycled water use would become available. The most promising potential use is supplementing flow in the San Luis Conduit, which delivers San Luis Reservoir water to Santa Clara County for groundwater recharge, surface water storage, and treatment at the District's surface water treatment plants.

SELECTED PROJECTS

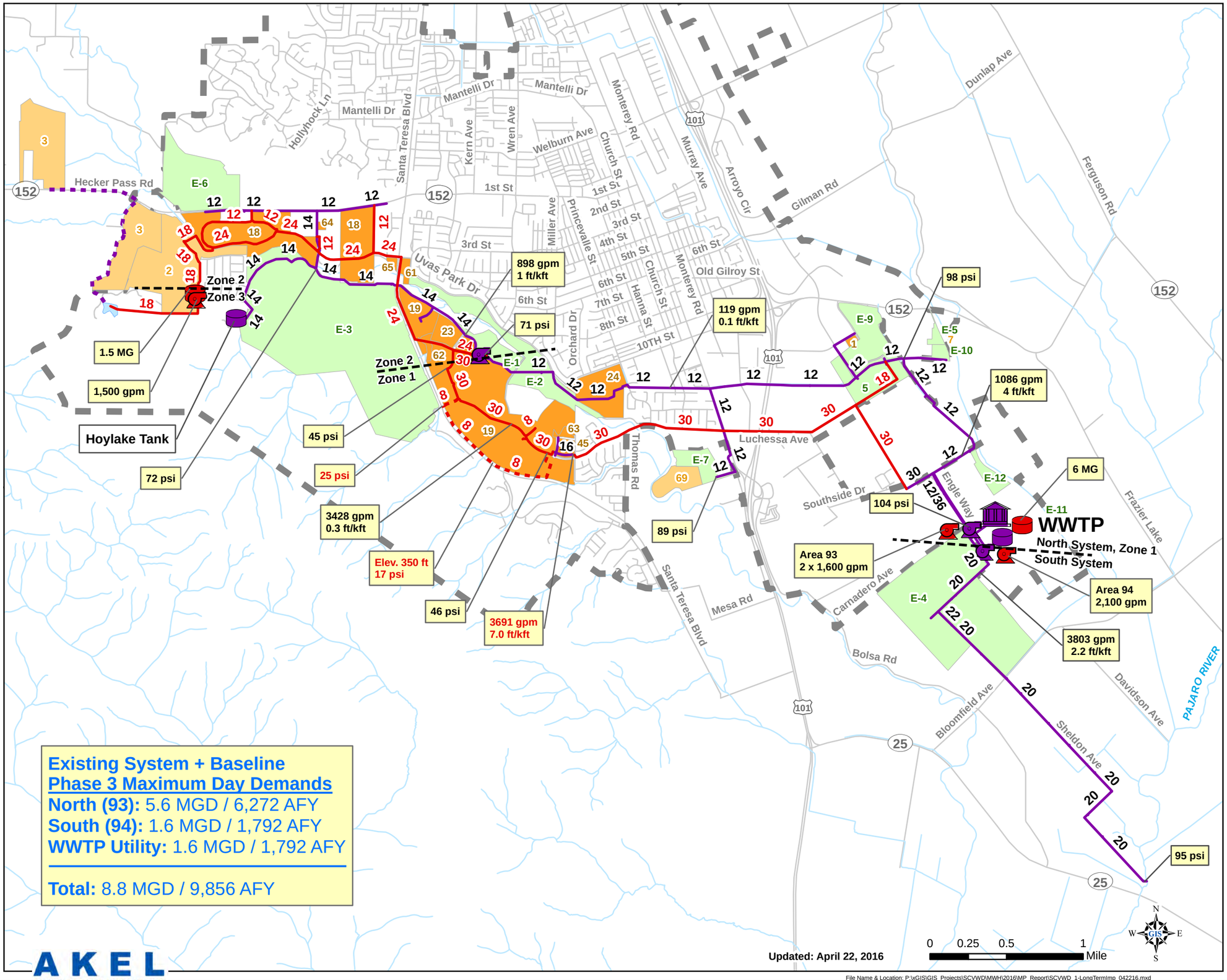
Of the recycled water alternatives considered in the 2015 Master Plan Update, the projects selected for implementation include the Baseline Alignment plus the Lake Kathryne Alignment in Gilroy. These alignments were selected because they would connect recycled water users that were identified in the Market Assessment to be the most economical, mitigate existing system deficiencies, and provide redundancy. The other potential users in Gilroy, not served by this alternative, did not present enough benefit to supply the small water demands at the high cost of infrastructure that would be required. Similarly, none of the Morgan Hill alternatives were selected for implementation because these alternatives did not present enough benefit for expansion due to small water demands and the high cost of infrastructure that would be required.

Alternatives for SCRWA to continue expanding recycled water infrastructure at the WWTP are being evaluated as a separate effort, but available information has been included in the 2015 Master Plan Update so that it may also be reflected in the CIP. More information on the capital

improvement projects planned at the SCRWA WWTP can be found in the SCRWA Capital Improvements Strategic Plan[1], dated October 2011.

The Lake Kathryne Alignment would extend the Baseline Alignment westward from the Meritage Development to Lake Kathryne to service the existing nurseries in western Gilroy. This alignment would require additional recycled water storage and/or pumping facilities. The proposed pipeline alignments, pumping and storage locations for these alignments are shown in Figure ES.1.

[1] For additional information on the SCRWA Capital Improvements Strategic Plan and subsequent version, contact the South County Regional Wastewater Authority (http://www.ci.gilroy.ca.us/561/South-County-Regional-Wastewater-Authori or 408-846-0202).



Existing System + Baseline
Phase 3 Maximum Day Demands
North (93): 5.6 MGD / 6,272 AFY
South (94): 1.6 MGD / 1,792 AFY
WWTP Utility: 1.6 MGD / 1,792 AFY

Total: 8.8 MGD / 9,856 AFY

Updated: April 22, 2016

0 0.25 0.5 1 Mile

N W GIS E S

Legend

Proposed
- Storage Tanks
- Booster Stations
- Long-Term Proposed Pipe
- Additional Conditions Apply

Existing
- WWTP
- Storage Tanks
- Booster Stations
- Recycled Water Pipelines
- Existing User Infrastructure
- Pressure Zone Line
- Existing Users
- In-Progress Users
- Baseline Users
- City Limits
- Roads
- Creeks
- Lake

Note 1: Minimum Pressures + Maximum Flows + Headlosses during Maximum Day Demands shown.

Figure ES.1
Existing System + Baseline Long-Term Improvements
South County Recycled Water System

Santa Clara Valley Water District /
South County Regional Wastewater Authority

Santa Clara Valley Water District

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File Name & Location: P:\xGIS\GIS_Projects\SCVWD\MWH\2016\MP_Report\SCVWD_1-LongTermImp_042216.mxd

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CAPITAL IMPROVEMENT PROGRAM

When developing the 20 year CIP, the Baseline plus Lake Kathryne alignments were divided into the following three segments: 1) Immediate Term Improvements, 2) Short Term Improvements, and 3) Long Term Improvements. The Immediate Term Improvements include the planned pipelines in the Meritage and Glen Loma developments (currently under contract and in construction), planned pipeline upgrades to the WWTP and distribution system connection, pipeline expansion between the WWTP and the Glen Loma development, and planned WWTP expansion projects. These projects help to mitigate the existing system's deficiencies including low pressures in Pressure Zone 1, low pressures at the Pressure Zone 2 pump station, and high headlosses in the existing system while expanding service to existing and new customers.

The Baseline Short Term Improvements include expansion of the system between Thomas Road and Hecker Pass, the remaining planned Glen Loma and Meritage Development system pipelines, expansion of recycled water storage and pump station capacities at the SCRWA WWTP, and customer meter automation. These improvements mitigate the remaining deficiencies in Pressure Zone 1, improve operations and monitoring, expand service, and improve overall system reliability.

The Baseline Long Term Improvements include the pipelines, tank, and pump station for connecting to Lake Kathryne along with a proposed recycled water fill station center for residential and commercial users at the WWTP, and continued planned WWTP expansion projects. These improvements expand service to new customers. A summary of these improvements is shown in Table ES.1.

Table ES.1 Proposed Capital Improvement Program

Capital Improvement Program	Demands			Distribution System Improvement Summary
	Average Day (MGD)	Maximum Month (MGD)	Maximum Day (MGD)	
Existing	2.2	3.8	5.2	-
Immediate - Term	2.9	5.1	7.7	**Distribution System Improvements:** • 14,840 feet of 30-inch diameter pipeline • 4,130 feet of 24-inch diameter pipeline • 2,430 feet of 18-inch diameter pipeline • 3,650 feet of 12-inch diameter pipeline • 1,550 feet of 8-inch diameter pipeline **Planned WWTP Recycled Water Projects:** • Area 94 (South) Recycled Water Pump Station Upgrade • UV Treatment Facility (9 MGD)
Short - Term	3.0	5.6	8.5	**Distribution System Improvements:** • 5,810 feet of 30-inch diameter pipeline • 8,150 feet of 24-inch diameter pipeline • 2,630 feet of 12-inch diameter pipeline • 5,270 feet of 8-inch diameter pipeline **Planned WWTP Recycled Water Projects:** • Area 93 (North) Recycled Water Pump Station Upgrade • Reservoir Expansion (Additional 6 MG) • Chlorine Contact Basin and Reservoir Return Pump Station Upgrade • Automated Flow Measurement and Smart Meter Conversion (proposed wholesaler/retailer improvement)
Long - Term	3.3	6.2	8.8	**Distribution System Improvements:** • 7,010 feet of 18-inch diameter pipeline • New 1.5 MG Zone 2 Tank • New 1,500 gpm Zone 3 Pump Station **Planned WWTP Recycled Water Projects:** • SCRWA WWTP Expansion Project, MBR (2.5 MGD Expansion) • Recycled Water Fill Station

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Key:

gpm = gallons per minute
MBR = membrane bioreactor
MG = million gallon
WWTP = wastewater treatment plant
MGD = million gallons per day
SCRWA = South County Regional Wastewater Authority
UV = ultraviolet

COST ESTIMATES

To further support planning and implementation of the proposed CIP, Class 5 order of magnitude cost estimates were developed for each component of the Immediate Term, Short Term, and Long Term improvements. The Association for the Advancement of Cost Engineering states that a Class 5 order of magnitude cost estimate is not supported with detailed engineering data about the specific project, and its accuracy is dependent on historical data and cost indices. It is generally expected that this estimate would be accurate within -30 percent to +50 percent. The order of magnitude cost estimates of the identified Immediate Term, Short Term, and Long Term improvements are presented in Table ES.2.

The estimated costs include $34 million for the recycled water distribution system and $64 million for WWTP expansion project costs, for a total of $98 million. Furthermore, the annual cost per acre-foot of water was calculated at $1,122/af for the distribution system only and $2,901/af for the entire CIP.

Table ES.2 Capital Improvement Program Costs

Description	Capital Improvement Program Scenario		
	Immediate - Term	Short - Term	Long - Term
Distribution System Costs			
Pipelines	$7,664,000	$5,326,000	$1,507,000
Tanks			$2,400,000
Pump Stations	(Costs Included in Planned WWTP Projects)		$1,108,000
Land Acquisition			$327,000
Sub Total	**$7,664,000**	**$5,326,000**	**$5,342,000**
Estimating Contingency (20%)	$1,533,000	$1,065,000	$1,069,000
Construction Contingency (20%)	$1,840,000	$1,278,000	$1,282,000
Administration Contingency (30%)	$3,311,000	$2,301,000	$2,308,000
Sub Total (Incremental)	**$14,348,000**	**$9,970,000**	**$10,001,000**
Distribution System Total for Entire CIP		$34,319,000	
Planned WWTP Recycled Water Project Costs			
Planned WWTP Recycled Water Projects[1]	**$4,445,000**	**$8,415,000**	**$50,850,500**
Planned Total for Entire CIP		$63,710,500	
Distribution System and Planned WWTP Recycled Water Projects Costs			
Total Project Costs (Incremental)	**$18,793,000**	**$18,385,000**	**$60,851,500**
Total Project Costs for the Entire CIP		$98,029,500	

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Notes:

1. The planned WWTP Recycled Water Projects include construction plus indirect costs, approximately 35% contingencies per SCRWA staff.
2. The Planned WWTP Recycled Water Projects have been provided by SCRWA for informational purposes and is not apart of the CIP recommended improvements
3. The Planned WWTP Recycled Water Project improvements include those listed on Table ES.1. More information on the capital improvement projects planned at the SCRWA WWTP can be found in the SCRWA Capital Improvements Strategic Plan , dated October 2011.

Key:

CIP = Capital Improvement Program

SCRWA = South County Regional Wastewater Authority

Chapter 1

Introduction and Background

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1 INTRODUCTION AND BACKGROUND

1.1 INTRODUCTION

The Santa Clara Valley Water District (SCVWD or the District) and the South County Regional Wastewater Authority (SCRWA) intend to expand the use of recycled water in the southern portion of Santa Clara County, California, specifically in and near the Cities of Gilroy and Morgan Hill.

The District Board's Governance Policies and Chief Executive Officer (CEO) Interpretations guide development of its recycled water program.

- The Board defines in writing its expectations about intended effects to be produced, intended recipients of those effects, and intended worth of the effects through Ends policies. The Board's water supply goal related to recycled water is contained in Ends Policy **E-2.1**: Current and future water supply for municipalities, industries, agriculture and the environment is reliable.
- The Board's water supply objectives are contained in the following Ends policies:
    - **E-2.1.1**: Aggressively protect groundwater from the threat of contamination and maintain and develop groundwater to optimize reliability and to minimize land subsidence and salt water intrusion.
    - **E-2.1.4**: Protect, maintain and develop recycled water
    - The CEO Interpretation of these Ends policies includes:
        - OM 2.1.4.a: At least 10% of annual recycled water production as a percentage of total County water demands by 2025.

Additionally, the District's intent to increase recycled water use throughout Santa Clara County is discussed in District policy documents, such as the Urban Water Management Plan, Integrated Water Resources Plan, and Groundwater Management Plan.

In order to facilitate the expansion of recycled water use in South Santa Clara County (South County), the District and SCRWA have partnered. SCRWA operates the South County Regional Wastewater Treatment Plant (WWTP) in the City of Gilroy. In 1999, the District, the City of Gilroy (Gilroy), the City of Morgan Hill (Morgan Hill), and SCRWA entered partnership agreements with SCRWA as the producer, the District as wholesaler, and the Cities of Gilroy and Morgan Hill as retailers to develop a recycled water project. An element of the agreements was the preparation of a Master Plan for addition recycled water projects.

The initial *South County Recycled Water Master Plan* (2004 Master Plan) was completed in late 2004. It identified Immediate Term, Short Term, and Long Term recycled water capital investment projects to improve the South County recycled water system's reliability and to expand the use of recycled water in South County. Table 1.1 shows the recommendations of the 2004 Master Plan and the projects that have been completed as of 2015.

Table 1.1 Recommended and Completed Projects from the 2004 Master Plan

Capital Improvement Program Phase (2004 Master Plan)	Distribution System Improvements (2004 Master Plan)	Completed Projects[1] (as of 2015)
Existing	-	-
Immediate–Term	• 3,000 feet of 12-inch diameter pipeline • Retrofit existing Hecker Pass pipeline • 3-MG storage reservoir • 3-mgd on-site WWTP pump station **COMPLETED**	• 4,800 feet of 20-inch distribution pipeline • 3-MG storage reservoir • 3-mgd on-site WWTP pump station (total 6-mgd pumping capacity) • Increased tertiary filtration capacity at the SCRWA WWTP • Retrofit 7,500 ft of existing 12-inch pipe
Short Term	• 16,000 feet of 16-inch diameter pipeline • 24,000 feet of 30-inch diameter pipeline • 3-MG storage reservoir • 6-mgd on-site WWTP pump station **IN PROGRESS**	• 3,000 feet of 36-inch and 30-inch distribution pipe • (2) Turnouts • 1 1,900 ft of 30-inch pipe *(Under Construction)*
Long Term	• 14,000 feet of 16-inch diameter pipeline • 2-mgd booster pump station expansion **IN PROGRESS**	• 9,200 ft of 24-inch pipe *(Under Construction)*

Key:
2004 Master Plan = 2004 South County Recycled Water Master Plan
ft = feet
MG = million gallon
mgd = million gallon per day
SCRWA = South County Regional Wastewater Authority
WWTP = wastewater treatment plant

Notes:
[1] Completed projects differ slightly (pipe sizes, distances, etc.) from what is listed for the 2004 Master Plan because projects were modified as planning and design of the projects progressed to improve operations, incorporate conditions of easement agreements, and resolve unforeseen conflicts. .

In addition, the District and SCRWA are continuing to implement the planning, design, and construction of projects from the 2004 Master Plan including:

- 14,000 linear feet of new pipeline extensions, with an estimated completion in 2016
- Additional pumping and storage capacity at the SCRWA WWTP

This document serves as an update to the 2004 Master Plan and will update potential users, recycled water requirements, demand projections, alternatives and the capital improvement program (CIP) for recycled water projects over the next five years and beyond.

1.1.1 Study Area

The study area includes the Cities of Gilroy and Morgan Hill. **Figure 1.1** shows the boundaries of the Cities of Gilroy and Morgan Hill. The area is bounded by agricultural fields to the North, East, and South and by hillsides to the West.

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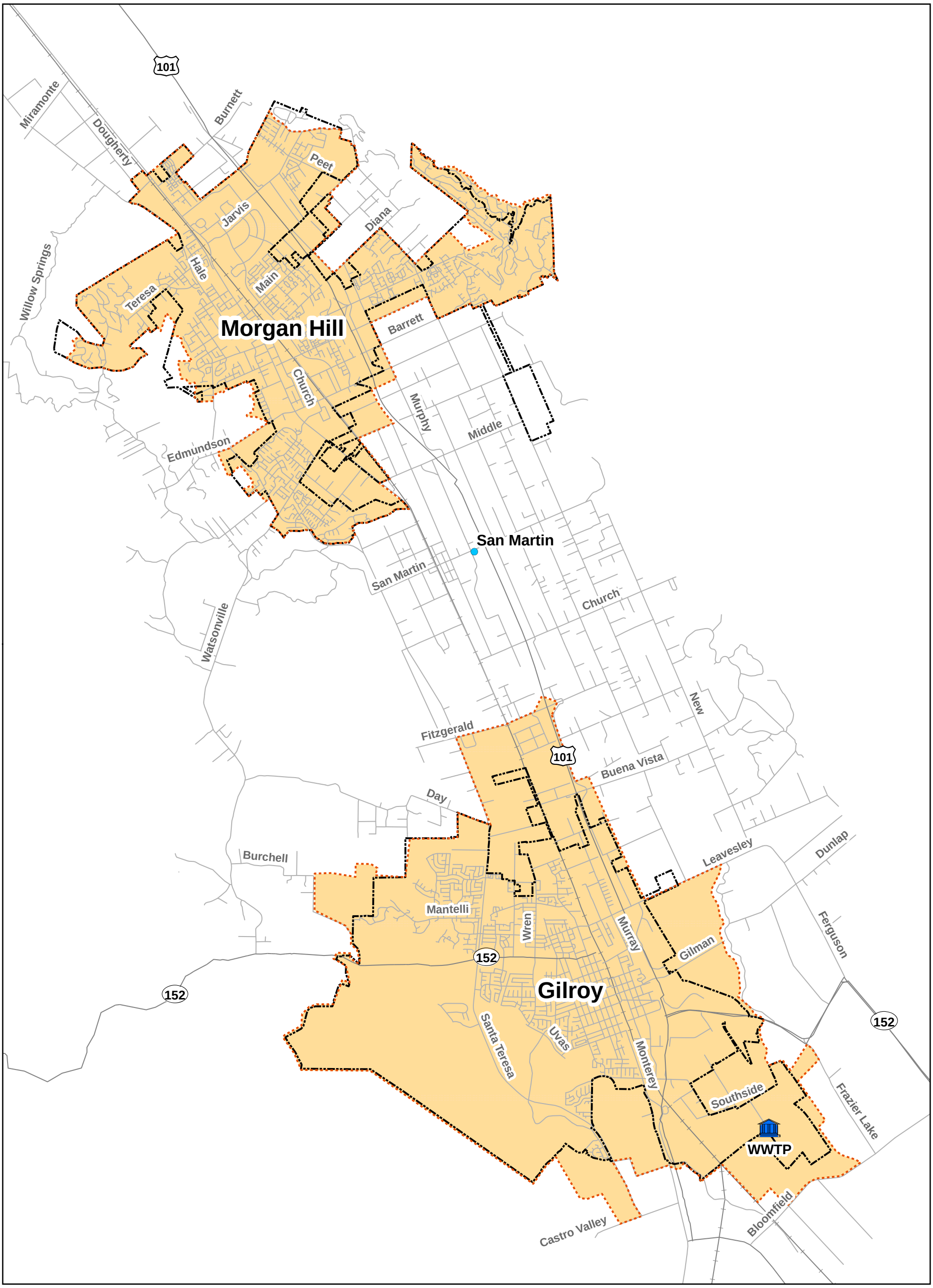

Legend

- WWTP
- Cities
- City Limits
- Urban Growth Boundary
- Roads
- Highways
- Railroads

Updated: May 9, 2011

0 0.5 1 2 Miles

N W GIS E S

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File Name: SCRWA_Fig1UBGProj_050911 File Location: [P]: XGIS/Projects/SCRWA

Figure 1.1
Study Area Map

South County Recycled Water System

Santa Clara Valley Water District /
South County Regional Wastewater Authority

Santa Clara Valley Water District

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1.2 PURPOSE OF STUDY

The *2015 South County Recycled Water Master Plan Update* (2015 Master Plan Update) presents a strategy for expanding use of recycled water in South Santa Clara County over a 20-year planning horizon. The purpose of this study is to develop an update to the 2004 Master Plan for the District and SCRWA to further expand the use of tertiary treated recycled water within the South County area and assess the potential for potable reuse options. From the time that the 2004 Master Plan was completed, various projects have been completed including:

- Installation of 4,800 feet of 20-inch distribution pipeline and 3,000 feet of 36-inch and 30-inch distribution pipe.
- Associated distribution facilities (control valves, isolation valves, and blow-off assemblies)
- Increased capacity of the tertiary filters constructed a 3-million gallon (MG) storage reservoir and increased the total pumping capacity to 6 million gallon per day (mgd) (firm capacity) at the SCRWA WWTP.

The purpose of the 2015 Master Plan Update includes the following:

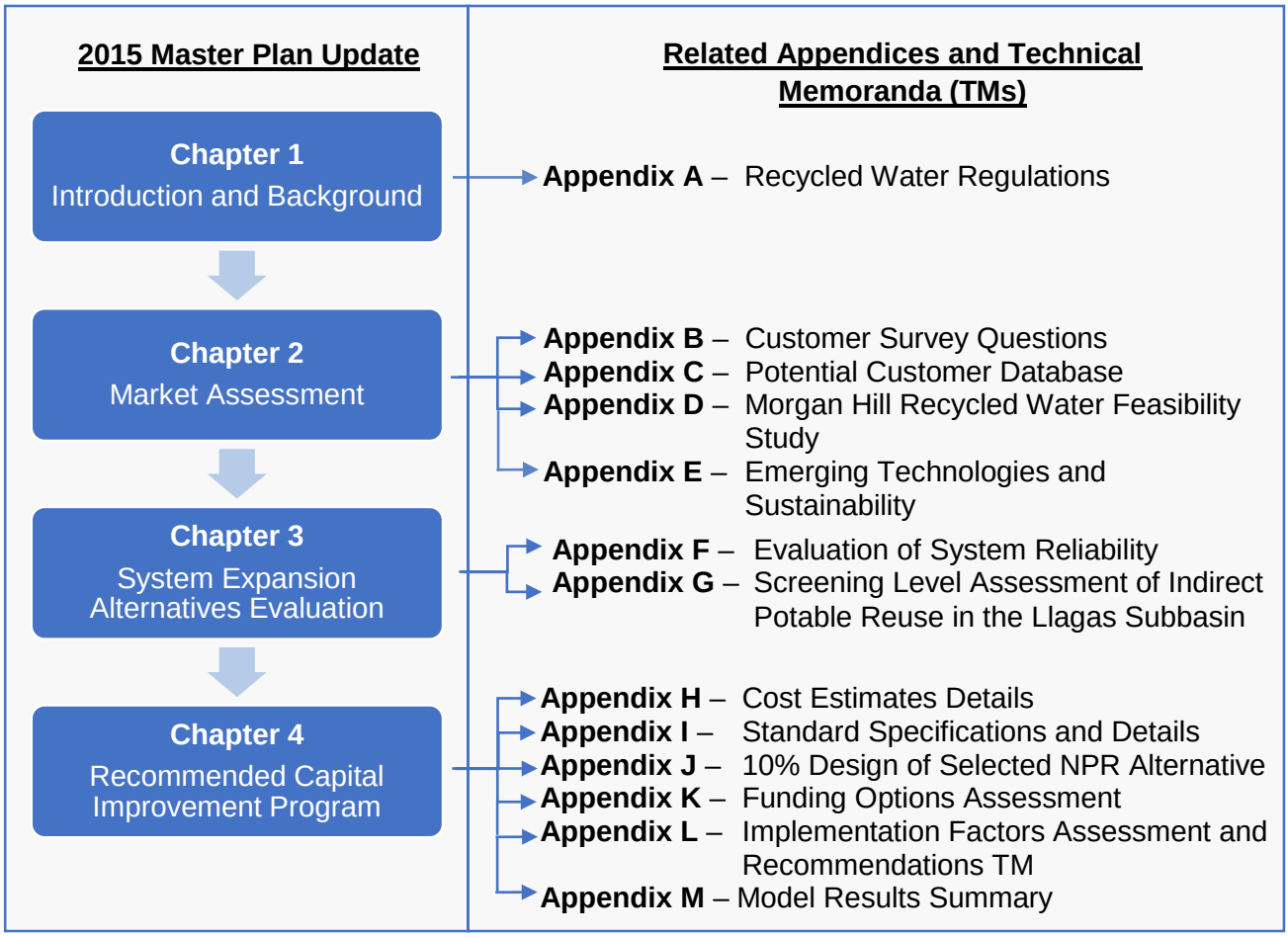
- Identify potential new customers and recycled water requirements
- Update regulatory and treatment requirements
- Update demand projections
- Evaluate recycled water options for Morgan Hill
- Develop and evaluate alternatives
- Develop system operational guidelines
- Determine recommended improvement projects
- Prepare 10% designs of the recommended non-potable reuse (NPR) alternative
- Identify outreach, environmental, and funding needs

The projects identified in the 2015 Master Plan Update have been selected to improve the reliability of the County's Long Term water supplies by offsetting groundwater use with recycled water.

1.2.1 2015 South County Recycled Water Master Plan Update Organization

The 2015 Master Plan Update is organized into five chapters and includes Technical Memoranda (TMs) and other analyses as appendices. The general organization of the 2015 Master Plan Update is shown in Figure 1.2.

Figure 1.2 2015 Master Plan Update Document Organization



Chapter 1 of the 2015 Master Plan Update provides an update on the background and introduction to the South County Recycled Water System including updates to the SCRWA wastewater treatment, recycled water use, recycled water regulations and potential future regulatory issues.

Chapter 2 of the 2015 Master Plan Update identifies, quantifies, and evaluates potential recycled water customers. For the Immediate Term, the 2015 Master Plan Update evaluates customers and alternatives that will create an immediate increase in recycled water demand. For the Short Term, the 2015 Master Plan Update evaluates users that can be feasibly implemented in the Short Term to increase recycled water demand. For the Long Term, the 2015 Master Plan Update identifies market demands and potential future customers that can be approached in the future should recycled water become available through system expansion or other means.

Chapter 3 of the 2015 Master Plan Update investigates alternatives for system expansion including alternatives and hydraulic analyses for expanding the existing NPR distribution system, as well as potential emerging technologies to support Indirect Potable Reuse (IPR) and

Direct Potable Reuse (DPR). Furthermore, this chapter reviews the updated projected system demands and provides system operational guidelines that can be used during periods of low and high demand.

Chapter 4 of the 2015 Master Plan Update describes the selected alternative and summarizes updates to the recommended capital improvement projects and CIP needed to improve the recycled water distribution system's reliability and capacity to mitigate existing capacity deficiencies, to improve system reliability, and to accommodate future system expansion. The ultimate goal is to recycle as much of the discharge from the SCRWA WWTP as possible and to have the production and distribution infrastructure in place to allow for additional users and increasing demands. This chapter also outlines funding options, discusses implementation factors and public outreach, and identifies California Environmental Quality Act (CEQA) requirements and provides options for CEQA documentation for the 2015 Master Plan Update.

1.3 BACKGROUND

1.3.1 Background Reports

Several existing reports and studies were reviewed to provide general background information for development of this document. These reports are used throughout the 2015 Master Plan Update as reference materials and to insure consistency with other District and SCRWA reports and documents.

The reports reviewed and referenced in this document are summarized in Table 1.2, including title, date, and author.

1.3.2 Existing Water Supply Management Efforts in South County

Various other water supply management and master planning efforts are also being conducted in South County including the Urban Water Management Plans (UWMP) for the City of Gilroy[2] and Morgan Hill[3] and the South Bay Water Recycling (SWBR) Strategic and Master Plan[4]. These plans investigate ways to implement and maintain the reliability of urban water supplies, ensure that future beneficial use can be complemented by sufficient water supply, and discuss non-potable and potable reuse opportunities.

1.3.3 Existing Water Purveyors

SCVWD acts as the water wholesaler and manages the groundwater basin in the South County. The Cities of Gilroy and Morgan Hill serve as the water retailers, providing water directly to customers. The City of Gilroy's municipal water system extracts groundwater from underground aquifers through 9 active wells located throughout the City. The City of Morgan Hill obtains its municipal water supply from 17 groundwater production wells. The municipal water supply is

[2] The City of Gilroy UWMP, which discusses urban water supplies, is available at http://www.cityofgilroy.org/265/Water-Management-Plan
[3] The City of Morgan Hill UWMP, which discusses urban water supplies, is available at http://www.water.ca.gov/urbanwatermanagement/2010uwmps/Morgan%20Hill,%20City%20of/
[4] The SBWR Strategic and Master Plan, which discusses non-potable and potable reuse opportunities, is available at http://www.valleywater.org/Services/RecycledWater.aspx

disinfected with chlorine and meets all water quality standards. Thousands of privately owned groundwater wells are also used for water supply in the South County area.

Recycled water partnership agreements were signed in 1999, designating SCRWA as the producer, the District as the wholesaler, and the Cities of Gilroy and Morgan Hill as the retailers of recycled water. Currently, in the South County, recycled water is only delivered in the Gilroy area due to its proximity to the SCRWA WWTP.

Table 1.2 Reports and References Used in 2015 Master Plan Update

Title	Date	Author
SCVWD Resolution No. 99-21	March 1999	SCVWD
SCVWD/SCRWA South County Recycled Water Master Plan	October 2004	Carollo Engineers
Review of the Santa Clara Valley Water District's Cost of Service and Rate Setting Methodology for Setting FY 2011 Groundwater Production Charges	March 2010	Raftelis Financial Consultants, Inc.
SCVWD South County Water Supply Planning Project, Project Report	July 2010	SCVWD
Report Documenting the Reasonableness of the Conjunctive Use Benefit of Treated Water to Groundwater and Surface Water Customers and the Benefit of Agriculture Customers to Municipal & Industrial Customers for the Santa Clara Valley Water District	February 2011	Raftelis Financial Consultants, Inc.
City of Gilroy 2010 Urban Water Management Plan	June 2011	Akel Engineering Group, Inc.
City of Morgan Hill 2010 Urban Water Management Plan	June 2011	Risk Management Professionals
South County Regional Wastewater Authority Capital Improvements Strategic Plan	October 2011	MWH
SCVWD 2012 Groundwater Management Plan	July 2012	SCVWD
SCVWD 2012 Water Supply and Infrastructure Master Plan	October 2012	SCVWD
SCVWD Annual Groundwater Report for Calendar Year 2013	2013	SCVWD
SCVWD FY 2014-15 Protection and Augmentation of Water Supplies	February 2014	SCVWD
California Urban Water Agencies, Meeting California's Water Needs, Water Reuse Update	March 2014	California Urban Water Agencies
SCRWA Application/Report of Waste Discharge (NPDES Permit for South County Regional Wastewater Treatment and Reclamation Facility)	September 2014	SCRWA
SCVWD Salt and Nutrient Management Plan, Llagas Subbasin	December 2014	Todd Groundwater
South Bay Water Recycling Strategic and Master Planning Report, Volume 1	December 2014	RMC and CDM Smith
2014 Site Supervisor Recycled Water Training Handbook	December 2014	MWH
SCRWA Public Works Quarterly Report	2014	SCRWA
South County Recycled Water Pipeline Project. Recycled Water System Evaluation	November 2010 and May 2014	Akel Engineering Group, Inc.
Technical Memorandum – 2014 SCRWA Wastewater Flow Projections	April 2015	MWH
SWRCB Regulations Related to Recycled Water	July 2015	SWRCB
WRRF Model Communication Plans for Increasing Awareness and Fostering Acceptance of Direct Potable Reuse	2015	WRRF
Screening Level Assessment of Indirect Potable Reuse in the Llagas Subbasin	September 2015	Todd Groundwater

Key:
SCRWA = South County Regional Wastewater Authority
SCVWD = Santa Clara Valley Water District
SWRCB= State Water Resources Control Board
WRRF = WateReuse Research Foundation

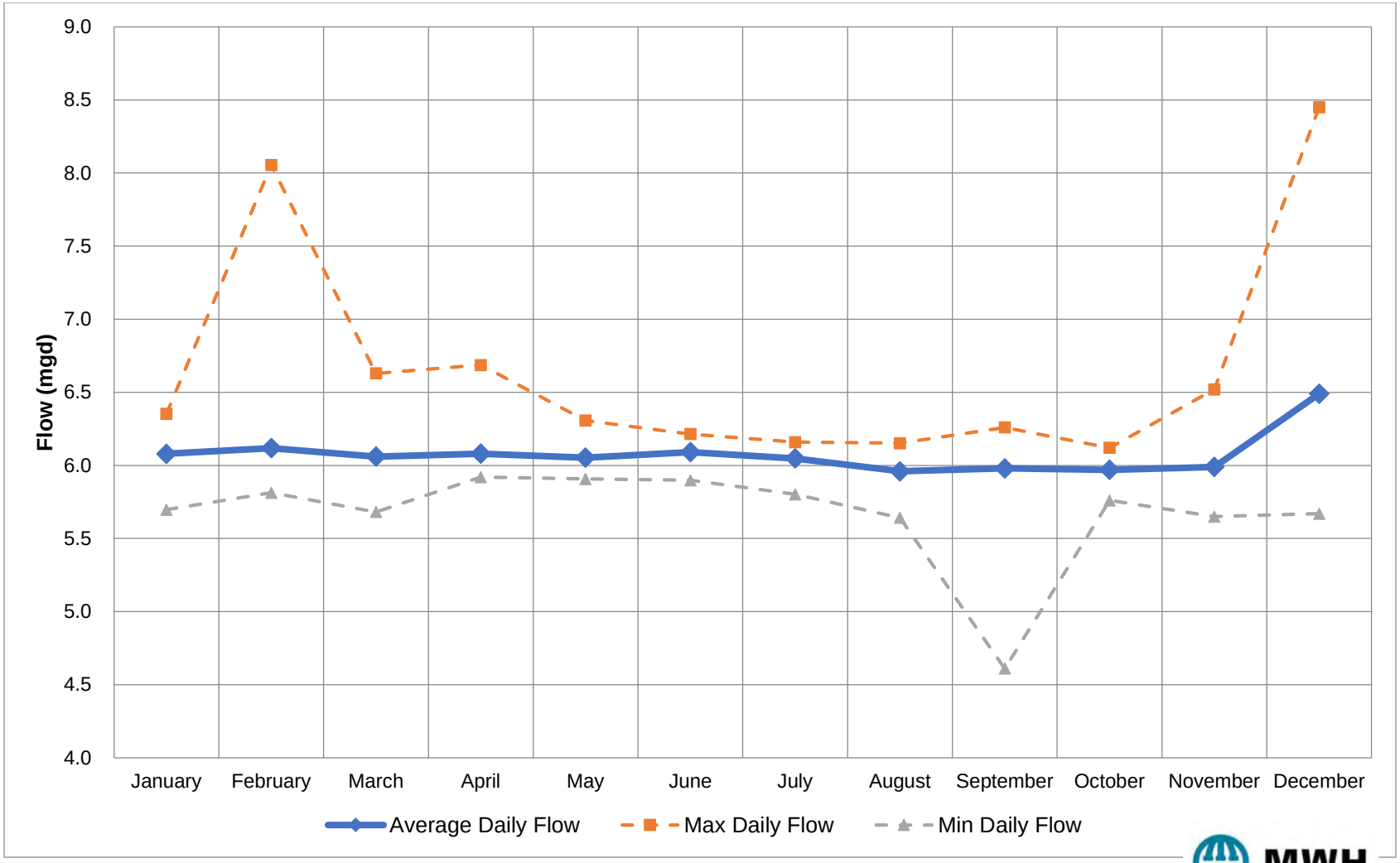
1.3.4 Existing Wastewater Treatment

SCRWA treats wastewater from the Cities of Gilroy and Morgan Hill. SCRWA owns and operates the existing WWTP, located along Southside Drive approximately 2 miles southeast of Gilroy. The SCRWA Facility is permitted under Waste Discharge Requirements (WDR) Order No. R3-2010-0009 and National Pollutant Discharge Elimination System (NPDES) No. CA0049964 by the Central Coast Regional Water Quality Control Board (CCQCB) to treat up to 8.5 mgd of wastewater at average dry weather flow[5] (ADWF) to secondary treatment standards. The treatment processes consist of influent screening, aerated grit removal, nitrification, denitrification, oxidation ditches, and secondary clarification. The current ADWF is approximately 6 mgd. Figure 1.3 depicts the average monthly influent flows for 2014. Figure 1.4 depicts the diurnal flow variation for a day in May 2014. On that day, the flow range at the WWTP ranged from a low of approximately 3 mgd in the early morning to a peak of around 9 mgd.

The SCRWA WWTP has a total secondary treatment capacity of 8.5 mgd ADWF and can currently divert up to 8 mgd of secondary effluent to tertiary facilities. The tertiary treatment process consists of coagulation, filtration with sand and anthracite filters, chlorination, and dechlorination. While the filtration capacity is 9 mgd, the system is currently limited by the chlorine contact basin capacity of 8 mgd. An ultraviolet (UV) disinfection facility is currently under construction that will have the ability to disinfect 9 mgd of filtered effluent. Lastly, there is a 3 MG storage reservoir that was built on-site at the WWTP to support the recycled water distribution system. This reservoir can also be used to supplement the treatment train during periods of high demand.

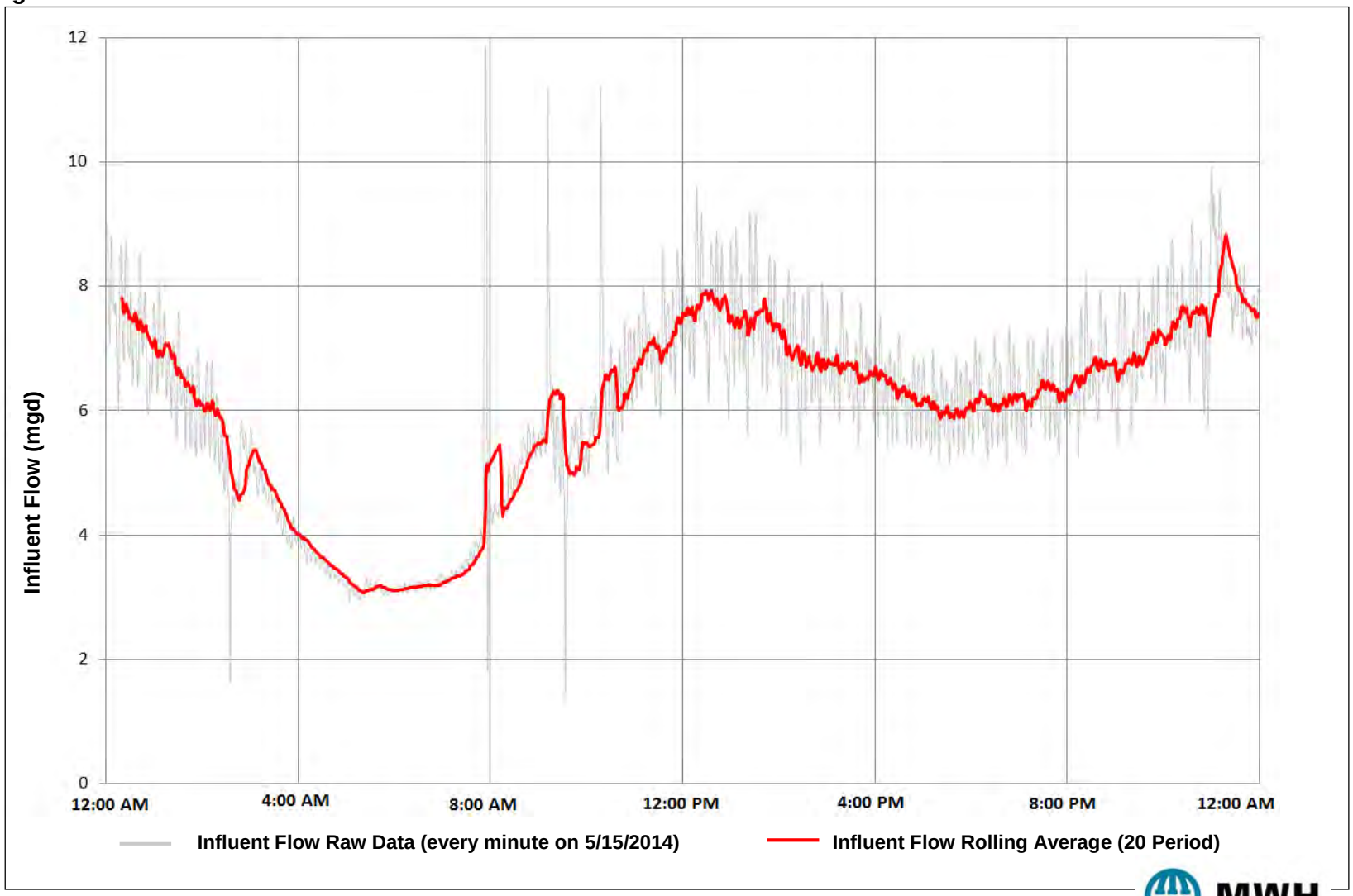
[5] The ADWF is defined as the average flow for the three driest months in a year and is used as the basis for permitting the SCRWA Facility.

Figure 1.3 2014 Average Annual SCRWA Influent Flows



Created from SCRWA 2014 Public Works Quarterly Report.

Figure 1.4 SCRWA Diurnal Flow Variations



Created from SCRWA WWTP May 2014 SCADA Dataset.

1.3.5 Existing Recycled Water Use

In 1977, the District, the City of Gilroy, and the Gavilan Water Conservation District (annexed by SCVWD in 1987) began a partnership to construct and operate a recycled water system extending from the SCRWA WWTP to several customers along Hecker Pass Highway. Initially, this system delivered primary-treated recycled water. Due to the low quality of the water and several recurring operational problems, the system operated sporadically over the next 20 years.

In 1999, the District, the City of Gilroy, the City of Morgan Hill, and SCRWA entered partnership agreements with SCRWA as the supplier, the District as wholesaler, and the Cities of Gilroy and of Morgan Hill as retailers to develop a recycled water project. The project included rehabilitation of the existing pipeline, additional pipeline construction, pump stations, and a closed tank reservoir. Since then, various expansions of the treatment plant and recycled water distribution system have been implemented based on the 2004 Master Plan.

As of February 2015, the existing recycled water distribution pipelines provide eight existing customers with tertiary treated recycled water. Recycled water is used for landscape irrigation at Christmas Hill Ranch Park, Christmas Hill Park, Gilroy Golf Course, Gilroy Sports Park, Gilroy Shooting Range, McCarthy Business Park, and Eagle Ridge Development and Golf Course. Recycled water is used for agricultural irrigation on local farmland, including Obata Farms and SCRWA-owned agricultural buffer lands. The Calpine-Gilroy Energy Center Peaker Plant and Cogeneration Plant use recycled water for cooling. Additionally, three customers will be online and receiving recycled water in the near-term – C&E Farms, Obata Farms (new turnout), and United Natural Foods, Inc. (UNFI). Figure 1.5 depicts the locations of the existing recycled water customers. Table 1.3 summarizes information for these existing customers, including location, type of use, average annual recycled water demand, and estimated maximum month recycled water demand.

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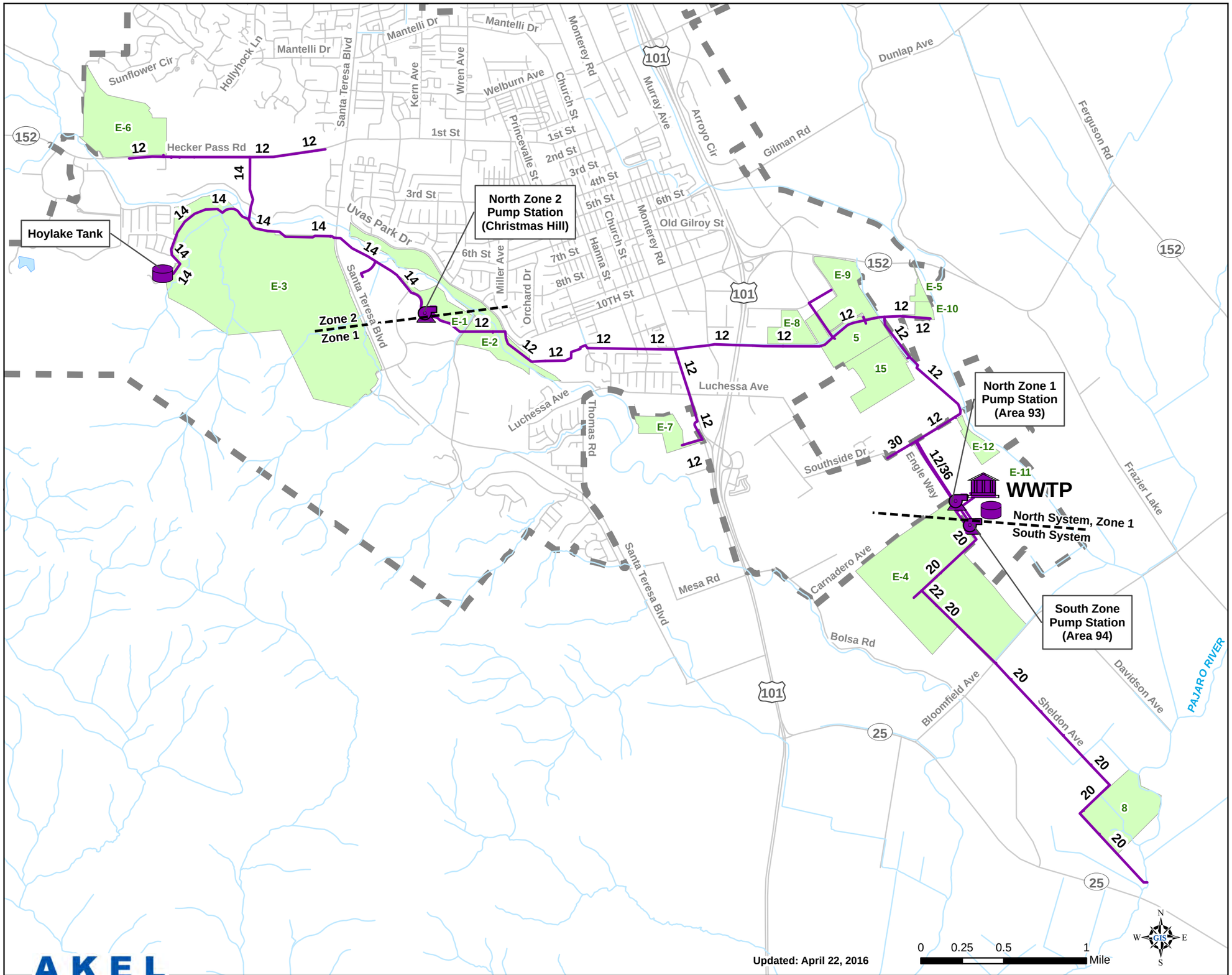

Legend

Existing

- WWTP
- Storage Tanks
- Booster Stations
- Recycled Water Pipelines
- Pressure Zone Line
- Existing Users
- City Limits
- Roads
- Creeks
- Lake

Updated: April 22, 2016

File Name & Location: P:\xGIS\GIS_Projects\SCVWD\MWH\2016\MP_Report\SCVWD_1-5_ExSys_042216.mxd

Figure 1.5
Existing System

South County Recycled Water System

Santa Clara Valley Water District /
South County Regional Wastewater Authority

Santa Clara Valley Water District

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Table 1.3 Existing South County Recycled Water Customers

Site No.[1]	Customer	Usage Type	Estimated Annual Demands[2] (afy)	Actual Usage (2014-15)[3] (afy)
E-1	Christmas Hill Park – Ranch	Irrigation	25	7
E-2	Christmas Hill Park – North	Irrigation		19
E-3	Eagle Ridge Golf Course	Irrigation	330	455
E-4	Obata Farms (Mission Farms) Turnouts #1 – #6	Agricultural	150	174
E-8	Obata Farms (North)	Agricultural		60
E-5	Calpine Power Plant – Peaker	M&I	260	6
E-10	Calpine Power Plant – Cogen	M&I		77
E-6	City of Gilroy – Golf Course	Irrigation	120	129
E-7	City of Gilroy – Sports Park	Irrigation	30	32
E-9	McCarthy Business Park	Irrigation	5	15
E-11	WWTP Utility Water	M&I	1,000	1020
E-12	City of Gilroy – Shooting Range	Irrigation	1	1
5	UNFI Gilroy[4]	Irrigation	20	n/a
8	C&E Farms[4]	Agricultural	150	n/a
15	Obata Farms (new turnout)	Agricultural	150	n/a
		Total	**2,241**	**1,995**

Key:
afy = acre-feet per year M&I = municipal and industrial UNFI = United Natural Foods, Inc.

Notes:
[1] "E-"denotes customer was receiving recycled water, as of September 2015.
[2] Estimated demands for existing users obtained from Recycled Water Use Permits.
[3] Actual usage from "SCRWA Reclaimed Water Usage Log" average for 2014-2015 listed.
[4] Customer will be on-line and receiving recycled water in the near-term.

For many years, SCRWA has been able to produce enough recycled water to keep up with customer demands. With recent drought conditions, however, existing and new customers are looking for recycled water to meet their water demands and a "drought-proof" water supply. In the summer of 2014 and 2015, there were various periods of high recycled water demand that stressed the recycled water treatment system at the SCRWA WWTP and, at times, users reported pressure drops in the system requiring longer recycled water use periods. As recycled water demand increases, it is important to consider the availability of supply from the SCRWA WWTP and ensure that adequate facilities are in place to accommodate additional demand from new recycled water users. Alternatives for SCRWA to continue expanding tertiary treatment facilities to allow for additional recycled water production, pumping, and storage as well as system operational guidelines are being evaluated as a separate effort, but available information has been included in the 2015 Master Plan Update to help the SCRWA and SCVWD accommodate these high demand periods. More information on the capital improvement projects planned at the SCRWA WWTP can be found in the SCRWA Capital Improvements Strategic Plan[6], dated October 2011. Figure 1.6 displays annual recycled water usage from

[6] For additional information on the SCRWA Capital Improvements Strategic Plan and subsequent version, contact the South County Regional Wastewater Authority (http://www.ci.gilroy.ca.us/561/South-County-Regional-Wastewater-Authori or 408-846-0202).

2000 to 2014 in both acre-feet and million gallons. As shown in the figure, annual recycled water usage remained relatively constant from 2000 to 2006, followed by a steep increase from 2006 to 2008 due to drought conditions during that time. A decrease in recycled water usage occurred from 2008 to 2010, which is likely due to the economic downturn. Finally, recycled water use has been consistently rising from 2010 to 2014 and it is expected that recycled water demand will continue to increase with the existing drought conditions.

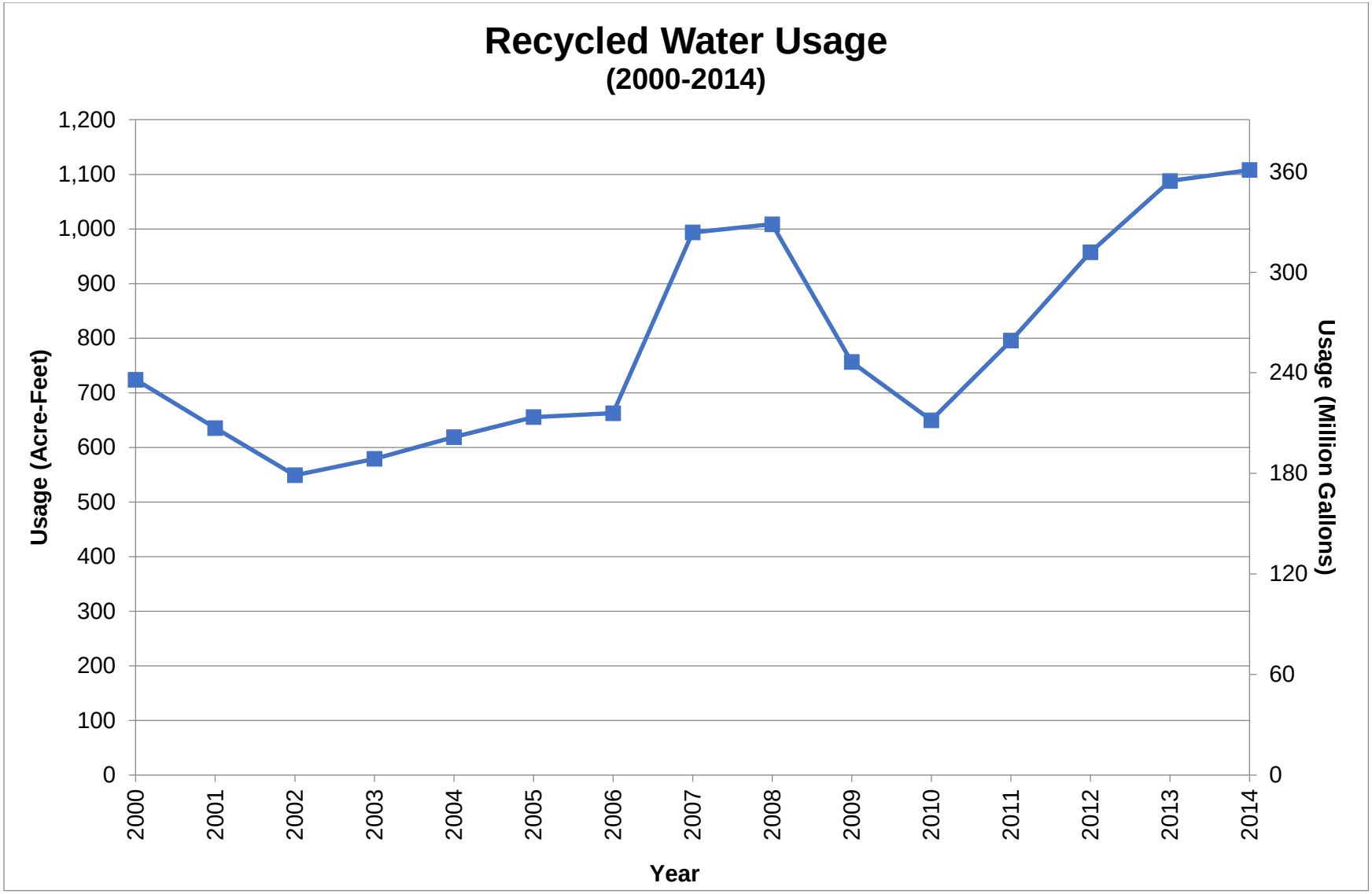
1.3.6 Recycled Water Regulations

The use of recycled water is regulated by several state agencies in California, primarily the State Water Resources Control Board Division of Drinking Water (DDW) and Regional Water Quality Control Boards (Regional Water Board). The general recycled water regulations, which designate wastewater treatment processes, effluent quality, and uses of recycled water, are contained in the California Code of Regulations, Title 22, Division 4, Chapter 3, Sections 60301 through 60355 (Title 22). Additional California regulations for recycled water are contained in the California Health and Safety Code, the California Water Code (CWC), and Title 17 of the California Code of Regulations. As of July 1, 2014, the administration of the Drinking Water Program (DWP) has transferred from the Department of Public Health (DPH) to the State Water Resources Control Board in order to best position the state to both effectively protect water quality and the public health as it relates to water quality, while meeting current needs and future demands on water supplies. On June 18, 2014, a revision to California recycled water regulations went into effect that incorporated regulation for groundwater replenishment using recycled water. Furthermore, the most recent revision to California recycled water regulations went into effect on July 16, 2015, and updated use area requirements for recycled water and general requirements of dual plumbed recycled water systems.

The CCQCB has issued Master Water Reclamation Requirements Order No. 98-052 to regulate recycled water production at the SCRWA WWTP and specific use requirements. Order No. 98-052 requires SCRWA to submit annual self-monitoring reports to the Regional Water Board, including water quality monitoring, user inspections, and any violations and corrective actions taken.

Once referred to as “The Purple Book,” *Regulations Related to Recycled Water* is a compilation of recycled water-related regulations and is included in Appendix A. It can also be found online at: http://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/Lawbook.shtml.

Figure 1.6 Recycled Water Usage 2000 – 2014 in Acre-Feet and Million Gallons



Created from SCRWA 2014 Recycled Water Handbook

1.3.7 Potential Future Regulatory Issues

CWC Section 13562 requires the DDW to develop and adopt uniform water recycling criteria for surface water augmentation on or before December 31, 2016, pending a finding by a convened expert panel that the proposed criteria would adequately protect public health.

CWC Section 13563 requires the DDW to investigate and report to the California State Legislature on the feasibility of developing uniform water recycling criteria for direct potable reuse on or before December 31, 2016. This includes a public review draft of its report by September 1, 2016, a public comment period, and a final report by the end of 2016.

It is important to note that federal drinking water standards and State water recycling regulations are under continuous review and frequent revision. Standards for some constituents of emerging concern such as pharmaceuticals and personal care products, industrial chemicals present at low concentrations, and chemicals that may affect hormone status (referred to as "endocrine disruptors") are likely to be included in future drinking water regulations. New and emerging contaminants (such as 1,2,3-trichloropropane, N-Nitrosodimethylamine (NDMA) and other nitrosamines, and 1,4-dioxane) may also be regulated in the future.

These constituents are routinely found in wastewater effluent and could be found in drinking water, if recycled wastewater is used as a source of drinking water, even indirect reuse. Therefore, water recycling projects require close coordination with U.S. Environmental Protection Agency and DDW staff to ensure compliance with the most recent guidelines.

Chapter 2

Market Assessment

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2 MARKET ASSESSMENT

2.1 MARKET ASSESSMENT OBJECTIVES

The 2004 Master Plan identified Immediate Term, Short Term, and Long Term recycled water capital investment projects to improve the South County Recycled Water System's reliability and to expand the use of recycled water in the South County. The objectives of the market assessment in 2004 included:

- Maximize the use of recycled water in South County and limit use of potable water for uses for which recycled water is a reasonable alternative.
- Diversify recycled water usage in order to maximize the use of recycled water throughout the year.

These objectives remain for the 2015 Master Plan Update. This update builds on the market assessment performed in 2004 and the existing customers that are currently using recycled water. The market assessment was used to identify additional recycled water users for available recycled water at the SCRWA WWTP and to account for seasonal and diurnal demand variations to determine if additional storage is required.

2.2 MARKET ASSESSMENT PROCESS

2.2.1 2004 Market Assessment Process and Screening Criteria

In the 2004 Master Plan, the market assessment was divided into two stages: Stage I screening which allowed for an initial "big picture" view and Stage II screening which focused on the details of implementation feasibility. In Stage I screening, users were narrowed down using the following screening criteria:

- Year-round versus seasonal use
- Proximity to existing system
- Use quantity
- Implementation factors
- Preliminary environmental factors

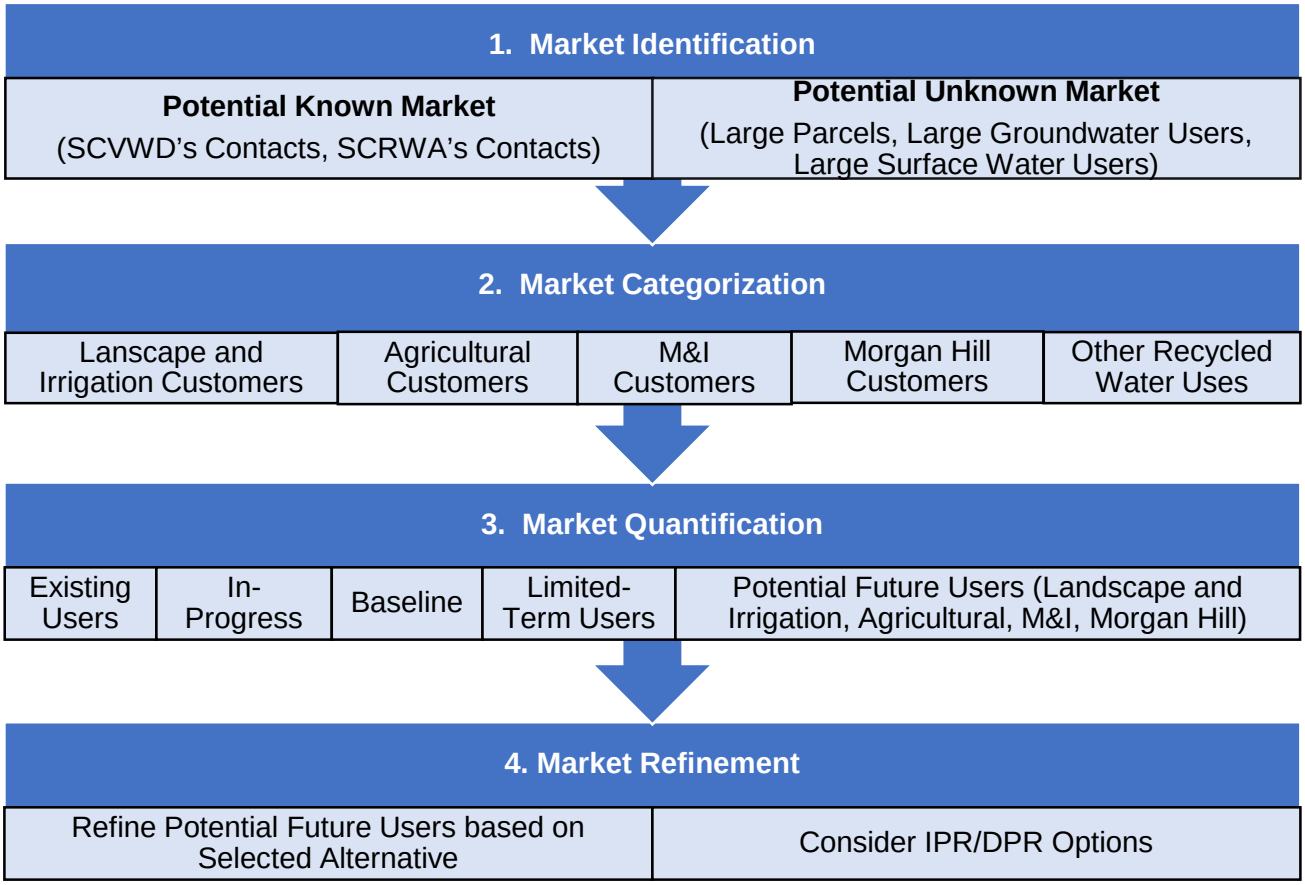
In Stage II screening, the most viable alternatives based on distribution alignment, flow demands, cost effectiveness, and specific environmental issues were identified.

2.2.2 2015 Market Assessment Process

Since the 2004 Master Plan, many users that were identified have been connected to the recycled water system and are now considered existing users. Furthermore, there is higher recycled water demand due to the current drought conditions. While there is potential to add recycled water customers for the available SCRWA influent flow, seasonal variations in demand and SCRWA influent flow must be accounted for (e.g., maximum demand for irrigation is in the summer when WWTP influent flow is lowest).

The 2015 market assessment was divided into the four stages shown in Figure 2.1 and discussed in the remainder of this chapter. The last step in the market assessment process is to refine the market assessment based on the selected alternative. The selected alternative along with the potential customers that were analyzed for the purposes of determining recommended infrastructure improvements are discussed in Chapter 4.

Figure 2.1 2015 Market Assessment Process



Furthermore, it is important to note that the approach to the market assessment was different for the City of Gilroy versus the City of Morgan Hill. As shown in Figure 2.1, Morgan Hill customers are defined as a category within the market categorization phase and within the potential future users of the market quantification phase since there are currently no existing customers in the City of Morgan Hill. The overall approach is based on identifying customers that can be added to the existing NPR distribution system.

2.3 MARKET IDENTIFICATION

The first step in the market assessment process is market identification. During this stage, the potential recycled water customers were separated into two categories:

1. Potential Known Market
2. Potential Unknown Market

The **potential known market** was identified by the District, City of Gilroy, City of Morgan Hill, and SCRWA. These potential customers were contacted to assess or confirm their interest in recycled water and to update anticipated demands. The **potential unknown market** was explored by identifying parcels of land in the study area of 20 acres or larger, existing large surface water customers in the study area, and major groundwater pumping in the Llagas Subbasin.

Potential new customers in the City of Gilroy were contacted, initially by phone, to determine their interest in using recycled water. Customers from the potential known market were contacted, followed by additional customers from the potential unknown market. Existing customers, such as parks, were not contacted. A list of approximately 15 customers from the potential known market was identified by District, SCRWA, and City of Gilroy. In additional to the potential known market customers, approximately 10 customers from the potential unknown market were also contacted. A survey was conducted in order to gain an understanding of each potential customer's interest in using recycled water and potential demand. The entire list of questions that was used during the surveys is included in Appendix B, and a database of contact information and survey answers relayed by potential customers is included in Appendix C.

In the potential unknown market, customers were identified for both the City of Gilroy and Morgan Hill, but most were not contacted by phone because the availability of recycled water depends on the selected distribution system alternative.

2.4 MARKET CATEGORIZATION

In the next stage of the market assessment, identified customers were categorized by recycled water use types. The recycled water use categories include:

- Landscape and irrigation
- Municipal and industrial processes
- Agricultural
- Direct potable reuse
- Indirect potable reuse

These different use categories were investigated for both the City of Gilroy and the City of Morgan Hill. Each of these use types has associated water quality requirements, health restrictions, and customer demands which drive the physical improvements such as treatment and distribution facilities. Additional detail on these recycled water use types and existing and potential customers are discussed in more detail below.

2.4.1 Landscape and Irrigation Customers

Potential uses of recycled water for landscape and irrigation include roadway medians, parks, school grounds, cemeteries, golf courses, recreational turf areas, communally or commercially maintained landscaping, and ornamental water features. For compliance with Title 22 recycled water guidelines, signs explaining the non-potable nature of recycled water must be posted.

There are currently seven irrigation customers connected to the recycled water system, the largest group of existing recycled water customers. They include Christmas Hill Park, Eagle Ridge Golf Course, City of Gilroy, and McCarthy Business Park. These customers are discussed in more detail in Section 2.5. Furthermore, eight irrigation customers have been permitted for future recycled water use, and the largest number of potential future customers has been identified as landscape and irrigation customers.

2.4.2 Agricultural Customers

Agricultural recycled water use includes water used for the production of crops and/or livestock and the preparation of these products for market. When applying recycled water for agricultural irrigation, customers must consider and not exceed crop consumption and nutrient loading rates. SCRWA produces recycled water that meets Title 22 disinfected tertiary recycled water requirements which can be used for all applications of agricultural irrigation including food crops where recycled water contacts the edible portion of the crop, including root crops.

There are currently four agriculture customers connected to the recycled water system including Obata Farms and C&E Farms. These customers are discussed in more detail in Section 2.5. Furthermore, four agricultural customers have been permitted for future recycled water use, and four have been identified as potential future customers.

2.4.3 Municipal and Industrial Customers

Municipal and industrial (M&I) customers include water used for commercial, industrial, and institutional purposes. Certain industries can use recycled water in their industrial processes. Generally, the quality and availability of the recycled water are of greatest concern to a potential industrial customer. Industrial uses for recycled water vary widely depending on the particular industry, but the most common use is for process cooling water. Other uses are for high water use industries such as making concrete and manufacturing paper or electronic equipment. Regulatory requirements also widely vary depending on the particular industry. In addition, the SCRWA WWTP uses recycled water for its utility needs.

There are currently three M&I customers connected to the recycled water system including the SCRWA WWTP and Calpine Power Plant. Furthermore, one M&I customer has been permitted for future recycled water use, and two have been identified as potential future customers.

2.4.4 Morgan Hill Customers

Currently, recycled water is not distributed from the SCRWA WWTP to the City of Morgan Hill. Various opportunities to bring recycled water to Morgan Hill are being considered and are discussed in the draft Morgan Hill Recycled Water Feasibility Evaluation in Appendix D. In order to evaluate the feasibility of bringing recycled water to Morgan Hill, the potential customers must be identified. Many potential recycled water customers in Morgan Hill have been identified and all potential customers fall into the irrigation use category.

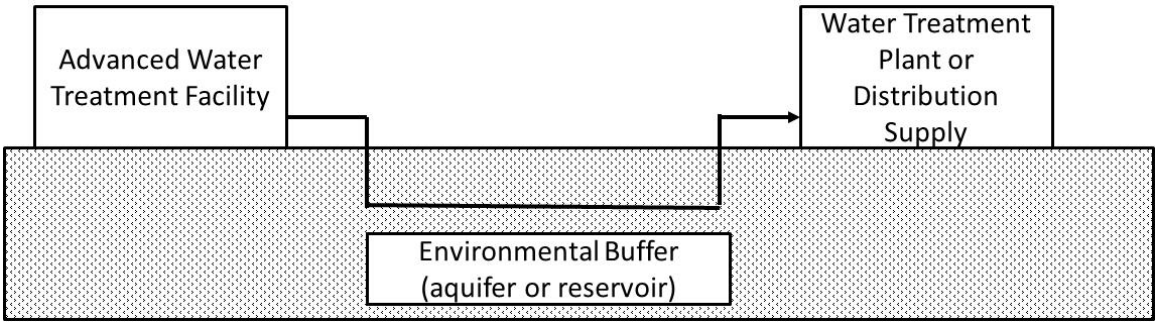
2.4.5 Other Potential Recycled Water Uses

There are many other potential uses of recycled water that could be implemented in the South County, including potable reuse. There are two major types of potable reuse: IPR and DPR. Additional details on IPR and DPR and their applicability in the South County system are included in the Emerging Technologies and Sustainability TM in Appendix E and summarized in the sections below.

2.4.5.1 Indirect Potable Reuse

In IPR, secondary wastewater effluent is treated in an advanced water treatment facility. The treated water is stored in an environmental buffer and further treated in a water treatment plant or supplied to a potable water distribution system. Examples of environmental buffers include groundwater aquifers and reservoirs. Figure 2.2 shows the major treatment components of IPR.

Figure 2.2 Schematic of Major Treatment Components for Indirect Potable Reuse



Adapted from Tchobanoglous (2014).

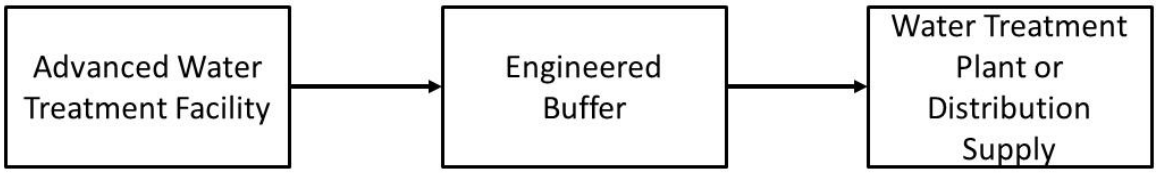
The typical treatment processes utilized for IPR applications are microfiltration (MF) or ultrafiltration (UF) followed by reverse osmosis (RO) and advanced oxidation processes (AOP). Examples of full-scale IPR projects include Orange County Water District, West Basin Municipal Water District, Bedok NEWater Facility in Singapore, and the City of San Diego IPR Demonstration project.

2.4.5.2 Direct Potable Reuse

In DPR, primary/secondary effluent is treated in an advanced water treatment facility. The treated water is supplied into a raw water supply or into a drinking water treatment plant or

directly into a potable water distribution system. Engineered storage buffers have been proposed in DPR systems to allow for quality assurance and further proof of the advanced water treatment performance reliability, especially for systems that need to compensate for product water variability with additional response time prior to introduction into water distribution systems. Figure 2.3 shows the major treatment components of DPR.

Figure 2.3 Schematic of Major Treatment Components for Direct Potable Reuse



Adapted from Tchobanoglous (2014).

A comprehensive description of DPR and its applications is included in Appendix E. There are only two DPR full-scale facilities in the United States (Big Springs, TX and Wichita Falls, TX). Both of these facilities have MF followed by RO and AOP, but the section of a treatment train is dependent on the specific application. Specifically, the need for RO depends on the total dissolved solids (TDS) concentration in the waste steam. Furthermore, there may be additional requirements for disinfection. If RO is used, RO concentrate disposal methods also need to be investigated.

2.5 MARKET QUANTIFICATION

When quantifying customer's demand of recycled water, existing and potential recycled water customers were grouped into prioritization categories. Potential recycled water customers from the potential unknown market that are already located near the existing infrastructure and have an imminent need for recycled water were considered first. For other potential future customers, first priority was given to customers that have a need for water year-round such as industrial/commercial customers. Second priority was given to customers that have a seasonal need, such as school yards, golf courses, parks, and street median strips that were identified. The breakdown of prioritization categories is shown below:

- Existing Customer
- In-Progress Customer
- Baseline
- Limited-Term Customer
- Potential Future Customer

Figure 2.4 displays the existing recycled water system and the future users that fall into these categories and Table 2.1 shows the recycled water customers and their estimated demands. Table 2.1 also shows estimated peak flow demands for the existing and future users. These demands and how they were determined are discussed in Chapter 3. Furthermore, these

prioritization categories and the customers that fall within them are described in more detail in sections.

2.5.1 Existing Customers

Existing customers include customers that are currently connected to the recycled water system, have a billing account with the District, and have been inspected by SCRWA. There are currently 15 existing customers within the South County Recycled Water System. As discussed in Table 1.3, the overall, the total estimated demand was 2,241 acre-feet per year (afy), but the actual demand from calendar year 2014 to 2015 was 1,995 afy. The largest existing use of recycled water is for the SCRWA WWTP utility flow which made up approximately fifty percent of the total recycled water use in 2014. The SCRWA WWTP operations and processes that currently use recycled water include:

- Filter Surface Washwater
- Oxidation Ditch Scum Sprayers
- Solids Handling
- Irrigation
- Filter Backwash (draws from the chlorine contact basin)
- General Plant Wash down (hosing)
- Chemical Carry Water

The next largest existing recycled water customer is Eagle Ridge Golf course which made up approximately 20 percent of the total recycled water use in 2013.

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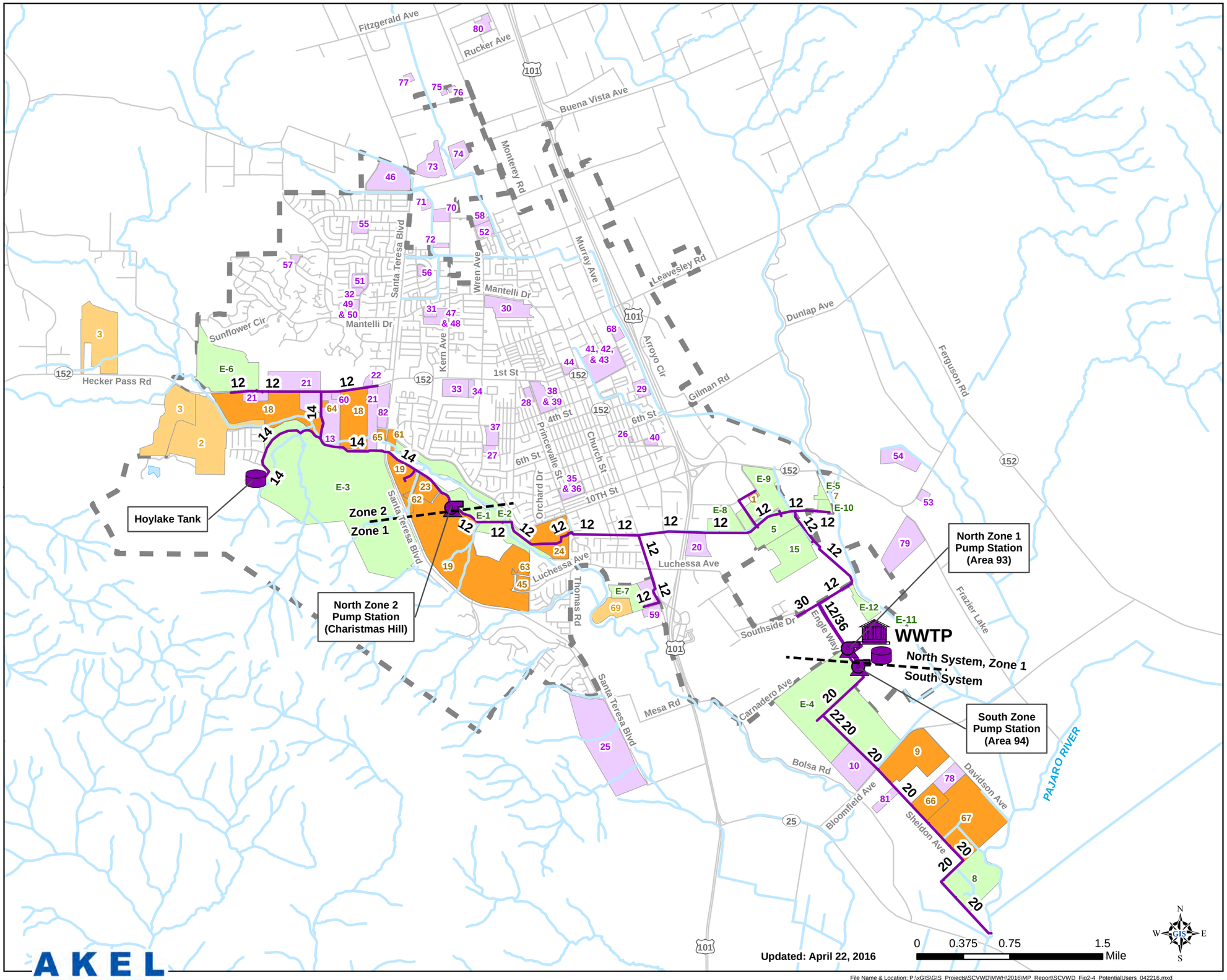

Legend

Existing

- WWTP
- Storage Tanks
- Booster Stations
- Recycled Water Pipelines
- Pressure Zone Line
- Existing Users
- In Progress Users
- Baseline Users
- Potential Users
- City Limits
- Roads
- Lake
- Creeks

Figure 2.4
Existing System + Potential Users (Gilroy)

South County Recycled Water System

Santa Clara Valley Water District /
South County Regional Wastewater Authority

Santa Clara Valley Water District

AKEL ENGINEERING GROUP, INC.

Updated: April 22, 2016

File Name & Location: P:\xGIS\GIS_Projects\SCVWD\MWH\2016\MP_Report\SCVWD_Fig2-4_PotentialUsers_042216.mxd

Table 2.1 Existing and Potential Recycled Water Customer Demands for the City of Gilroy

Site No.	Site Name	Recycled Water System	Zone	Usage Category	Hours of Operation (period)	Hours of Operation (hrs)
Existing Users						
E-1	Christmas Hill Park - Ranch	North	1	Irrigation	10pm - 7am	9
E-2	Christmas Hill Park - North	North	1	Irrigation	10pm - 7am	9
E-3	Eagle Ridge Golf Course	North	2	Irrigation	6am - 2 pm	8
E-4	SCRWA Farms (Ag Lease) Turnout #1-#6	South	-	Agricultural	7 am-1pm; 7pm-1am	12
E-8	Obata Farms (North)	North	1	Agricultural	7 am-1pm; 7pm-1am	12
E-5	Calpine Power Plant - Peaker	North	1	M&I	24hr	24
E-10	Calpine Power Plant - Cogen	North	1	M&I	24hr	24
E-6	City of Gilroy - Golf Course	North	2	Irrigation	9pm - 6am	9
E-7	City of Gilroy - Sports Park	North	1	Irrigation	10pm - 7am	9
E-9	McCarthy Business Park	North	1	Irrigation	9pm - 6am	9
E-11	WWTP Utility Water	WWTP Utility	-	M&I	24hr	24
E-12	City of Gilroy - Shooting Range	North	1	Irrigation	7am - 11pm	4
5	United Natural Food	North	1	Irrigation	10pm - 7am	9
8	C & E Farms	South	-	Agricultural	8am-5pm	9
15	Obata (new turnout)	North	1	Agricultural	7 am-1pm; 7pm-1am	12
In-Progress Users						
1	Cintas Corporation	North	1	M&I	24hr	24
9	Flanagan (Kapa Seeds)	South	-	Agricultural	6am - 12pm	6
18	Meritage Development	North	2	Irrigation	10pm - 7am	9
19	Glen Loma Ranch Development	North	1	Irrigation	10pm - 7am	9
23	Ascension Solorsano Middle School	North	1	Irrigation	10pm - 7am	9
24	Gilroy High School	North	1	Irrigation	10pm - 7am	9
45	Las Animas Elementary	North	1	Irrigation	10pm - 7am	9
61	Santa Teresa & Third Street Park	North	2	Irrigation	10pm - 7am	9
62	Glen Loma Second Park (Santa Teresa Blvd and Club Dr)	North	2	Irrigation	10pm - 7am	9
63	Sydney Casper City Park	North	1	Irrigation	10pm - 7am	9
64	City Park (Hecker Pass)	North	2	Irrigation	10pm - 7am	9
65	City Park (SW corner of Santa Teresa Blvd and 3rd St)	North	2	Irrigation	10pm - 7am	9
66	C & E Farms (Additional Parcel)	South	-	Agricultural	8am-5pm	9
67	Christopher Ranch (Existing Turnout)	South	-	Agricultural	12am - 4pm	12
Baseline Users						
2	Gilroy Gardens (formerly Bonafante)	North	2	Irrigation	6am-5pm	12
3	Western Tree Nursery I & II	North	2	Irrigation	24hr	24
7	Calpine Power Plant - Additional Demand	North	1	Irrigation	24hr	24
69	Gilroy Sports Park Expansion	North	1	Irrigation	10pm - 7am	9
Limited Term Users						
TC1	United Natural Foods Inc. (Online)	North	1	Construction	Varies (Tank Filling)	10
TC2	Glen Loma Ranch Development (Online)	North	2	Construction	Varies (Tank Filling)	10
TC3	Meritage Development West (Online)	North	2	Construction	7am-5pm	10
13	Syngenta	North	2	Irrigation	8am-5pm	9
60	Fiorio Farms (Hecker Pass)	North	2	Agricultural	8am-5pm	9
Potential Future Users						
6	Sundance Landscaping, Inc.				Fill-Station User	
10	Bonfante Nurseries	South	-	Agricultural	6am-5pm	9
20	Temple-Inland Corrugated Packaging	North	1	M&I	8am-5pm	9
21	Hoey Development	North	2	Irrigation	10pm - 7am	9
22	Vineyard Christian School	North	2	Irrigation	10pm - 7am	9
25	Gavilan College, Sports Park, and Golf Course	North	1	Irrigation	10pm - 7am	9
26	Forest Street Park	North	1	Irrigation	10pm - 7am	9
27	El Roble Park	North	1	Irrigation	10pm - 7am	9
28	Miller Park	North	1	Irrigation	10pm - 7am	9
29	San Ysidro Park	North	1	Irrigation	10pm - 7am	9
30	Las Animas Park	North	2	Irrigation	10pm - 7am	9
31	Rainbow Park	North	2	Irrigation	10pm - 7am	9
32	Del Rey Park	North	2	Irrigation	10pm - 7am	9
33	Gavilan Hills Memorial Park	North	2	Irrigation	10pm - 7am	9
34	St. Mary's Cemetery	North	2	Irrigation	10pm - 7am	9
35/36	Glen View Elementary/Gateway School	North	1	Irrigation	10pm - 7am	9
37	El Roble Elementary	North	1	Irrigation	10pm - 7am	9
38	Jordan Elementary	North	1	Irrigation	10pm - 7am	9
39	Brownell Academy of Humanities	North	1	Irrigation	10pm - 7am	9
40	Eliot Elementary	North	1	Irrigation	10pm - 7am	9
41/42/43	South Valley Junior High/Gilroy Community Day/Gilroy Adult Ec	North	1	Irrigation	10pm - 7am	9
44	St. Mary's	North	1	Irrigation	10pm - 7am	9
46	Christopher High School	North	2	Irrigation	10pm - 7am	9
47/48	Rod Kelley Elementary/Mt. Madonna High	North	2	Irrigation	10pm - 7am	9
49/50	Adventist Christian/Pacific West Christian Academy	North	2	Irrigation	10pm - 7am	9
51	Luigi Aprea Fundamental Elementary	North	2	Irrigation	10pm - 7am	9
52	Antonio Del Buono Elementary	North	2	Irrigation	10pm - 7am	9
53	San Ysidro Elementary	North	1	Irrigation	10pm - 7am	9
54	Obata Farms	North	1	Agricultural	7 am-1pm; 7pm-1am	12
55	Sunrise Park	North	2	Irrigation	10pm - 7am	9
56	Los Arroyos Park	North	2	Irrigation	10pm - 7am	9
57	Carriage Hills Park	North	2	Irrigation	10pm - 7am	9
58	Farrell Avenue Park	North	2	Irrigation	10pm - 7am	9
59	Fiorio Farms (Gilroy Sports Park)	North	1	Agricultural	6am - 5pm	12
68	Lomar Laundry	North	1	M&I	24hr	24
70	Future Elementary School	North	2	Irrigation	10pm - 7am	9
71	Future Neighborhood Park #1	North	2	Irrigation	10pm - 7am	9
72	Future Neighborhood Park #2	North	2	Irrigation	10pm - 7am	9
73	Future Community Park	North	2	Irrigation	10pm - 7am	9
74	Future Middle School	North	2	Irrigation	10pm - 7am	9
75	Future Active Adult Gathering Area #1	North	2	Irrigation	10pm - 7am	9
76	Future Active Adult Gathering Area #2	North	2	Irrigation	10pm - 7am	9
77	Future Neighborhood Park #3	North	2	Irrigation	10pm - 7am	9
78	Cherry Orchard	South	-	Agricultural	8am - 5pm	9
79	Frazier Lake Road Agriculture User	North	1	Agricultural	6am-5pm	12
80	Rucker Elementary	North	2	Irrigation	10pm - 7am	9
81	Mike Steffen	South	-	Agricultural	8am - 5pm	9
82	Village Green	North	2	Irrigation	10pm - 7am	9

2.5.2 In-Progress Customers

In-progress customers include customers that are permitted to use recycled water but are either not yet connected to the recycled water system (North system) or have not yet taken delivery of recycled water (South system). There are currently 11 in-progress recycled water customers including 9 customers in the North and 3 customers in the South system. Table 2.2 shows the in-progress recycled water customers and their estimated demand.

Table 2.2 Gilroy In-Progress Recycled Water Usage

Site No.	Site Name	Usage Type	Estimated Annual Average Demand[1] (afy)
North System			
1	Cintas Corporation	M&I	119
9	Flanagan (Kapa Seeds)	Agricultural	68
18	Meritage Development	Irrigation	21
19	Glen Loma Ranch Development	Irrigation	29
23	Ascension Solarsano Middle School	Irrigation	27
24	Gilroy High School	Irrigation	78
45	Las Animas Elementary	Irrigation	14
61	Santa Teresa & Third Street Park	Irrigation	14
62	City Park (Santa Teresa Blvd and Club Dr.)	Irrigation	14
63	Sydney Casper City Park	Irrigation	14
64	City Park (Hecker Pass)	Irrigation	14
65	City Park (southwest corner of Santa Teresa Blvd. and 3rd Street)	Irrigation	14
66	C&E Farms (Additional Parcel)	Agricultural	74
67	Christopher Ranch (Existing Turnout)	Agricultural	375
Total			**873**

Key:
afy = acre-feet per year M&I = municipal and industrial
Note:
[1] Approved customer estimated demands per District and MWH staff.

Overall the total estimated demand for in-progress customers is approximately 873 afy. Many of these customers are irrigation customers, specifically, irrigation for City Parks. The largest expected in-progress customer is Christopher Ranch with an expected agricultural usage of 375 afy.

2.5.3 Baseline Customers

Baseline customers include customers within close proximity to the existing recycled water pipeline alignment that are interested in using recycled water in the future. There are currently 4 baseline recycled water customers. Table 2.3 shows these baseline recycled water customers and their estimated demand.

Table 2.3 Gilroy Baseline Recycled Water Usage

Site No.	Site Name	Usage Type	Estimated Annual Average Demand[1] (afy)
2	Gilroy Gardens (formerly Bonafante)	Irrigation	169
3	Western Tree Nursery I & II	Irrigation	597
7	Calpine Power Plant (Additional Demand)	Irrigation	23
69	Gilroy Sports Park Expansion	Irrigation	16
Total			**805**

Key:
afy = acre-feet per year
Note:
[1] Demand estimates per District and MWH staff, except for Calpine Power Plant, which is per the 2004 Master Plan.

Overall the total estimated demand for baseline customers is approximately 805 afy. All of these customers are irrigation customers. The largest expected baseline customer is the Western Tree Nursery usage of 597 afy.

2.5.4 Limited-Term Customers

Limited-term customers include customers that will have a temporary use of recycled water such as construction needs or temporary tanks. There are currently 3 potential limited-term customers. Table 2.4 shows the existing and potential limited-term recycled water customers and their estimated demand.

Table 2.4 Gilroy Existing and Potential Limited-Term Recycled Water Usage

Site No.	Site Name	Usage Type	Estimated Annual Average Demand[1] (afy)
TC-1	United Natural Foods, Inc. (Online)	Construction	15
TC-2	Glen Loma Ranch Development (Online)	Construction	840
TC-3	Meritage Development West (Online)	Construction	13
13	Syngenta	Irrigation	19
60	Fiorio Farms (Hecker Pass)	Agricultural	45
Total			**932**

Key:
afy = acre-feet per year
Note:
[1] Demand estimate per District and MWH staff.

Overall, the total estimated demand for existing and potential limited-term customers is approximately 932 afy. Out of the 5 limited-term customers, three are for temporary construction needs that are already online. The last two are for Short Term demand from Syngenta (irrigation use) and Fiori Farms (agricultural use).The largest expected limited-term customer is Glen Loma Ranch Development, which is already online, with an expected temporary construction usage of 840 afy.

2.5.5 Potential Future Customers

The last and largest recycled water customer category is potential future customers. Potential future customers have a water use that would be suitable for recycled water and could be approached in the future should recycled water become available via system expansion or other means. Potential future customers have been categorized by the following usage types:

- Potential Future Irrigation Customers
- Potential Future Agricultural Customers
- Potential Future M&I Customers
- Potential Future Morgan Hill Customers

Potential future customers from these categories and their estimated demand are discussed in the following sections.

2.5.5.1 Potential Future Landscape and Irrigation Customers

The largest potential future customer usage type is irrigation. Potential future irrigation customers have been identified and could be approached in the future should recycled water become available through system expansion or other means. The potential future irrigation customers and their estimated annual average demands are listed in Table 2.5.

Overall the total estimated possible annual average demand for potential future irrigation customers is approximately 903 afy. As alternatives for potential distribution system extensions are refined and, ultimately, an alternative is selected, these potential future irrigation customers can be approached to determine interest in recycled water and their potential recycled water needs in the future.

Table 2.5 Gilroy Potential Future Irrigation Recycled Water Usage

Site No.	Site Name	Usage Type	Estimated Annual Average Demand[1] (afy)
21	Hoey Development	Irrigation	18
22	Vineyard Christian School	Irrigation	6
25	Gilroy College, Sports Park, and golf course	Irrigation	39
26	Hoey Development	Irrigation	5
27	El Roble Park	Irrigation	18
28	Miller Park	Irrigation	22
29	San Ysidro Park	Irrigation	58
30	Las Animas Elementary	Irrigation	102
31	Rainbow park	Irrigation	3
32	Del Ray Park	Irrigation	17
33	Gavilan Hills Memorial Park	Irrigation	43
34	St. Mary's Cemetery	Irrigation	5
35/36	Glen View Elementary/Gateway School	Irrigation	25
37	El Roble Elementary	Irrigation	18
38	Jordan Elementary	Irrigation	9
39	Brownell Academy of Humanities	Irrigation	9
40	Eliot Elementary	Irrigation	4
41/42/43	South Valley Junior High/Gilroy Community College/Gilroy Adult Education	Irrigation	46
44	St. Mary's	Irrigation	13
46	Las Animas Elementary/Cornerstone Christian	Irrigation	103
47/48	Rod Kelley Elementary/Mt. Madonna High	Irrigation	19
49/50	Adventist Christian/Pacific West Christian Academy	Irrigation	20
51	Luigi Aprea Fundamental Elementary	Irrigation	13
52	Antonio Del Buono Elementary	Irrigation	10
53	San Ysidro Elementary	Irrigation	9
55	Sunrise Park	Irrigation	25
56	Los Arroyos Park	Irrigation	12
57	Carriage Hills Park	Irrigation	14
58	Farell Avenue Park	Irrigation	11
70	Future Elementary School	Irrigation	17
71	Future Neighborhood Park #1	Irrigation	12
72	Future Neighborhood Park #2	Irrigation	11
73	Future Community Park	Irrigation	91
74	Future Middle School	Irrigation	30
75	Future Active Adult Gathering Area #1	Irrigation	5
76	Future Active Adult Gathering Area #2	Irrigation	6
77	Future Neighborhood Park #3	Irrigation	10
80	Rucker Elementary	Irrigation	18
82	Village Green	Irrigation	7
Total			**903**

Key: afy = acre-feet per year

Note:

[1] Demand estimates per MWH and District Staff, the 2004 Master Plan, or calculated based on acreages of similar use. See Table 2.1 for how demands were calculated for each individual user.

2.5.5.2 Potential Future Agricultural Customers

The next potential future customer usage type is agricultural. There are only four potential future agricultural customers that have been identified. Potential future agricultural customers have been identified and could be approached in the future should recycled water become available through system expansion or other means. The potential future agricultural customers and their estimated annual average demands are listed in Table 2.6.

Table 2.6 Gilroy Potential Future Agricultural Recycled Water Customers

Site No.	Site Name	Usage Type	Estimated Annual Average Demand[1] (afy)
10	Bonafante Nurseries	Agricultural	214
54	Obata Farms	Agricultural	67
59	Fiorio Farms (Gilroy Sports Park)	Agricultural	34
78	Cherry Orchard	Agricultural	49
79	Frazier Lake Road Agricultural User	Agricultural	108
81	Mike Steffen	Agricultural	5
Total			**477**

Key:
afy = acre-feet per year
Note:
[1] Demand estimates per MWH and District Staff, the 2004 Master Plan, or calculated based on acreages of similar use. See Table 2.1 for how demands were calculated for each individual user.

Overall the total estimated possible annual average demand for potential future agricultural customers is approximately 477 afy. As alternatives for potential distribution system extensions are refined and, ultimately, an alternative is selected, these potential future agricultural customers can be approached to determine interest in recycled water and their potential recycled water needs in the future.

2.5.5.3 Potential Future Municipal and Industrial Customers

The next potential future customer usage type is M&I. There are only two potential future M&I customers that have been identified. Potential future M&I customers have been identified and could be approached in the future should recycled water become available through system expansion or other means. The potential future agricultural customers and their estimated annual average demands are listed in Table 2.7.

Table 2.7 Gilroy Potential Future M&I Recycled Water Customers

Site No.	Site Name	Usage Type	Estimated Annual Average Demand[1] (afy)
20	Temple-Inland Corrugated Packaging	M&I	29
68	Lomar Laundry	M&I	163
Total			**192**

Key:
afy = acre-feet per year
Note:
[1] Demand estimates per MWH and District Staff, the 2004 Master Plan, or calculated based on acreages of similar use. See Table 2.1 for how demands were calculated for each individual user.

Overall the total estimated possible annual average demand for potential future M&I customers is approximately 192 afy As alternatives for potential distribution system extensions are refined and, ultimately, an alternative is selected, these potential future M&I customers can be approached to determine interest in recycled water and their potential recycled water needs in the future.

2.5.5.4 Potential Future Morgan Hill Customers

There is a great deal of potential recycled water demand in the City of Morgan Hill. Since recycled water is currently not distributed from the SCRWA WWTP to Morgan Hill, various opportunities to bring recycled water to Morgan Hill are being considered and are included in the draft Morgan Hill Recycled Water Feasibility Evaluation in Appendix D.

The potential future customer usage type that has been identified for the City of Morgan Hill includes irrigation, nurseries, and one agricultural customer. These customers have been identified and could be approached in the future should recycled water become available to Morgan Hill through system expansion or other means. The potential future Morgan Hill customers are listed in Table 2.8.

The feasibility of connecting these customers will depend on the feasibility of extending the distribution system to Morgan Hill or other potential options for getting recycled water to Morgan Hill. Once an alternative is selected, customers can be refined and approached to determine interest in using recycled water.

Table 2.8 Morgan Hill Potential Future Recycled Water Customers

Site No.	Site Name	Usage Type	Hours of Operation	
			(period)	(hrs)
M-1	Ann Sobrato High School	Irrigation	10PM-7AM	9
M-2	Morgan Hill Growers	Irrigation	24HR	24
M-3	Park	Irrigation	10PM-7AM	9
M-4	Morgan Hill Orthopedics & Sports Medicine	Irrigation	10PM-7AM	9
M-5	Park	Irrigation	10PM-7AM	9
M-6	Park	Irrigation	10PM-7AM	9
M-7	California Color Growers LLC	Irrigation	24HR	24
M-8	El Toro Elementary School	Irrigation	10PM-7AM	9
M-9	PA Walsh Elementary School	Irrigation	10PM-7AM	9
M-10	Central High School	Irrigation	10PM-7AM	9
M-11	Park	Irrigation	10PM-7AM	9
M-12	Park	Irrigation	10PM-7AM	9
M-13	Park	Irrigation	10PM-7AM	9
M-14	Park	Irrigation	10PM-7AM	9
M-15	Jackson Elementary School	Irrigation	10PM-7AM	9
M-16	Park	Irrigation	10PM-7AM	9
M-17	Nordstrom Elementary School	Irrigation	10PM-7AM	9
M-18	St Catherine's School	Irrigation	10PM-7AM	9
M-19	Morgan Hill Community and Cultural Center	Irrigation	10PM-7AM	9
M-20	Morgan Hill Community Park	Irrigation	10PM-7AM	9
M-21	Nursery	Irrigation	24HR	24
M-22	Coyote Valley Nursery	Irrigation	24HR	24
M-23	Valley Orchids Inc	Irrigation	24HR	24
M-24	Hoo Gee Nursery	Irrigation	24HR	24
M-25	Hung's Nursery	Irrigation	24HR	24
M-26	Kajiko Nursery	Irrigation	24HR	24
M-27	Institute Golf Course	Irrigation	9PM-7AM	10
M-28	Gabilan Growers	Irrigation	24HR	24
M-29	Farmer's Market	Irrigation	7AM-1PM	6
M-30	Greenfield Nursery	Irrigation	24HR	24
M-31	Lakeside Nursery	Irrigation	24HR	24
M-32	Paradise Park	Irrigation	10PM-7AM	9
M-33	Morgan Hill Outdoor Sports Center	Irrigation	10PM-7AM	9
M-34	Britton Field (Park)	Irrigation	10PM-7AM	9
M-35	Burnett Elementary School	Irrigation	10PM-7AM	9
M-36	Holiday Lake Meadow (Park)	Irrigation	10PM-7AM	9
M-37	Park	Irrigation	10PM-7AM	9
M-38	Nursery	Irrigation	24HR	24
M-39	Barrett Elementary School	Irrigation	10PM-7AM	9
M-40	Park	Irrigation	10PM-7AM	9
M-41	Del Monte Townhomes	Irrigation	10PM-7AM	9
M-42	Park	Irrigation	10PM-7AM	9
M-43	Park	Irrigation	10PM-7AM	9
M-44	Live Oak High School	Irrigation	10PM-7AM	9
M-45	Park	Irrigation	10PM-7AM	9
M-46	Park	Irrigation	10PM-7AM	9
M-47	Park	Irrigation	10PM-7AM	9
M-48	Park (Coyote Estates)	Irrigation	10PM-7AM	9
M-49	Park	Irrigation	10PM-7AM	9
M-50	Park	Irrigation	10PM-7AM	9
M-51	TenCate Advanced Composites	Irrigation	10PM-7AM	9
M-52	Morgan Hill Library	Irrigation	10PM-7AM	7
M-53	Oak Creek Park	Irrigation	10PM-7AM	9
M-54	Oakwood School	Irrigation	10PM-7AM	9
M-55	Howard Wiechert Park	Irrigation	10PM-7AM	9
M-56	Coyote Valley Sporting Clays	Irrigation	7AM-11PM	4
M-57	Wing Mok Nursery	Irrigation	24HR	24
M-58	Nursery	Irrigation	24HR	24
M-59	Farm	Agricultural	8AM-5PM	9
M-60	Park	Irrigation	10PM-7AM	9
M-61	Stratford School	Irrigation	10PM-7AM	9
M-62	Morgan Hill Bible Church	Irrigation	10PM-7AM	9
M-63	Kawahara Nursery Inc	Irrigation	24HR	24
M-64	Madrone Plaza	Irrigation	10PM-7AM	9
M-65	Diana Park	Irrigation	10PM-7AM	9
M-66	Park	Irrigation	10PM-7AM	9
M-67	Park	Irrigation	10PM-7AM	9
M-68	Park	Irrigation	10PM-7AM	9
M-69	Park	Irrigation	10PM-7AM	9
M-70	Park	Irrigation	10PM-7AM	9
M-71	Park	Irrigation	10PM-7AM	9
M-72	Jackson Park	Irrigation	10PM-7AM	9
M-73	William F. James Boys Ranch	Irrigation	10PM-7AM	9
M-74	Galvan Park	Irrigation	10PM-7AM	9
M-75	Nordstrom Park	Irrigation	10PM-7AM	9
M-76	Park	Irrigation	10PM-7AM	9
M-77	Park	Irrigation	10PM-7AM	9
M-78	Park	Irrigation	10PM-7AM	9
M-79	Paradise Valley Elementary School	Irrigation	10PM-7AM	9

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2.6 MARKET QUANTIFICATION SUMMARY

The market quantification provides both customers that are approved for recycled water use and potential future customers that could be approached in the future should recycled water become available through system expansion or other means. Chapter 3 includes distribution alternatives and requirements, including discussion of SCRWA WWTP recycled water system expansion projects. The customers that can be connected to the South County Recycled Water System depend largely on the distribution alignment that is chosen and the SCRWA WWTP recycled water system expansion projects.

Existing recycled water customers have a total annual average usage of 1,995 afy, which is more than double the demand estimated in the 2004 Master Plan. The identified in-progress customers have an estimated annual average usage of approximately 750 afy. The identified baseline customers have an estimated annual average usage of approximately 800 afy. The identified limited-term customers have an estimated annual average usage of approximately 1,000 afy. Based on these demand estimates, the total recycled water demand for permitted and temporary customers is approximately 4,500 afy. Furthermore, many potential future recycled water customers in the landscape and irrigation, agricultural, and M&I categories have been identified based on the potential distribution system extensions. Furthermore, potential future customers for the City of Morgan Hill were identified in the case that recycled water becomes available for distribution in Morgan Hill.

2.7 WATER QUALITY SUMMARY

The disinfected tertiary recycled water produced at the SCRWA WWTP meets all Title 22 water quality criteria requirements for disinfected tertiary recycled water uses, as reported in annual monitoring reports. Existing customers of recycled water from the SCRWA WWTP have not reported any concerns regarding water quality. Due to the success of the existing recycled water customers, it is expected that the recycled water quality will be sufficient for new customers. However, when conducting the recycled water surveys for potential new customers, water quality of recycled water was typically an area of concern including concern of high salt content or mineral concentrations, chlorine content, and concern for using recycled water for food crops. A water quality analysis of the tertiary effluent from the SCRWA WWTP is included in Section 2.7.1 and a summary of groundwater and surface water quality is included in Section 2.7.2.

2.7.1 Existing SCRWA WWTP Treated Water Quality

SCRWA treats wastewater from Gilroy and Morgan Hill. The treatment processes of SCRWA WWTP consist of influent screening, aerated grit removal, nitrification, denitrification, oxidation ditches, and secondary clarification. The WWTP diverts the secondary effluent to a tertiary treatment process that meets the recycled water criteria of Title 22 unrestricted use category which allows reuse in most non-potable recycled water applications. The tertiary treatment process consists of coagulation, filtration with sand and anthracite filters, and chlorination. Average yearly tertiary water quality is shown in Table 2.9**.** Concentrations of organics and disinfection byproducts (DBPs) are shown in Table 2.10**.** SCRWA is required to meet NPDES

for an emergency discharge to the local Pajaro River, and an average monthly discharge limit of 0.40 microgram per liter (µg/L) and a maximum daily limit of 0.80 µg/L are in effect for chlorodibromomethane.

Table 2.9 Average Yearly Tertiary Effluent Water Quality at SCRWA

	Units	2009	2010	2011	2012	2013	2014
Average total flow	MGM	26.65	19.38	16.72	26.04	29.54	30.08
Average daily flow	MGD	0.87	0.64	0.55	0.85	0.97	0.99
pH	-	7.24	7.23	7.23	7.23	7.17	7.20
Biochemical oxygen demand (BOD)	mg/L	2.00	2.25	2.33	2.67	2.58	3
Total suspended solids (TSS)	mg/L	1.00	1.00	1.08	1.50	1.08	1.75
Turbidity	NTU	0.36	0.42	0.40	0.50	0.42	0.35
Total Coliform Bacteria	MPN/100 mL	2.00	2.33	2.08	2.00	2.08	<2
Nitrate-N	mg/L	3.18	3.73	3.45	2.92	3.33	2.36
Dissolved oxygen	mg/L	4.08	4.48	3.98	3.93	3.61	3.33

Key:
BOD = biochemical oxygen demand
MGD = million gallon per day
MGM = million gallon per month
mg/L = milligram per liter
mL = milliliter
MPN = most probable number
N = nitrogen
NTU = Nephelometric Turbidity Unit
TSS = total suspended solids

Table 2.10 Average Organics and Disinfection Byproducts Concentration at SCRWA

	Units	Result
Total organic carbon (TOC)	µg/L	6.17
Bromodichloromethane	µg/L	25.99
Bromoform	µg/L	ND
Chloroform	µg/L	100.05
Chlorodibromomethane	µg/L	4.78
Total Trihalomethanes (THMs)	µg/L	130.82

Key:
µg/L = microgram per liter
ND = not detectable
TOC = total organic carbon
THMs = Trihalomethanes

In 2013, the SCRWA secondary effluent average TDS concentration was 718 mg/L. The tertiary effluent TDS concentration will be comparable, but increased due to chlorine disinfection using sodium hypochlorite.

As a point of comparison, the drinking water maximum contaminant level (MCL) for Total Trihalomethanes (THMs) is 80 µg/L and the average level of Total THMs detected in drinking water for the Cities of Gilroy and Morgan Hill in 2014 was 3.55 µg/L and 3.57 µg/L [7], respectively. Therefore, the current Total THMs concentration at the SCRWA is greater than both the drinking water MCL and the detected concentrations in drinking water for the City of Gilroy and Morgan Hill. The SCRWA is currently constructing a UV disinfection facility which will decrease the Total THMs concentration in the tertiary effluent.

2.7.2 Groundwater and Surface Water Quality

As a point of comparison, groundwater and surface water quality for TDS and nitrate (as the appropriate indicator of salts and nutrients in the Llagas Subbasin) were investigated. Table 2.11 lists numeric basin plan objectives for groundwater for the Llagas Subbasin with municipal and domestic water supply (MUN) and agricultural water supply (AGR) beneficial uses in the Central Coast.

Table 2.11 General Basin Plan Objectives[1]

Parameter	Units	MUN Concentration	AGR Concentration
TDS	mg/L	500/1,000/1,500[2]	450
Nitrate + Nitrite-N	mg/L	10	100[3]
Nitrate-NO_3	mg/L	45	
Nitrite	mg/L		10[3]

Key:
AGR = agricultural
mg/L milligrams per liter
MUN = municipal
N = nitrogen
TDS = total dissolved solids

Notes:
[1] Source: Technical Memorandum 1 – Hydrogeologic Conceptual Model for Llagas Subbasin – Salt and Nutrient Management plan dated April 2013 by Todd Engineers.
[2] The levels specified for TDS are the recommended levels for constituents with secondary maximum contaminant levels.
[3] For livestock watering

Table 2.12 presents the annual average TDS and nitrate concentrations of imported water and reservoir water. As shown in the table, imported and reservoir water is of excellent quality with respect to TDS and nitrate.

[7] Total THM values were taken from City of Gilroy and Morgan Hill Annual Water Quality Report for 2014.
Gilroy: http://www.cityofgilroy.org/cityofgilroy_files/city_hall/community_services/water/CCR14.pdf
Morgan Hill: http://www.morgan-hill.ca.gov/DocumentCenter/View/16252

Table 2.12 Average Imported and Reservoir Water Quality for Water Year 2001 to 2011[1]

Source	TDS (mg/L)	Nitrate-NO_3 (mg/L)
Imported Water	278	2.05
Anderson Reservoir	239	0.38
Coyote Reservoir	204	0.12
Uvas Reservoir[2]	185	0.00
Chesbro Reservoir[2]	220	0.00

Key:
mg/L = milligrams per liter NO_3 = Nitrate TDS = total dissolved solids

Notes:
[1] Source: Technical Memorandum 2 – Future Salt and Nutrient Groundwater Quality and Assimilative Capacity for Llagas Subbasin – Salt and Nutrient Management Plan dated June 2013 by Todd Engineers.

[2] TDS and Nitrate-NO_3 only available for Uvas and Chesbro Reservoir from water year 2009-2001.

The effects of irrigating with recycled water on TDS and nitrate-NO_3 loading and concentrations in the aquifer are minimal[8]. Per the Llagas Subbasin Salt and Nutrient Management Plan, over the planning horizon which extends to 2035, less than 1% of the assimilative capacity for TDS is used by recycled water irrigation, and none of the nitrate assimilative capacity is consumed by recycled water irrigation. As the percentage of recycled water use increases, then it is expected on a long term basis that TDS concentrations in groundwater would increase, and there is potential that salt removal may be needed in the future.

2.7.3 Water Quality Requirements of Existing and Potential Customers

SCRWA recycled water is defined as water that meets disinfected tertiary recycled water requirements per California Code of Regulations. This level of treatment allows for unrestricted reuse in virtually all non-potable recycled water applications. The primary recycled water quality requirements are for the landscape and irrigation application. A comparison of the effluent water quality to water quality guidelines for irrigation was developed and is presented in Table 2.13. Effluent concentration values were taken from the SCRWA 2013 Recycled Water Handbook. For constituents not currently monitored and reported by SCRWA, values were taken from the 2004 Master Plan for comparison.

[8] Source: Technical Memorandum 2 – Future Salt and Nutrient Groundwater Quality and Assimilative Capacity for Llagas Subbasin – Salt and Nutrient Management Plan dated June 2013 by Todd Engineers.

Table 2.13 Water Quality Guidelines for Irrigation[1]

Irrigation Water Key Quality Parameter		Units	Established Criteria Degree of Use Restriction[2],[3],[4]			
			None	Slight to Moderate	Severe	SCRWA Effluent[5]
Salinity	EC_w	dS/m	<0.7	0.7-3.0	>3.0	1.1[9]
	TDS	mg/L	<450	450-2000	>2000	757
Permeability[6],[9]						
SAR[7],[8],[9] **=**	0 – 3 and EC_w =		>0.7	0.7-0.2	<0.2	1.1[9]
	3 – 6 and EC_w =		>1.2	1.2-0.3	<0.3	
	6 – 12 and EC_w =		>1.9	1.9-0.5	<2.9	
	12 – 20 and EC_w =		>2.9	2.9-1.3	<1.3	
	20 – 40 and EC_w =		>5.0	5.0-2.9	<2.9	
Sodium (Na)						
	Surface	SAR	<3	3-9	>9	4.1[7],[8],[9]
	Sprinkler	mg/L	<70	>70		123
Chloride (Cl)						
	Surface	mg/L	<140	140-355	>355	178
	Sprinkler	mg/L	<100	<100	>100	
Boron (B)		mg/L	<0.7	0.7-3.0	>3.0	0.4
Bicarbonate		mg/L	<90	90-500	>500	237[8],[9]
pH		--	6.5-8.4 (normal range)			7.3
Ammonia (NH_4)		mg/L	(see combined N values below)			-
Nitrate (NO_3)		mg/L	(see combined N values below)			3.3
Combined Nitrogen (N)		mg/L	<5	5-30	>30	-

Key:

adj RNa = adjusted SAR
Cax = bicarbonate/calcium ratio
Cl = chloride
dS/m = deci Siemens per meter
EC = electrical conductivity
LF = leaching fraction
mg/L = milligrams per liter
N = combined nitrogen
Na = sodium
NH_4 = ammonia
NO_3 = nitrate
SAR = Sodium Adsorption ratio
SCRWA = South County Regional Wastewater Authority
SCVWD = Santa Clara Valley Water District

Notes:

[1] Adapted from University of California Committee of Consultants (1974), and Ayers and Westcot (1994).

[2] Method and Timing of Irrigation: Assumes normal surface and sprinkler irrigation methods are used. Water is applied as needed, and the plants utilize a considerable portion of the available stored soil water (50 percent or more) before the next irrigation. At least 15 percent of the applied water percolates below the root zone (leaching fraction [LF] > 15 percent).

[3] Site Conditions: Assumes soil texture ranges from sandy loam to clay with good internal drainage with no uncontrolled shallow water table present.

[4] Definitions of "The Degree of Use Restriction" terms:

None = Recycled water can be used similar to the best available irrigation water.

Slight = Some additional management will be required above that with the best available irrigation water in terms of leaching salts from the root zone and/or choice of plants.

Moderate = Increased level of management required and choice of plants limited to those which are tolerant of the specific parameters.

Severe = Typically cannot be used due to limitations imposed by the specific parameters.

[5] Unless otherwise indicated, values taken from the SCRWA 2013 Recycled Water Handbook.

[6] Permeability is evaluated based on the combination of adjusted SAR and EC values and taken from the 2004 Master Plan.

[7] Adjusted SAR (adj. RNa) includes the effect of bicarbonate/calcium ratio (Cax) and is taken from the 2004 Master Plan.

[8] Average SCRWA recycled water value taken from the 2004 Master Plan. Source: SCVWD monitoring of recycled water for Advanced Recycled Water Treatment Feasibility Study

[9] Value taken from the 2004 Master Plan.

Overall, none of the water quality parameters should place severe restrictions on the use of recycled water for irrigation. Existing recycled water use at all sites in Gilroy has been successful, highlighting the potential for increased irrigation use with minimal water quality concerns.

2.7.4 Water Quality Requirements of Indirect and Direct Potable Reuse

2.7.4.1 Indirect Potable Reuse Water Quality Requirements

California regulations for IPR groundwater recharge are shown in Table 2.14. The DDW Regulations Related to Recycled Water are contained in Appendix A and include regulations related to indirect potable reuse. Along with the water quality requirements for recycled water, a 6 month retention time in an environmental buffer was required.

New DDW regulations related to recycled water now distinguish between IPR groundwater replenishment reuse projects (GRRPs) that utilize surface application from those that utilize subsurface injection. For both GRRP applications, the six month environmental buffer has been replaced with a treatment requirement that achieves a pathogen reduction specification of 12-log enteric virus reduction, 10-log Giardia cyst reduction, and 10-log Cryptosporidium oocyst reduction prior to recharge. At least three separate treatment processes must be utilized, and each separate treatment process may be credited with no more than 6-log reduction, with at least three processes each being credited with no less than 1.0 log reduction. At a minimum, the recycled water shall fulfill the definition of filtered wastewater pursuant to section 60301.320 and the definition of disinfected tertiary recycled water, pursuant to section 60301 of the DDW regulations. For each demonstrated month of underground retention, a 1-log virus credit reduction will be granted. A GRRP that meets the above stated filtration and disinfection requirements or provides full advanced treatment (FAT) or a demonstrated FAT equivalent of the entire flow used for groundwater replenishment and demonstrates at least six months retention underground will be credited with 10-log Giardia cyst reduction and 10-log Cryptosporidium oocyst reduction. All other log reduction credits must be validated for each of the treatment processes using a challenge test approved by DDW. Surface spreading operations do not require on-going monitoring of the pathogenic microorganisms or surrogate parameter to verify the performance of each treatment process's ability to achieve the credited log reduction. A tracer study must be utilized to demonstrate the retention time underground.

Table 2.14 California Regulations for Groundwater Recharge into Potable Aquifers[1]

Recycled water quality limits	Other selected requirements
• ≥ 5 log virus inactivation	• Industrial pretreatment and source control program
• ≤ 2.2 total coli/100 mL	• ≥ 80 percent dilution for spreading
• ≤ 2 nephelometric turbidity units (NTU)	• ≥ 50 percent dilution for spreading applications (to start) that provide RO and advanced oxidation
• ≤ 0.5 mg/L TOC of wastewater origin	• ≥ 50 percent dilution for injection (to start)
• Drinking water MCLs	• Minimum 3 separate treatment processes to achieve 12-log virus, 10-log Giardia, and 10-log Cryptosporidium reduction
• Action levels for lead and copper	• Monitor recycled water and monitoring wells for priority toxic pollutants, chemicals with state notification levels specified by DDW, and unregulated constituents specified by DDW
• Nitrogen limits depending on method used	• Operations plan
	• Contingency plan

Key:
DDW = State Water Resources Control Board Division of Drinking Water
MCL = maximum contaminant level
NTU = nephelometric turbidity unit
NWRI = National Water Research Institute
RO = reverse osmosis
TOC = total organic carbon

Notes:
[1] Source: National Water Research Institute (NWRI), Regulatory aspects of direct potable reuse in California, White Paper, available at: http://www.nwri-usa.org/pdfs/NWRIPaperDirectPotableReuse2010.pdf,

All drinking water MCLs must be met along with a ≥ 5 log inactivation of virus in the treatment process. Typical treatment processes utilized for IPR applications are MF or UF followed by RO and AOP. For AOPs, NDMA and 1,4 dioxane removals by at least 1.2 logs and 0.5 logs, respectively are required.

Specific monitoring requirements are specified for nitrogen compounds and the average of the results of four consecutive samples must not exceed 10 mg/L (nitrate as N) in order to maintain operations. Quarterly monitoring is required for inorganic chemicals exclusive of nitrogen compounds (Table 64431-A of DDW regulations), radionuclide chemicals (Tables 64442 and 64443 of DDW regulations), organic chemicals (Table 64444-A of DDW regulations), disinfection byproducts (Table 64533-Aof DDW regulations), and lead and copper. One annual sample must be analyzed for secondary drinking water contaminants (Tables 64449-A and 64449-B of DDW regulations) for compliance. Monitoring requirements are also in place for any diluent water used in calculating the recycled wastewater contributions (RWC) and they differ depending upon the quality of the diluent water. The initial maximum RWC shall not exceed 0.20 or an alternative initial RWC approved by DDW. An alternative RWC up to 1.0 may be approved by the Department if a demonstration is made that the total organic carbon (TOC) concentrations will not exceed 0.5mg/L divided by the proposed initial RWC. For surface application GRRP, the soil-aquifer treatment (SAT) is assessed through monitoring of TOC, indicator compounds, and surrogate parameters as approved by the Department. Additionally, each quarter the GRRP shall monitoring for priority toxic pollutants (chemicals listed in 40 CFR section 131.38) and chemicals specified by the Department based upon review of the GRRP's engineering report, the affected groundwater basin(s) and other Department-specified notification level compounds.

Alternatives to requirements in the DDW July 2014 Regulations for surface spreading are considered if a suitable demonstration of public health protection can be made to the Department and written approval is granted from the Department prior to its implementation. A public hearing may in some cases by required by the Department.

Groundwater recharge through sub-surface application also mandates the use of FAT which is the treatment of an oxidized wastewater as defined in section 60301.650 of the DDW regulations. FAT is defined as use of a reverse osmosis membrane and a suitable oxidation process. In lieu of demonstrating that a sufficient oxidation process has been designed for implementation, testing demonstrating that the oxidation process will provide no less than 0.5-log reduction of 1,4-dioxane must be demonstrated. If the AOP demonstration is performed, it must include monitoring of nine indicator compounds, with at least one from each of the following functions groups: hydroxyl aromatic, amino/acylamino aromatic, nonaromatic with carbon double bonds, deprotonated amine, akloxy polyaromatic, alkoxy aromatic, alkyl aromatic, saturated aliphatic, and nitro aromatic. Removal of at least 0.5-log is required for the first seven functional groups and 0.3-log is required for the final two functional groups as supported by challenge testing. At least one surrogate or operational parameter that reflects

removal of at least five of the nine indicator compounds must be selected pursuant to a prescriptive set of conditions. Each RO membrane element used in the project must achieve a minimum rejection of sodium chloride of no less than 99.0 percent and an average (nominal) rejection of sodium chloride of no less than 99.2 percent, as demonstrated through Method A of ASTM International's method D4194-03 with several substitute test conditions. These include operation at a recovery of no less than 15 percent; sodium chloride rejection based on three or more successive measurements performed in a specified manner; an influent pH no less than 6.5 and no greater than 8.0; and an influent sodium chloride concentration of no greater than 2000 mg/L that is verified prior to start of testing. During the first twenty weeks of full-scale operation the membrane must produce a permeate with no more than five percent of the sample results having TOC concentrations greater than 0.25 mg/L, as verified through monitoring of at least a weekly frequency. On-going monitoring of performance (e.g. conductivity or TOC) indicating when integrity of the process has been compromised must also be proposed. This shall include at least one form of continuous monitoring with associated surrogate and/or operational parameter limits and alarm settings that indicate when integrity has been compromised.

2.7.4.2 Direct Potable Reuse Water Quality Requirements

The DDW, with the assistance of an Advisory Group and Expert Panel, are in the process of reporting to the Legislature on the feasibility of developing uniform water recycling criteria for direct potable reuse. While DPR regulations are not currently in place, this may become a viable option in the future. DPR would also require additional treatment in order to be used as a raw water supply for a drinking water treatment plant or be pumped directly into a potable water distribution system. The water quality goals for any potable water reuse project should be set based on the criteria that the water produced by the treatment processes is protective of human health meaning that reuse projects must adequately deal with the two principal health threats of concerns: microbial and chemical contaminants.

There are only two DPR full-scale facilities in the United States (Big Springs, Texas (TX) and Wichita Falls, TX). Both of these facilities have MF followed by RO and advanced oxidation. However, a full-scale plant in Africa (Windhoek, Namibia) does not include RO due to the low TDS of wastewater source. Thus, the selection of a treatment train will strongly depend on the TDS requirements for treatment.

2.8 MARKET REFINEMENT AND CUSTOMER SELECTION

Currently, there are more recycled water customers identified than recycled water available from the SCRWA WWTP. The next step following the market assessment is to refine the identified customers based on the selected NPR alternative. Various criteria were used to rank the identified alternatives and potential customers to determine the best alignment and potential customers to serve with the available recycled water to meet future non-potable and potable water needs.

2.8.1 Evaluation Criteria

Evaluation criteria were developed in coordination with the District to aid in the ranking of each customer. These criteria provided a guide to identify the most viable potential new customers to add to the recycled water system and the potential future alignments to connect them. A ranking system of 1 through 5, with 5 being the best, was used for each of the following evaluation categories:

- **Category 1: Year Round/Seasonal Use and High/Low Demands**
  Year round users with high consistent usage are preferred over highly seasonal users with high usage during summer months. Recycled water usage peaks during the summer months with the onset of irrigation and dips during winter months. Having customers with more consistent year-round usage helps the WWTP with reduced effluent discharge in the low demand months.
- **Category 2: Flexibility of Water Usage/On-Site Storage**
  Customers with on-site storage are preferred over users with strict usage times as it allows the District to optimize the capacity of the recycled water system. Having customers with water use flexibility, such as having on-site tanks or reservoirs, allows these users to fill their storage during off-peak hours.
- **Category 3: Proximity to the Existing/Baseline System**
  Customers with a closer proximity to the existing system require less infrastructure which results with less capital and maintenance costs.
- **Category 4: Level of Interest/Required Water Quality**
  This category accounts for the customer's level of interest, their concerns about water quality, and customer on-site infrastructure improvements that may be necessary.
- **Category 5: Capital, Construction, and Operations and Maintenance (O&M) Annual Costs**
  This category accounts for the total annual costs which includes capital, construction, and operation and maintenance costs presented in a dollar per acre foot of recycled water that is required to connect each potential customer to the system.

The detailed ranking system for each evaluation category is documented on Table 2.15.

2.8.2. Customer Scoring and Ranking

Each user was analyzed and given a rank based on each of the categories and a cumulative score was given. The City of Gilroy customer scores are shown on Table 2.16. The rankings span from 25 points for the WWTP Utility Water to 10 points for users that would require extensive improvements and/or would have low demands. This table is split into the four groups as identified by the District, SCRWA, and City of Gilroy; Existing Customers, In-Progress Users, Baseline Users, and Potential Users. Within each of these groups, the users are organized by the total score and color coded from dark green (high score) to dark red (low score) for ease of reference between each potential customer. Figure 2.5 shows that the users with higher rankings were generally located near the existing or baseline system.

The rankings for the City of Morgan Hill potential customers are documented in Table 2.17. This table contains two rankings; one that includes the costs of constructing a new recycled water

transmission main to Morgan Hill and the other that excludes the Morgan Hill transmission main cost. Since the City of Morgan Hill contributes to the inflow of the SCRWA WWTP a secondary evaluation was performed excluding the cost of the Morgan Hill transmission main between the SCRWA WWTP and Morgan Hill. This transmission main was excluded from the ranking to provide a more equitable comparison between possible alternatives in Morgan Hill and Gilroy.

The total scores range from 15 to 9 with the Morgan Hill transmission main cost included and from 16 to 9 without. These scores continue the same color coding from the Gilroy customers on Table 2.16. Figure 2.6 shows the potential customer rankings for Morgan Hill (Including the Morgan Hill Transmission Main cost).

2.8.3. Recommended Customer List

As the system expands the District, SCRWA, and the Cities of Gilroy and Morgan Hill will be able to utilize these tables and figures to prioritize the potential users that are the most viable to connect to the system. These tables also include the users' estimated annual and maximum day demands, allowing the District to keep track of the total projected system demands as to not exceed the supply capacity of the SCRWA WWTP.

Table 2.15 Customer Ranking System

Category 1 - Year Round/Seasonal Use and High/Low Demand

The scores in this category range from 1 to 5:

1. Highly Seasonal with High Demands (Irrigation)
2. Seasonal with High Variable Demand (Irrigation)
3. Seasonal with Low Variable Demand (M&I)
4. Mildly Seasonal with Low Consistent Demand (M&I)
5. Year Round Usage with Consistent High Demand (M&I)

Category 2 - Flexibility of Water Usage/On-site Storage

The scores in this category range from 1 to 5:

1. Strict usage times
2. Flexible usage times with potable water supply back-up required
3. Flexible usage times with ground water supply well back up required
4. Flexible usage times with no back up supply required
5. On-Site Storage (allows off-peak storage filling)

Category 3 - Proximity to Baseline System

The scores in this category range from 1 to 5:

1. System extension greater than 1/4 mile
2. System extension between 500 feet and 1/4 mile
3. System extension less than 500 feet
4. New turnout required
5. Existing turnout available

Category 4 - Level of Interest/Water Quality

The scores in this category range from 1 to 5:

1. No Interest
2. Interested but require high quality water and/or significant on-site infrastructure improvements
3. Interested and willing to meet higher quality requirements at their own expense and/or moderate on-site infrastructure improvements
4. Moderate Interest and not concerned about water quality and/or low on-site infrastructure improvements
5. High Interest and not concerned about quality and/or low on-site infrastructure improvements

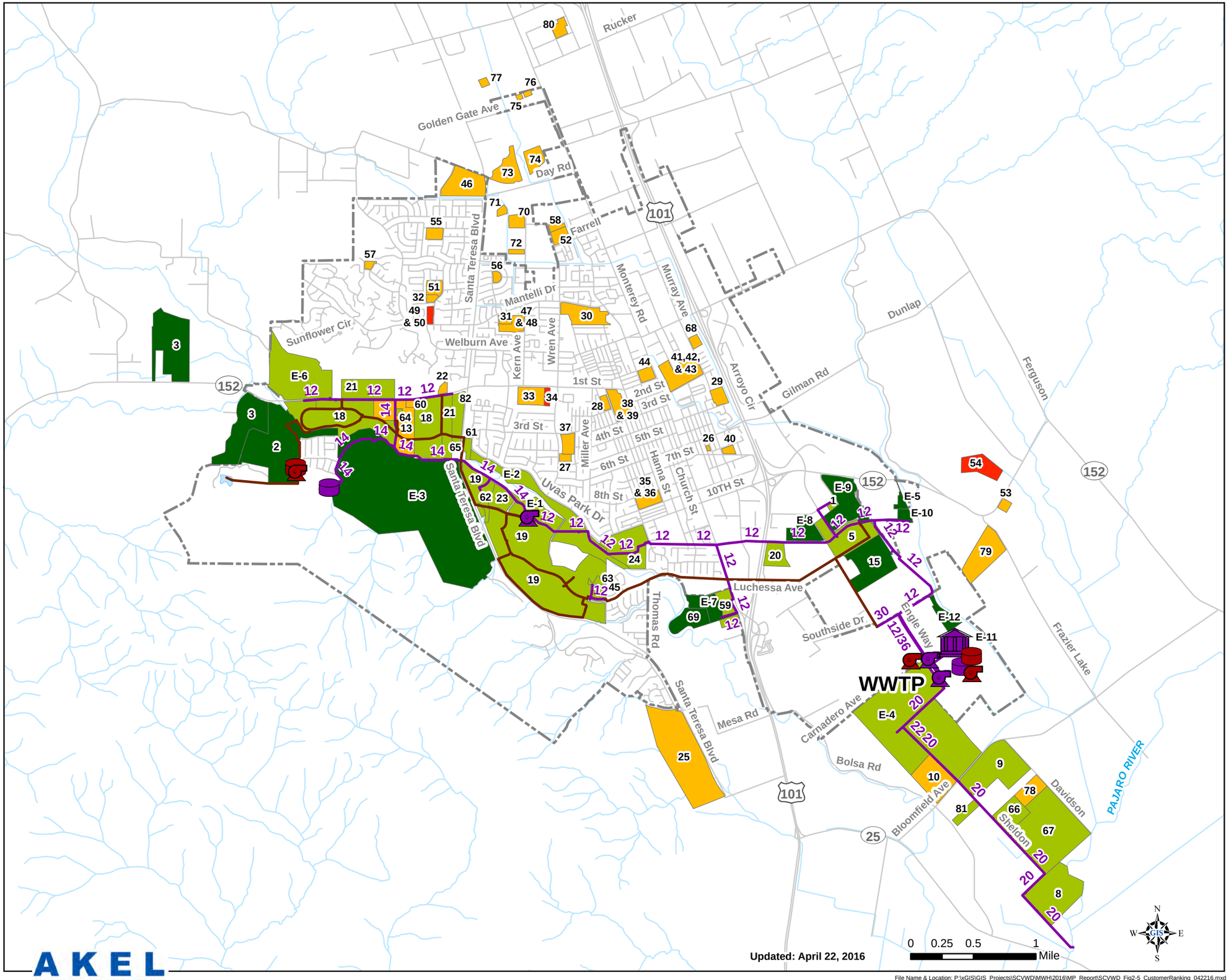
Category 5 - Capital, Construction, and O&M Annual Costs

The scores in this category range from 1 to 5:

1. > $2,500 per acre foot
2. $1,500 - $2,500 per acre foot
3. $1,000 - $1,500 per acre foot
4. $500 - $1,000 per acre foot
5. < $500 per acre foot

Table 2.16 City of Gilroy Customer Scores

Site No.	Site Name	Recycled Water Demand Estimates		Evaluation Criteria					
				Category 1	Category 2	Category 3	Category 4	Category 5	Total Score
		Annual Average (afy)	Maximum Day (MGD)	Seasonal Usage (1-5)	Flexibility of Use (1-5)	Proximity (1-5)	Level of Interest (1-5)	Capital/ O&M Costs (1-5)	
Existing Customers									
E-11	WWTP Utility Water	1,172	1.26	5	5	5	5	5	25
E-5	Calpine Power Plant - Peaker	20	0.05	5	1	5	5	5	21
E-10	Calpine Power Plant - Cogen	273	0.69	5	1	5	5	5	21
E-3	Eagle Ridge Golf Course	514	1.10	2	5	5	5	4	21
E-7	City of Gilroy - Sports Park	37	0.08	3	1	5	5	5	19
E-8	Obata Farms (North)	68	0.21	1	3	5	5	5	19
E-9	McCarthy Business Park	17	0.04	3	1	5	5	5	19
15	Obata (new turnout)	169	0.53	1	3	5	5	5	19
E-12	City of Gilroy - Shooting Range	1	0.00	3	1	5	5	5	19
E-1	Christmas Hill Park - Ranch	8	0.02	3	1	5	5	4	18
E-2	Christmas Hill Park - North	22	0.04	3	1	5	5	4	18
5	United Natural Food	23	0.05	3	1	4	5	5	18
E-4	SCRWA Farms (Ag Lease) Turnout #1-#6	151	1.45	1	3	5	5	4	18
8	C & E Farms	169	0.53	1	3	5	5	4	18
E-6	City of Gilroy - Golf Course	146	0.36	2	1	5	5	3	16
	Sub-Total	2789	6.43						
In-Progress Users									
1	Cintas Corporation	119	0.29	5	2	5	2	4	18
19	Glen Loma Ranch Development	29	0.07	3	1	4	5	4	17
23	Ascension Solorsano Middle School	27	0.07	3	1	4	5	4	17
24	Gilroy High School	78	0.19	3	1	4	5	4	17
45	Las Animas Elementary	14	0.03	3	1	4	5	4	17
61	Santa Teresa & Third Street Park	14	0.03	3	1	4	5	4	17
62	Glen Loma Ranch Second Park (Santa Teresa Blvd and Club Dr)	14	0.03	3	1	4	5	4	17
63	Sydney Casper City Park	14	0.03	3	1	4	5	4	17
65	City Park (SW corner of Santa Teresa Blvd and 3rd St)	14	0.03	3	1	4	5	4	17
9	Flanagan (Kapa Seeds)	68	0.21	1	3	4	5	4	17
66	C & E Farms (Additional Parcel)	74	0.23	1	3	4	5	4	17
67	Christopher Ranch (Existing Turnout)	375	1.17	1	3	4	5	4	17
64	City Park (Hecker Pass)	14	0.03	3	1	4	5	3	16
18	Meritage Development	21	0.05	3	1	4	5	2	15
	Sub-Total	873	2.48						
Baseline Users									
2	Gilroy Gardens (formerly Bonafante)	169	0.45	5	5	4	5	3	22
3	Western Tree Nursery I & II	597	1.60	5	5	4	5	2	21
7	Calpine Power Plant - Additional Demand	23	0.05	5	1	5	5	5	21
69	Gilroy Sports Park Expansion	16	0.04	3	1	5	5	5	19
	Sub-Total	805	2.15						
Potential Users									
6	Sundance Landscaping, Inc. (Possible Fill-Station User)	0	0.00	2	5	5	4	5	21
81	Mike Steffen	5	0.02	2	3	4	5	4	18
20	Temple-Inland Corrugated Packaging	29	0.07	5	2	4	1	4	16
21	Hoey Development	18	0.04	3	1	4	4	3	15
59	Gilroy Sports Park (Agriculture)	34	0.11	1	1	4	4	5	15
82	Village Green	7	0.04	2	2	4	2	5	15
13	Syngenta	19	0.06	2	3	4	2	3	14
60	Hecker Pass (Agriculture)	45	0.14	1	1	4	5	3	14
68	Lomar Laundry	163	0.39	5	2	1	3	3	14
78	Cherry Orchard	49	0.15	1	3	2	4	4	14
25	Gavilan College, Sports Park, and Golf Course	39	0.09	3	3	1	5	1	13
31	Rainbow Park	3	0.01	3	1	1	5	3	13
41/42/43	South Valley Jr. High/Gilroy Community Day/Gilroy Adult Edu.	46	0.11	3	1	1	5	3	13
47/48	Rod Kelley Elementary/Mt. Madonna High	19	0.05	3	1	1	5	3	13
56	Los Arroyos Park	12	0.03	3	1	1	5	3	13
10	Bonfante Nurseries	214	0.67	1	1	5	1	4	12
22	Vineyard Christian School	6	0.01	3	1	4	1	3	12
29	San Ysidro Park	58	0.14	3	1	1	5	2	12
30	Las Animas Park	102	0.25	3	1	1	5	2	12
32	Del Rey Park	17	0.04	3	1	1	5	2	12
33	Gavilan Hills Memorial Park	43	0.10	3	1	1	5	2	12
35/36	Glen View Elementary/Gateway School	25	0.06	3	1	1	5	2	12
38/39	Jordan Elementary/Brownell Academy of Humanities	17	0.04	3	1	1	5	2	12
46	Christopher High School	103	0.25	3	1	1	5	2	12
51	Luigi Aprea Fundamental Elementary	13	0.03	3	1	1	5	2	12
58	Farrell Avenue Park	11	0.03	3	1	1	5	2	12
70	Future Elementary School	17	0.04	3	1	1	5	2	12
71	Future Neighborhood Park #1	12	0.03	3	1	1	5	2	12
72	Future Neighborhood Park #2	11	0.03	3	1	1	5	2	12
73	Future Community Park	91	0.22	3	1	1	5	2	12
74	Future Middle School	30	0.07	3	1	1	5	2	12
79	Frazier Lake Road Agriculture User	108	0.34	1	1	1	5	4	12
26	Forest Street Park	5	0.01	3	1	1	5	1	11
27	El Roble Park	18	0.04	3	1	1	5	1	11
28	Miller Park	22	0.05	3	1	1	5	1	11
37	El Roble Elementary	18	0.04	3	1	1	5	1	11
40	Eliot Elementary	4	0.01	3	1	1	5	1	11
44	St. Mary's	13	0.03	3	1	1	3	3	11
52	Antonio Del Buono Elementary	10	0.02	3	1	1	5	1	11
53	San Ysidro Elementary	9	0.02	3	1	1	3	3	11
55	Sunrise Park	25	0.06	3	1	1	5	1	11
57	Carriage Hills Park	14	0.03	3	1	1	5	1	11
75	Future Active Adult Gathering Area #1	5	0.01	3	1	1	5	1	11
76	Future Active Adult Gathering Area #2	6	0.01	3	1	1	5	1	11
77	Future Neighborhood Park #3	10	0.03	3	1	1	5	1	11
80	Rucker Elementary	18	0.04	3	1	1	5	1	11
34	St. Mary's Cemetery	5	0.01	3	1	1	4	1	10
49/50	Adventist Christian/Pacific West Christian Academy	20	0.05	3	1	1	3	2	10
54	Obata Farms	67	0.21	1	1	1	5	2	10
	Sub-Total	1637	4.36						



Legend

Proposed

- Storage Tanks
- Booster Stations
- Pipes

Existing

- WWTP
- Storage Tanks
- Booster Stations
- Recycled Water Pipelines

Users Ranked by Total Score

- 25 - 19
- 18 - 15
- 14 - 11
- 10 - 9
- City Limits
- Roads
- Creeks
- Lake

Figure 2.5
Potential Recycled Water Customer Rankings (Gilroy)
South County Recycled Water System

Santa Clara Valley Water District /
South County Regional Wastewater Authority

Santa Clara Valley Water District

AKEL ENGINEERING GROUP, INC.

File Name & Location: P:\xGIS\GIS_Projects\SCVWD\MWH\2016\MP_Report\SCVWD_Fig2-5_CustomerRanking_042216.mxd

Table 2.17 City of Morgan Hill Customer Scores

Site No.	Site Name	Recycled Water Demand Estimates		Evaluation Criteria						Evaluation Criteria (Not Including the Recharge Pipeline Project Costs)					
		Annual Average	Maximum Day Demand	Category 1 Seasonal Usage	Category 2 Flexibility of Use	Category 3 Proximity	Category 4 Level of Interest	Category 5 Capital/ O&M Costs	Total Score	Category 1 Seasonal Usage	Category 2 Flexibility of Use	Category 3 Proximity	Category 4 Level of Interest	Category 5 Capital/ O&M Costs	Total Score
		(afy)	(MGD)	(1-5)	(1-5)	(1-5)	(1-5)	(1-5)		(1-5)	(1-5)	(1-5)	(1-5)	(1-5)	
MH-30	Greenfield Nursery	70	0.22	5	3	1	3	3	15	5	3	1	3	4	16
MH-7	California Color Growers LLC	141	0.44	5	3	1	3	2	14	5	3	1	3	3	15
MH-21	Nursery	40	0.13	5	3	1	3	2	14	5	3	1	3	3	15
MH-26	Kajiko Nursery	149	0.47	5	3	1	3	2	14	5	3	1	3	3	15
MH-38	Nursery	52	0.16	5	3	1	3	2	14	5	3	1	3	3	15
MH-58	Nursery	66	0.21	5	3	1	3	2	14	5	3	1	3	4	16
MH-63	Kawahara Nursery Inc	353	1.10	5	3	1	3	2	14	5	3	1	3	2	14
MH-2	Morgan Hill Growers	39	0.12	5	3	1	3	1	13	5	3	1	3	2	14
MH-22	Coyote Valley Nursery	53	0.17	5	3	1	3	1	13	5	3	1	3	2	14
MH-23	Valley Orchids Inc	67	0.21	5	3	1	3	1	13	5	3	1	3	1	13
MH-24	Hoo Gee Nursery	65	0.20	5	3	1	3	1	13	5	3	1	3	2	14
MH-25	Hung's Nursery	37	0.11	5	3	1	3	1	13	5	3	1	3	2	14
MH-28	Gabilan Growers	13	0.04	5	3	1	3	1	13	5	3	1	3	2	14
MH-31	Lakeside Nursery	19	0.06	5	3	1	3	1	13	5	3	1	3	2	14
MH-57	Wing Mok Nursery	49	0.15	5	3	1	3	1	13	5	3	1	3	1	13
MH-1	Ann Sobrato High School	84	0.20	3	1	1	5	2	12	3	1	1	5	2	12
MH-8	El Toro Elementary School	21	0.05	3	1	1	5	2	12	3	1	1	5	2	12
MH-11	Park	7	0.02	3	1	1	5	2	12	3	1	1	5	2	12
MH-12	Park	10	0.02	3	1	1	5	2	12	3	1	1	5	3	13
MH-17	Nordstrom Elementary School	17	0.04	3	1	1	5	2	12	3	1	1	5	4	14
MH-27	Institute Golf Course	494	1.21	5	1	1	3	2	12	5	1	1	3	3	13
MH-44	Live Oak High School	81	0.20	3	1	1	5	2	12	3	1	1	5	4	14
MH-66	Park	3	0.01	3	1	1	5	2	12	3	1	1	5	3	13
MH-68	Park	5	0.01	3	1	1	5	2	12	3	1	1	5	3	13
MH-75	Nordstrom Park	14	0.03	3	1	1	5	2	12	3	1	1	5	4	14
MH-76	Park	3	0.01	3	1	1	5	2	12	3	1	1	5	3	13
MH-3	Park	2	0.00	3	1	1	5	1	11	3	1	1	5	1	11
MH-5	Park	12	0.03	3	1	1	5	1	11	3	1	1	5	1	11
MH-6	Park	5	0.01	3	1	1	5	1	11	3	1	1	5	2	12
MH-9	PA Walsh Elementary School	17	0.04	3	1	1	5	1	11	3	1	1	5	2	12
MH-10	Central High School	6	0.01	3	1	1	5	1	11	3	1	1	5	1	11
MH-13	Park	8	0.02	3	1	1	5	1	11	3	1	1	5	2	12
MH-14	Park	3	0.01	3	1	1	5	1	11	3	1	1	5	1	11
MH-15	Jackson Elementary School	13	0.03	3	1	1	5	1	11	3	1	1	5	1	11
MH-16	Park	10	0.02	3	1	1	5	1	11	3	1	1	5	3	13
MH-18	St Catherine's School	14	0.03	3	1	1	5	1	11	3	1	1	5	1	11
MH-20	Morgan Hill Community Park	70	0.17	3	1	1	5	1	11	3	1	1	5	2	12
MH-32	Paradise Park	16	0.04	3	1	1	5	1	11	3	1	1	5	1	11
MH-34	Britton Field (Park)	59	0.14	3	1	1	5	1	11	3	1	1	5	2	12
MH-35	Burnett Elementary School	19	0.05	3	1	1	5	1	11	3	1	1	5	2	12
MH-36	Holiday Lake Meadow (Park)	17	0.04	3	1	1	5	1	11	3	1	1	5	1	11
MH-37	Park	3	0.01	3	1	1	5	1	11	3	1	1	5	1	11
MH-39	Barrett Elementary School	16	0.04	3	1	1	5	1	11	3	1	1	5	2	12
MH-40	Park	6	0.02	3	1	1	5	1	11	3	1	1	5	1	11
MH-42	Park	2	0.00	3	1	1	5	1	11	3	1	1	5	1	11
MH-43	Park	5	0.01	3	1	1	5	1	11	3	1	1	5	1	11
MH-45	Park	7	0.02	3	1	1	5	1	11	3	1	1	5	1	11
MH-46	Park	6	0.01	3	1	1	5	1	11	3	1	1	5	1	11
MH-47	Park	2	0.01	3	1	1	5	1	11	3	1	1	5	1	11
MH-48	Park (Coyote Estates)	1	0.00	3	1	1	5	1	11	3	1	1	5	2	12
MH-49	Park	7	0.02	3	1	1	5	1	11	3	1	1	5	3	13
MH-50	Park	9	0.02	3	1	1	5	1	11	3	1	1	5	2	12
MH-53	Oak Creek Park	9	0.02	3	1	1	5	1	11	3	1	1	5	1	11
MH-54	Oakwood School	44	0.11	3	1	1	5	1	11	3	1	1	5	2	12
MH-55	Howard Wiechert Park	3	0.01	3	1	1	5	1	11	3	1	1	5	1	11
MH-60	Park	3	0.01	3	1	1	5	1	11	3	1	1	5	1	11
MH-61	Stratford School	4	0.01	3	1	1	5	1	11	3	1	1	5	1	11
MH-65	Diana Park	10	0.02	3	1	1	5	1	11	3	1	1	5	1	11
MH-67	Park	2	0.00	3	1	1	5	1	11	3	1	1	5	2	12
MH-69	Park	2	0.00	3	1	1	5	1	11	3	1	1	5	1	11
MH-70	Park	2	0.00	3	1	1	5	1	11	3	1	1	5	1	11
MH-71	Park	8	0.02	3	1	1	5	1	11	3	1	1	5	1	11
MH-72	Jackson Park	4	0.01	3	1	1	5	1	11	3	1	1	5	1	11
MH-74	Galvan Park	23	0.06	3	1	1	5	1	11	3	1	1	5	2	12
MH-77	Park	11	0.03	3	1	1	5	1	11	3	1	1	5	1	11
MH-78	Park	9	0.02	3	1	1	5	1	11	3	1	1	5	2	12
MH-79	Paradise Valley Elementary School	24	0.06	3	1	1	5	1	11	3	1	1	5	1	11
MH-29	Farmer's Market	4	0.01	3	1	1	3	2	10	3	1	1	3	3	11
MH-33	Morgan Hill Outdoor Sports Center	54	0.12	3	1	1	3	2	10	3	1	1	3	4	12
MH-51	TenCate Advanced Composites	19	0.05	3	1	1	3	2	10	3	1	1	3	3	11
MH-59	Farm	36	0.11	1	3	1	3	2	10	1	3	1	3	4	12
MH-4	Morgan Hill Orthopaedics & Sports Medicine	78	0.19	3	1	1	3	1	9	3	1	1	3	4	12
MH-19	Morgan Hill Community and Cultural Center	22	0.05	3	1	1	3	1	9	3	1	1	3	2	10
MH-41	Del Monte Townhomes	17	0.04	3	1	1	3	1	9	3	1	1	3	1	9
MH-52	Morgan Hill Library	7	0.02	3	1	1	3	1	9	3	1	1	3	1	9
MH-56	Coyote Valley Sporting Clays	1	0.00	3	1	1	3	1	9	3	1	1	3	1	9
MH-62	Morgan Hill Bible Church	7	0.02	3	1	1	3	1	9	3	1	1	3	1	9
MH-64	Madrone Plaza	4	0.01	3	1	1	3	1	9	3	1	1	3	2	10
MH-73	William F. James Boys Ranch	185	0.45	3	1	1	3	1	9	3	1	1	3	2	10
	Total	2,877	7.85												

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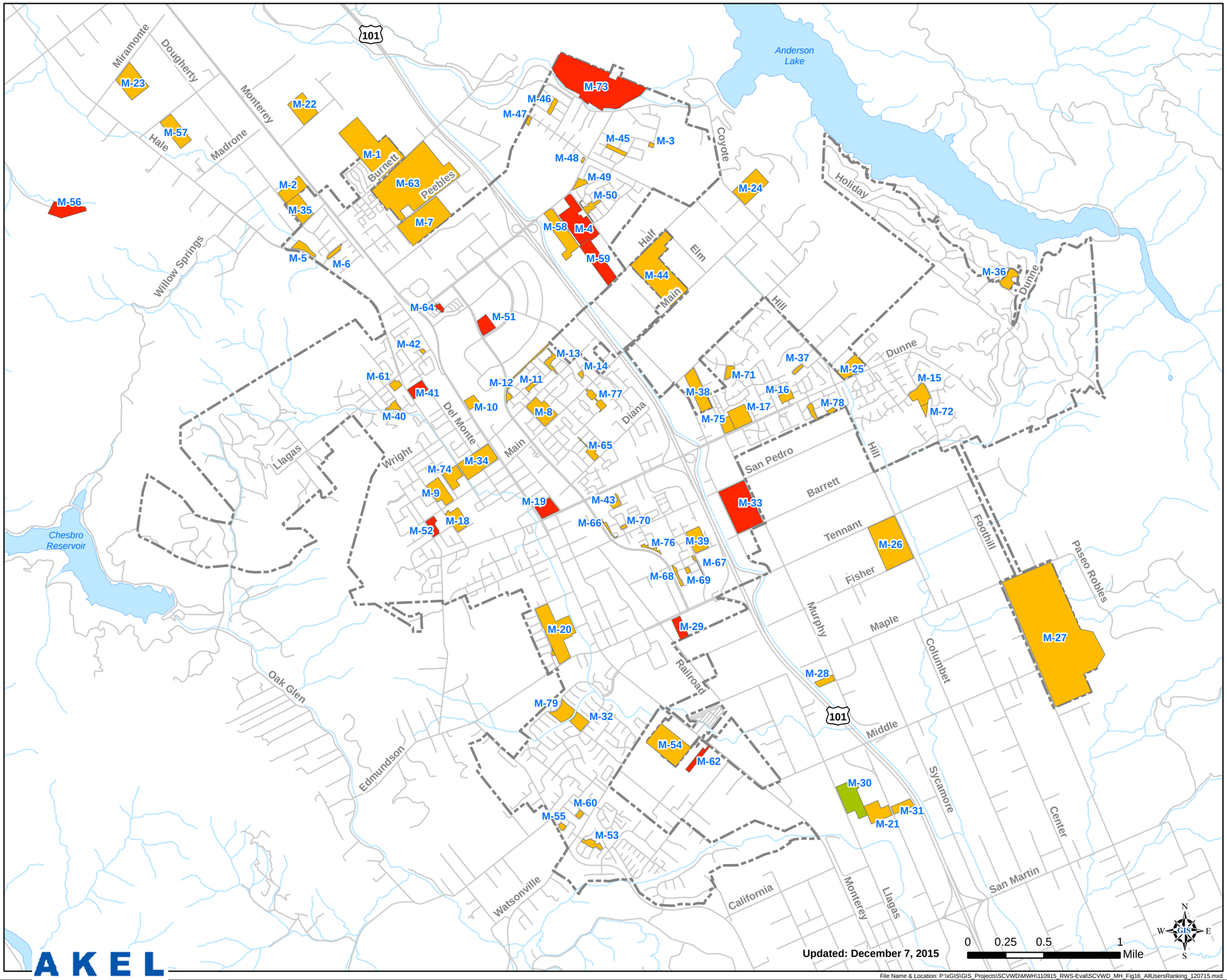

Legend

Potential Users by Total Score

- 25 - 19
- 18 - 15
- 14 - 11
- 10 - 9
- City Limits
- Roads
- Creeks
- Lakes

Updated: December 7, 2015

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Figure 2.6
Potential Recycled Water Customer Rankings (Morgan Hill)
South County Recycled Water System

Santa Clara Valley Water District /
South County Regional Wastewater Authority

Santa Clara Valley Water District

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Chapter 3

System Expansion Alternatives Evaluation

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3 SYSTEM EXPANSION ALTERNATIVES EVALUATION

3.1 INTRODUCTION

The previous chapters provide background, identify potential recycled water customers, and quantify demand for recycled water in the South County. This chapter reviews the existing recycled water system, provides details of, and evaluates preliminary project alternatives. Lastly, Chapter 4 will develop the selected project alternatives for Immediate Term, Short Term, and Long Term CIPs.

The existing recycled water system consists of a tertiary treatment facility at the SCRWA WWTP, a main transmission pipeline, distribution piping to the existing recycled water customers, storage reservoirs, and pumping facilities. These facilities are described further below.

3.2 BASELINE CONDITIONS

The recycled water system conditions that make up the baseline for this analysis are:

1. Existing distribution system and facilities
2. Existing treatment system and limitations

The distribution system and facilities are the primary component of this 2015 Master Plan Update. Information on recycled water treatment facilities and their relation to the distribution system are included, but overall upgrades or expansion of the recycled water treatment facilities located at the SCRWA WWTP are being conducted as a separate effort. More information on the capital improvement projects planned at the SCRWA WWTP can be found in the SCRWA Capital Improvements Strategic Plan[9], dated October 2011.

3.2.1 Existing Distribution System and Facilities

The existing recycled water distribution system consists of approximately 77,250 linear feet (14.6 miles) of 8-inch to 36-inch diameter pipeline, a 4 mgd booster pump station, a 1.5 MG storage tank, and is supported by a 3 MG reservoir, 3.5 mgd pump station, and 3 mgd pump station at the SCRWA WWTP as documented in Table 3.1. The existing recycled water system is comprised of two primary distribution systems that operate independently of the other, the North System and the South System (Pajaro River Pipeline). The existing system and existing customers are shown graphically on Figure 3.1 and the existing system customers are summarized on Table 3.2. Furthermore, Figure 3.2 documents the hydraulic profile of the two systems.

[9] For additional information on the SCRWA Capital Improvements Strategic Plan and subsequent version, contact the South County Regional Wastewater Authority (http://www.ci.gilroy.ca.us/561/South-County-Regional-Wastewater-Authori or 408-846-0202).

Table 3.1 Existing South County Recycled Water System Summary

Pipes		
Pipe Diameter (in)	Length (ft)	(mi)
North System		
8	750	0.1
12	43,800	8.3
14	11,550	2.2
30	1,400	0.3
36	2,850	0.5
Sub-Total	60,350	11.4
South System		
10	350	0.1
20	15,900	3.0
22	650	0.1
Sub-Total	16,900	3.2
Total	77,250	14.6

Booster Stations			
Booster Station ID	Pump No.	Head (ft)	Flow (gpm)
North System			
Zone 1 Pump Station (Area 93)	1	295	1,200
	2	295	1,200
	3	295	1,200
	Total Capacity	3,600 gpm / 5.2 MGD	
	Firm Capacity	2,400 gpm / 3.5 MGD	
Zone 2 Pump Station (Christmas Hill)	1	276	1,375
	2	276	1,375
	3	276	1,375
	Total Capacity	4,125 gpm / 5.9 MGD	
	Firm Capacity	2,750 gpm / 4.0 MGD	
South System			
South Zone Pump Station (Area 94)	1	170	2,100
	2	170	2,100
	Total Capacity	4,200 gpm / 6.0 MGD	
	Firm Capacity	2,100 gpm / 3.0 MGD	

Tanks				
Tank ID	Height (ft)	Diameter (ft)	Volume (MG)	Base Elevation (ft)
WWTP Reservoir	22.5	150	3.0	160
North System Tank (Hoylake)	22.5	105	1.5	385

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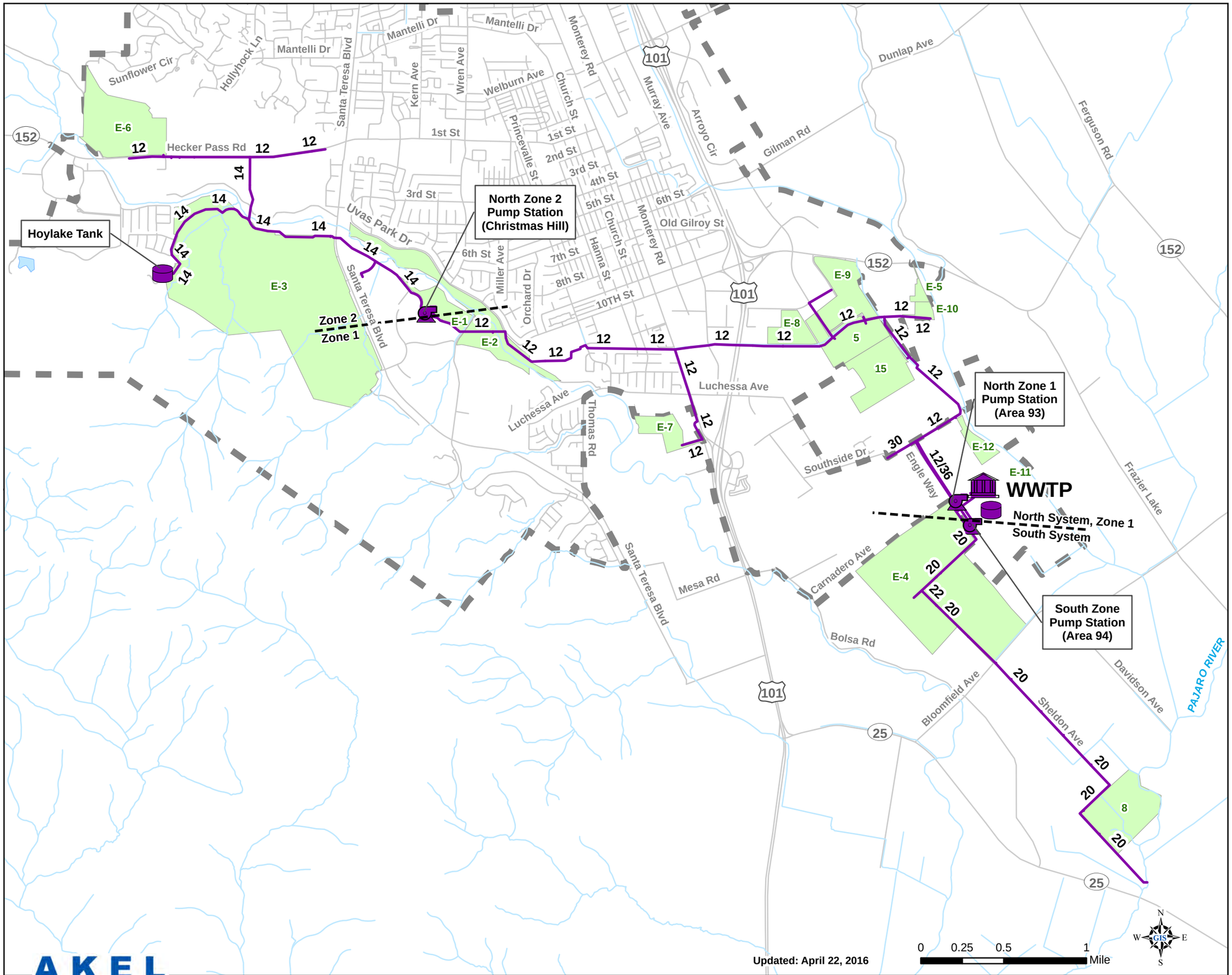
12/15/2015

Key:
ft = feet
gpm = gallons per minute
MGD = million gallons per day
WWTP = wastewater treatment plant



Legend

Existing

- WWTP
- Storage Tanks
- Booster Stations
- Recycled Water Pipelines
- Pressure Zone Line
- Existing Users
- City Limits
- Roads
- Creeks
- Lake

Updated: April 22, 2016

File Name & Location: P:\xGIS\GIS_Projects\SCVWD\MWH\2016\MP_Report\SCVWD_Fig3-1_ExSys_042216.mxd

Figure 3.1
Existing System

South County Recycled Water System

Santa Clara Valley Water District /
South County Regional Wastewater Authority

Santa Clara Valley Water District

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Table 3.2 Existing South County Recycled Water System Customers

Site No.	Site Name	Recycled Water System	Zone	Usage Type	On-Site Storage	Hours of Usage (period)	Hours of Usage (hrs)	Estimated Demands[1] (afy)	Actual Usage (2014)[2] (afy)
Existing Users									
E-1	Christmas Hill Park - Ranch	North	1	Irrigation		10pm - 7am	9	25	7
E-2	Christmas Hill Park	North	1	Irrigation		10pm - 7am	9		19
E-3	Eagle Ridge Golf Course	North	2	Irrigation	Pond	9pm - 6am	9	330	455
E-4	SCRWA Farms (Ag Lease) Turnout #1-#6	South	-	Agricultural		7 am-1pm; 7pm-1am	12	150	174
E-8	Obata Farms (North)	North	1	Agricultural		7 am-1pm; 7pm-1am	12		60
E-5	Calpine Power Plant - Peaker	North	1	M&I		24hr	24	260	6
E-10	Calpine Power Plant - Cogen	North	1	M&I		24hr	24		77
E-6	City of Gilroy - Golf Course	North	2	Irrigation		9pm - 7am	10	120	129
E-7	City of Gilroy - Sports Park	North	1	Irrigation		10pm - 7am	9	30	32
E-9	McCarthy Business Park	North	1	Irrigation		9pm - 6am	9	5	15
E-11	WWTP Utility Water	WWTP Utility	-	M&I		24hr	24	1,000	1020
E-12	City of Gilroy - Shooting Range	North	1	Irrigation		7am - 11pm	4	1	1
8	C & E Farms[3]	South	-	Agricultural		8am-5pm	9	150	-
15	Obata (new turnout)[3]	North	1	Agricultural		7 am-1pm; 7pm-1am	12	150	-
5	United Natural Food[3]	North	1	Irrigation		10pm - 7am	9	20	-
	Total							2,241	1,995

Notes:

1. Estimated Demands for existing users obtained from 'Recycled Water Use Permits.'
2. Actual usage per 'SCRWA Reclaimed Water Usage Log' for Calendar 2014 listed (quarter usage received)
3. Not used in 2014 Analysis Scenario, customers will be on-line and receiving water in the near-term.

9/14/2015

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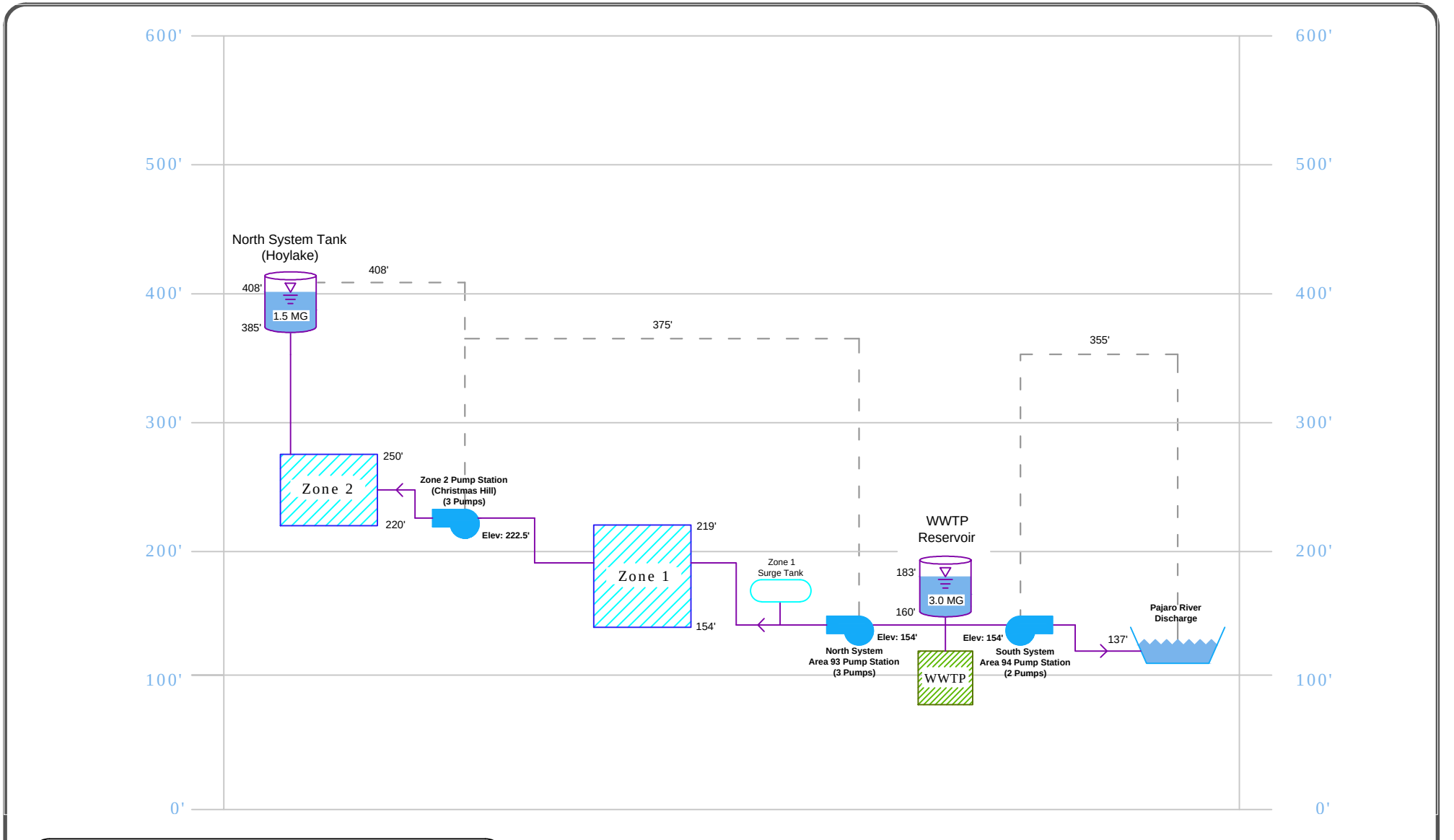
Key:

afy = acre-feet per year
M&I = municipal and industrial
SCRWA = South County Regional Wastewater Authority
WWTP = wastewater treatment plant



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- Transmission Main
- Pump Station (PSN) — PSN: Pump Station Name & Elevation
- River (HGL) — HGL: Hydraulic Grade Line (ft)
- Surge Tank (Tank Name)
- Storage Reservoir (RES) — RES: Reservoir Name; HWL: High Water Line; LOW: Bottom Elevation (ft); CAP: Capacity (MG)
- Zone — High / Low — Service Elevations
- Static HGL

Updated: February 4, 2016

AKEL ENGINEERING GROUP, INC.

Figure 3.2

Hydraulic Profile Schematic

Santa Clara Valley Water District/
South County Regional
Wastewater Authority

Santa Clara Valley Water District

3.2.1.1 North System Pipelines

The North System is comprised of two pressure zones and serves the existing recycled water customers (M&I and Agriculture uses) north of the SCRWA WWTP.

- **Pressure Zone 1:** This zone is pressurized by the Area 93 Pump Station at the WWTP and includes a 200 cubic feet (ft^3) pressurized surge tank.

  The existing pipeline alignment heads north from the WWTP along Engle Way with parallel 12-inch and 36-inch mains and east with a 12-inch main along Southside Drive to supply the Gilroy Shooting Range. The 12-inch main then follows the Miller Slough north to the Princevalle Drain flood control maintenance road. A 12-inch spur from this intersection supplies the Calpine Energy Center to the east.

  From the Calpine Energy Center spur, the 12-inch main continues west along the Princevalle Drain to supply the McCarthy Business Park, and at Camino Arroyo a 12-inch branch heads north, which will serve the Cintas Corporation when they connect to the system. The 12-inch pipeline continues west to supply water to Obata Farms (northern site) and then crosses under Highway 101. At Monterey Road and the Princevalle Drain, a 12-inch extension supplies water south to the Gilroy Sports Park. The 12-inch pipeline then continues west along the Princevalle Drain and crosses through Gilroy High School to supply water to Christmas Hill Park and ending at the Zone 2 Pump Station.

- **Pressure Zone 2:** This zone is supplied by the Zone 2 Pump Station (Christmas Hill) located just west of Christmas Hill Park which pumps water to the 1.5 MG Hoylake Tank.

  From the Zone 2 Pump Station a 14-inch pipeline parallels the Uvas Creek Preserve along Grenache Way. At Club Drive there is an 8-inch spur which has been used to temporarily supply the Glen Loma Ranch Development with recycled water for grading and other construction activities. From Club Drive the 14-inch continues north-west to Santa Teresa Boulevard where the turnout is located for the Eagle Ridge Golf Course. From Santa Teresa Boulevard the 14-inch continues west where the pipeline splits to the north and west. The 12-inch north branch supplies water to the Gilroy Golf Course along Hecker Pass Highway. The 14-inch west branch continues southwest along Club Drive and connects to the 1.5 MG Hoylake Tank.

3.2.1.2 South System Pipelines (Pajaro River Pipeline)

The South System serves a dual use purpose, distributing recycled water year-round to agricultural customers south of the WWTP and as a river discharge for excess treated effluent water from the SCRWA WWTP during moderate to high inflow conditions and low recycled water demands. This system is pressurized by the Area 94 Pump Station which pumps into a 20-inch pipeline that heads south-west then south-east from the WWTP. The pipeline goes through a right-of-way in the SCRWA Farms Agriculture lands to the intersection of Bloomfield

Avenue and Sheldon Avenue. A 22-inch, inner diameter main continues south-east for 700 feet and decreases in diameter to a 20-inch main which continues south-east to a discharge turnout located on the Pajaro River near the railroad tracks. Turnouts along this pipeline serve the SCRWA Farms (Agriculture Lease) and C&E Farms customers.

3.2.1.3 Pump Stations

The existing recycled water distribution system has three pump stations: Area 93 Pump Station (North System, Pressure Zone 1), Zone 2 Christmas Hill Pump Station (North System Pressure Zone 2), and Area 94 Pump Station (South System) as documented on Table 3.1.

The Area 93 Pump Station is located at the SCRWA WWTP at an elevation of 154 feet and is comprised of three pumps. Each of the three pumps has a variable frequency drive that provides up to 1,200 gallons per minute (gpm). Thus, the total existing capacity is 3,600 gpm and the firm capacity is 2,400 gpm. During peak months the pumps are generally operated to maintain approximately 105 pounds per square inch (psi) (243 feet) in the North System Pressure Zone 1.

The Zone 2 Christmas Hill Pump Station is located west of Christmas Hill Park at an elevation 222 feet and is comprised of three pumps. Each of the three pumps has a variable frequency drive that provides up to 1,375 gpm. Thus, the total existing capacity is 4,125 gpm and the firm capacity is 2,750 gpm. The pumps are generally operated by water levels in the Hoylake Tank that is located west of Santa Teresa Boulevard within the Eagle Ridge Golf Community. During peak months the operating pressure is approximately 80 psi (185 feet) in the North System, Pressure Zone 2.

The Area 94 Pump Station is located at the SCRWA WWTP at an elevation of 154 feet and is comprised of two pumps. Each of the two pumps has a variable frequency drive that provides up to 2,100 gpm. Thus, the total existing capacity is 4,200 gpm and the firm capacity is 2,100 gpm. When serving customers in the South System the pumps are generally operated with high head to maintain approximately 80-85 psi (185-196 feet) in the South System. During river discharge pumping, the pumps are generally operated with low head as high pressures are not required to for river discharges.

3.2.1.4 Storage Tanks/Reservoirs

The existing distribution system has two storage tanks/reservoirs for a combined volume of 4.5 MG. A 3.0 MG reservoir is located at the SCRWA WWTP with a base elevation of 160 feet. This reservoir also has a return pump station with a capacity of 3 mgd that is used to drain the 3.0 MG reservoir. The same pipeline that is used drain this reservoir is also used to fill the reservoir by gravity. Therefore, this reservoir operates by alternating between fill and drain mode, but cannot do both at once. This reservoir is used to support the distribution system during peak demands, provides equalization of treatment flows at the WWTP, and the Area 93 and Area 94 Pump Stations both pump from this reservoir. In Zone 2 of the North System is the Hoylake Tank. This tank is located at the end of Hoylake Court, has a capacity of 1.5 MG, and a base elevation of 385 feet. The Zone 2 Christmas Hill Pump Station is set to fill this tank based on the water levels.

3.2.2 Existing Treatment Facilities and Limitations

The SCRWA Facility is permitted under WDR Order No. R3-2010-0009 and NPDES No. CA0049964 by the CCQCB, to treat up to 8.5 mgd of wastewater at ADWF[10] to secondary treatment standards.

The SCRWA WWTP has a total secondary treatment capacity of 8.5 mgd ADWF and can currently divert up to 8 mgd of secondary effluent to tertiary facilities. The tertiary treatment process consists of coagulation, filtration with sand and anthracite filters, chlorination, and dechlorination and meets the recycled water criteria of the Title 22 unrestricted use classification. While the filtration capacity is 9 mgd, the system is currently limited by the chlorine contact basin capacity of 8 mgd. A UV disinfection facility is currently under construction that will have the ability to disinfect 9 mgd of filtered effluent. For the purpose of the hydraulic analyses discussed in this section, it is assumed that the UV disinfection facility is in place and the current permit capacity amount of 8.5 mgd is the future flow available for recycled water use. It should be noted that the recycled water supply permit amount is greater than the current inflow to the WWTP and the addition of new customers is reliant upon an increase in inflow at the WWTP and the projected treatment expansion and associated permits for the WWTP.

Lastly, there is a 3 MG storage reservoir that was built on-site at the WWTP to support the recycled water distribution system. This reservoir can also be used to supplement the treatment train during periods of high demand.

3.2.2.1 SCRWA Plant Recycled Water Production Capacity and Limitations

Currently, the delivery of recycled water to users is limited by two factors:

1. The flow rate through the chlorine contact basin
2. The plant inflow

The chlorine contact basin can currently disinfect 8 mgd while maintaining a contact time of 90 minutes needed to meet Title 22 requirements. It is important to note that the SCRWA WWTP is currently constructing a UV disinfection facility that will have the ability to disinfect 9 mgd of filtered effluent.

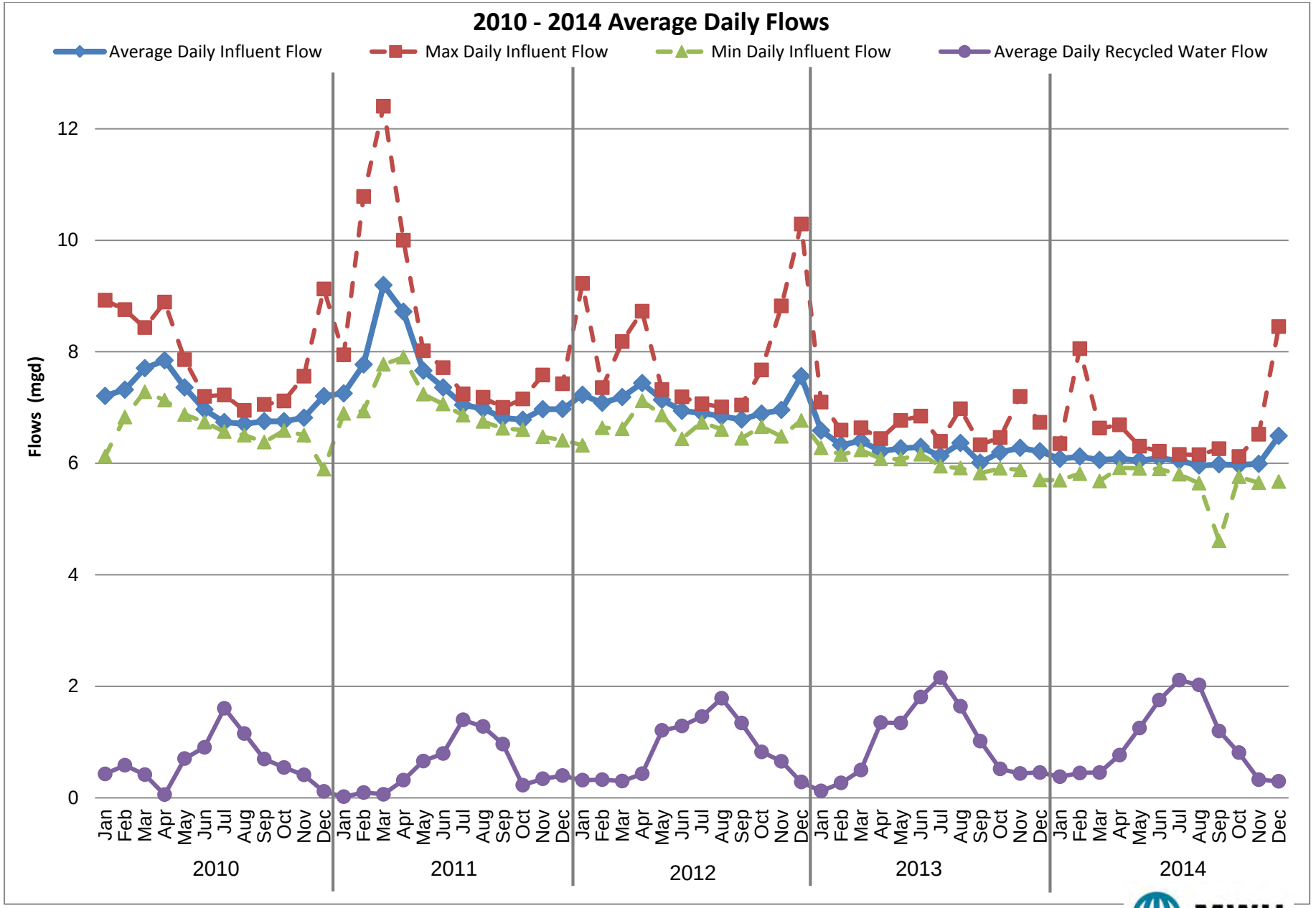
The average dry weather influent flow at the SCRWA WWTP in 2014 was approximately 6 mgd. Figure 3.3 shows the average, maximum and minimum daily flows into the plant over the past 5 years. Based on the figure, annual average flow into the SCRWA facility has generally decreased over the past 5 years. There is seasonal variation in plant inflow with higher flows typically occurring in November through April and lower flows typically occurring in May through October.

In addition to the WWTP influent, Figure 3.3 depicts the average daily recycled water flows and the average daily recycled water flows by month. In 2014, the recycled water used for SCRWA

[10] The ADWF is defined as the average flow for the three driest months in a year and is used as the basis for permitting the SCRWA Facility.

WWTP utility water made up half of the recycled water demand (SCRWA utility water uses include: filter surface washwater, oxidation ditch scum sprayers, solids handling, irrigation, filter backwash, hoses, and chemical carry water). While this demand is met with recycled water that cannot be distributed to customers through the distribution pipelines, the SCRWA WWTP is a year-round, high demand user that allows for more consistent use and recycled water system operation. It is important to note that high influent flows typically correspond with low recycled water demand periods.

Figure 3.3 SCRWA Average Daily Flows 2010 through 2014



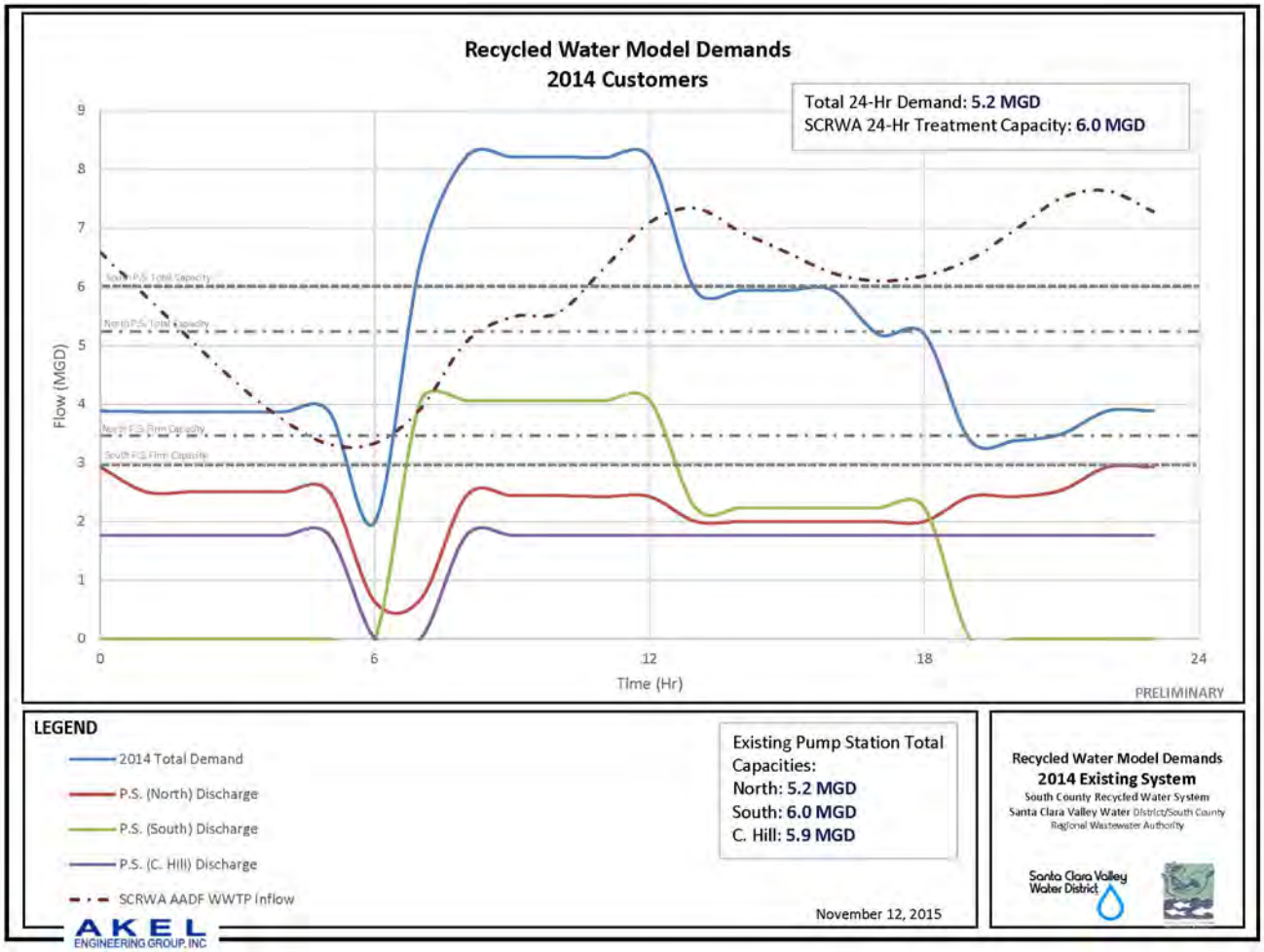
3.2.2.1.1 Seasonal Capacity Limitations and Reliable Production Capacities

As seen in Figure 3.4, there is great seasonal variation in recycled water demand with the highest demand typically occurring from April to September and the lowest demand occurring from November to May. While recycled water flow during the year is well below the WWTP influent flow, recycled water demands have neared minimum influent flows during the months of July 2013, July 2014, and August 2014. In addition, there are seasonal system capacity limitations when dealing with peak recycled water demand in the summer. As shown in Figure 3.4, hourly recycled water demand can reach over 8 mgd at times. During these high demand periods, the SCRWA WWTP recycled water treatment system (pumps, storage, chlorine contact basin) are under a great deal of stress.

It is important to note that alternatives for SCRWA to continue expanding recycled water infrastructure at the WWTP are being evaluated as a separate effort, but available information has been included in the 2015 Master Plan Update for CIP purposes. More information on the capital improvement projects planned at the SCRWA WWTP can be found in the SCRWA Capital Improvements Strategic Plan[11], dated October 2011.

[11] For additional information on the SCRWA Capital Improvements Strategic Plan and subsequent version, contact the South County Regional Wastewater Authority (http://www.ci.gilroy.ca.us/561/South-County-Regional-Wastewater-Authori or 408-846-0202).

Figure 3.4 Recycled Water Demands for 2014 Maximum Day



Reliable production capacities are also limited by plant outages or lack of redundancy at the plant. Plant outages may occur at the SCRWA WWTP for many different reasons including:

- Routine cleaning
- Equipment failures
- Construction shutdowns
- Testing procedures

It is important to be able to have redundant process trains and equipment in place in order to meet the required level of service described in Appendix F. The pumping capacity of the recycled water distribution system has been identified as having redundancy deficiency. As discussed in Section 3.2.1.3, the combined firm pumping capacity at the SCRWA WWTP (Area 93 and 94 Pump Stations) is 6.5 mgd. An additional pump is currently being added to Pump Station 94, which is expected to increase the firm capacity above the current South System recycled water demand. This will improve the reliability of this component of the recycled water system.

Upgrades to meet these redundancy needs as well as other recycled water upgrades at the SCRWA WWTP are included in the Capital Improvement Plan in Chapter 4. An evaluation of the recycled water system reliability is provided in Appendix F.

3.3 HYDRAULIC MODELING CRITERIA AND SYSTEM EVALUATION

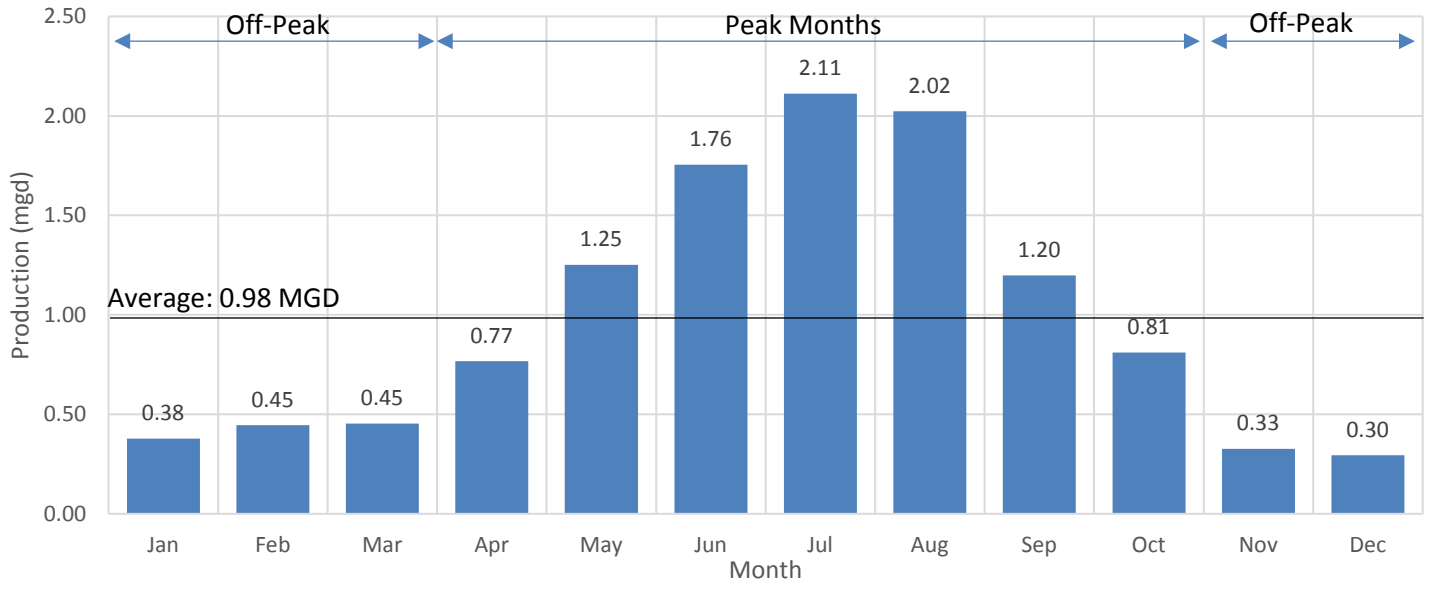
This section presents the seasonal water use distribution, peaking factors, system performance criteria, and hydraulic model update, which are used to identify the existing recycled water system deficiencies.

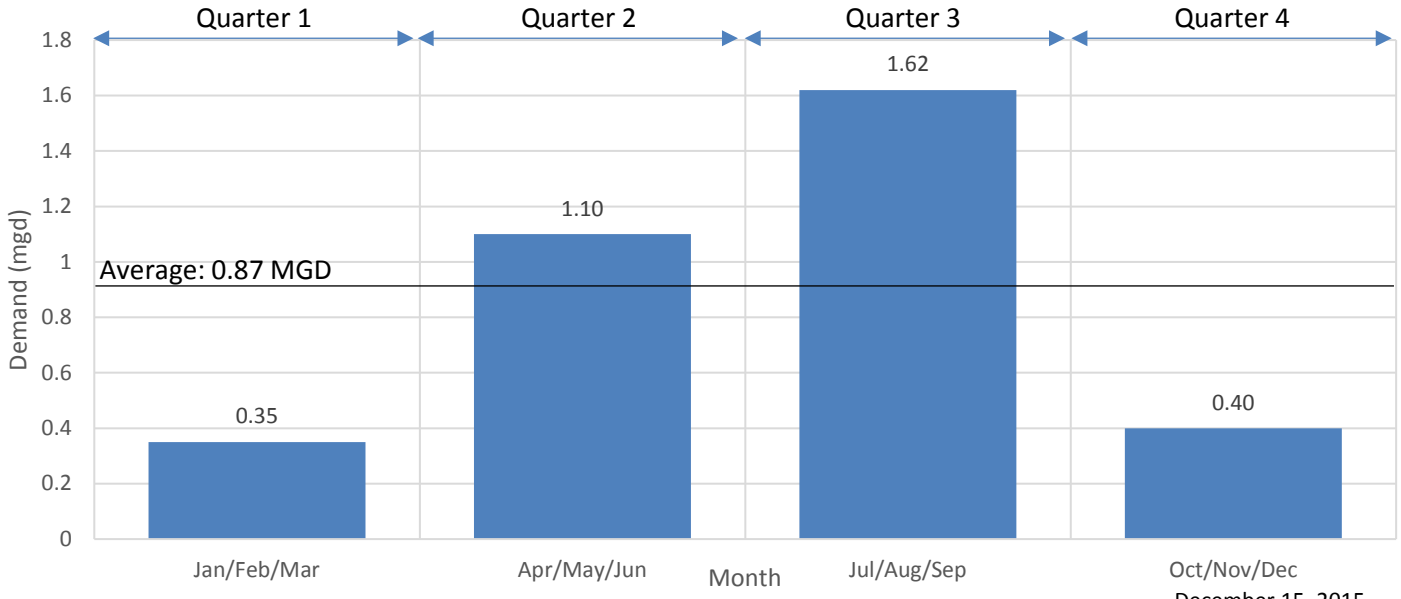
3.3.1 Seasonality and Daily Use Distribution

Recycled water demands vary with the time of day and month of the year. It is necessary to quantify this variability in demand so that the recycled water distribution system can be evaluated and designed to provide reliable water service under these conditions.

Agriculture and irrigation customers have high demand peaks during the summer months and low total usage during the winter, while commercial customers have more consistent usage throughout the year. Figure 3.5 documents the 2014 recycled water billing for each quarter along with the monthly production totals from the SCRWA WWTP. This figure shows the high monthly peaking that occurs from April through September. This figure also shows that there is 13 percent unaccounted for water between the water billing and production records.

Water demands also vary by account type and with the time of day according to the land use designation. These fluctuations were accounted for in the modeling effort and evaluation of the recycled water distribution system. The diurnal demand patterns affect the water levels in storage reservoirs and amount of flow through distribution mains.





December 15, 2015

Note:
1. WWTP Utility water not included in graph totals

Figure 3.5
2014 Production and Billing Records
South County Recycled Water System
Santa Clara Valley Water District/South County Regional Wastewater Authority

Santa Clara Valley Water District

AKEL ENGINEERING GROUP, INC

Each diurnal curve has a unique pattern that creates maximum and minimum flow conditions at different times of the day. Agriculture demands peak in the day light hours and are at a minimum during the night hours. Commercial and industrial demands typically occur either over constant 24 hours or during daytime hours. The irrigation demands are highest at night and lowest during the day.

Different diurnal patterns were used to model the demands of 1) agriculture, 2) commercial, and 3) irrigation use accounts. The diurnal patterns are based on the hours of irrigation received from the recycled water use permits and from the market assessment. In the absence of data that can be used to develop these patterns, they were based on typical irrigation hours for the land use type. Table 3.3 and Table 3.4 document the hours of operation for each user in Gilroy and Morgan Hill, respectively. The diurnal patterns for the existing customers were confirmed during the calibration effort of the hydraulic model and corresponding supervisory control and data acquisition (SCADA) information.

3.3.2 Peak Flow Demands

Water use conditions that are of importance to recycled water distribution systems include the average day demand (ADD), the maximum month demand (MMD), the maximum day demand (MDD), and the peak hour demand (PHD). This section describes the peaking factors used in the hydraulic analysis.

Maximum Month Demand (MMD)

The MMD is the highest demand that occurs within a calendar month during a year. The MMD usually occurs in either July or August.

2014 monthly water production records for the existing customers indicate the maximum month to average month ratio ranges between 1.2 and 3.3 depending on the water use type. The utility water at the WWTP, which is used for cleaning and other maintenance at the plant, had the low peaking factor of 1.2, irrigation and commercial customers had a peaking factor from 1.7 to 2.2, and agriculture customers had high peaking factors from 2.5 to 3.3. The peaking factors for the existing customers are documented on Table 3.3.

Due to the high variance of peaking factors, it was determined that the potential agriculture and irrigation/commercial customers would require separate peaking factors for the analysis. The peaking factor to be used for the potential Irrigation and commercial customers is 2.0, which is the average of the existing irrigation and commercial customers.

The peaking factor for the existing agricultural customers was found to be from 2.5 to 3.3. The two existing agriculture customers in 2014 were Obata Farms (North) and the SCRWA Farms (Ag Lease). SCRWA Farms has over 300 acres of land that it irrigates, while Obata Farms (North) has approximately 30 acres. Due to the large size of SCWRA Farms and number of turnouts, it was deemed the Obata peaking factor of 2.5 was more typical of the agriculture demands.

The following equations are recommended for estimating the MMD for new potential users, given the ADD:

Irrigation/Commercial User: Maximum Month Demand = **2.0** x Average Day Demand

Agriculture User: Maximum Month Demand = **2.5** x Average Day Demand

Maximum Day Demand

The MDD is the highest demand that occurs within a 24 hour day during a year. The MDD, which usually occurs during the summer months, is typically used for the evaluation and design of storage facilities, distribution mains, and pump stations.

The MDDs were obtained from SCADA at the WWTP pump stations. The maximum day to average day demand ratios ranged from 1.2 to 8.3 depending on water use type. The 8.3 peaking factor is the SCRWA Farms (Ag Lease) and was not considered typical usage for the other potential agricultural users, thus the Obata Farms peaking factor of 3.5 was used. Similar to the maximum month peaking factors it was determine that separate peaking factors should be used for commercial/irrigation users and agriculture users.

Through an analysis of these MDDs, it was determined that a ratio of 2.7 would be used in for commercial/irrigation users and the Obata MDD peaking of 3.5 should be used for agriculture users. The following equations are then used to estimate the MDD, given the ADD:

Commercial/Irrigation User: Maximum Month Demand = **2.7** x Average Day Demand

Agriculture User: Maximum Month Demand = **3.5** x Average Day Demand

Peak Hour Demand

The PHD is another high demand condition that is used in the evaluation and design of water distribution systems. The PHD is the highest demand that occurs within a one hour period during a year. The peak hour demand is considered to be the largest single measure of the maximum demand placed on the distribution system.

The peak hour demand factor is calculated based on the number or hours of operation per day for each customer. The PHD can then be calculated using the MDD and the following equation:

Peak Hour Demand = (24/**Hours of Operation**) x Maximum Day Demand

The City of Gilroy existing and potential customers' demands are documented on Table 3.3 and the City of Morgan Hill potential customers' demands are documented on Table 3.4. The demands presented in these tables were used to evaluate the existing system and proposed alternatives.

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Table 3.3 Gilroy Existing and Potential Recycled Water Customer Summary

Site No.	Site Name	Recycled Water System	Zone	Usage Category	Hours of Operation		Peaking Factors		Estimated Annual Average Demand			Recycled Water Demand Estimates		
							Maximum Month Demand	Maximum Day Demand				Maximum Month	Maximum Day	Peak Hour
					(period)	(hrs)			(afy)	(gpm)	Note	(gpm)	(gpm)	(gpm)
Existing Users														
E-1	Christmas Hill Park - Ranch	North	1	Irrigation	10pm - 7am	9	2.1	2.8	8	5	1	11	14	38
E-2	Christmas Hill Park	North	1	Irrigation	10pm - 7am	9	1.7	2.2	22	13	1	22	30	81
E-3	Eagle Ridge Golf Course	North	2	Irrigation	6am - 2 pm	8	1.8	2.4	514	319	1	565	763	2,289
E-4	SCRWA Farms (Ag Lease) Turnout #1-#6	South	-	Agricultural	7 am-1pm; 7pm-1am	12	3.3	8.3	151	122	1	403	1,008	2,821
E-8	Obata Farms (North)	North	1	Agricultural	7 am-1pm; 7pm-1am	12	2.5	3.5	68	42	1	105	147	294
E-5	Calpine Power Plant - Peaker	North	1	M&I	24hr	24	2.2	2.9	20	12	1	27	36	36
E-10	Calpine Power Plant - Cogen	North	1	M&I	24hr	24	2.1	2.8	273	170	1	354	478	478
E-6	City of Gilroy - Golf Course	North	2	Irrigation	9pm - 6am	9	2.0	2.7	146	91	1	184	249	664
E-7	City of Gilroy - Sports Park	North	1	Irrigation	10pm - 7am	9	1.9	2.5	37	23	1	43	58	154
E-9	McCarthy Business Park	North	1	Irrigation	9pm - 6am	9	2.1	2.8	17	10	1	22	29	78
E-11	WWTP Utility Water	WWTP Utility	-	M&I	24hr	24	1.2	1.2	1,172	728	1	874	874	1,092
E-12	City of Gilroy - Shooting Range	North	1	Irrigation	7am - 11pm	4	2.1	2.8	1	1	1	1	2	12
5	United Natural Food[7]	North	1	Irrigation	10pm - 7am	9	2.0	2.7	23	14	2	28	38	101
8	C & E Farms[7]	South	-	Agricultural	8am-5pm	9	2.5	3.5	169	105	2	263	368	982
15	Obata (new turnout)	North	1	Agricultural	7 am-1pm; 7pm-1am	12	2.5	3.5	169	105	2	263	368	737
								Sub Total	2,789	1,761		3,166	4,463	
In-Progress Users														
1	Cintas Corporation	North	1	M&I	24hr	24	2.0	2.7	119	74	2	147	199	199
9	Flanagan (Kapa Seeds)[7]	South	-	Agricultural	6am - 12pm	6	2.5	3.5	68	42	2	105	147	589
18	Meritage Development	North	2	Irrigation	10pm - 7am	9	2.0	2.7	21	14	2	28	38	101
19	Glen Loma Ranch Development	North	1	Irrigation	10pm - 7am	9	2.0	2.7	29	18	2	36	49	131
23	Ascension Solorsano Middle School	North	1	Irrigation	10pm - 7am	9	2.0	2.7	27	17	5	34	46	122
24	Gilroy High School	North	1	Irrigation	10pm - 7am	9	2.0	2.7	78	48	5	97	131	349
45	Las Animas Elementary	North	1	Irrigation	10pm - 7am	9	2.0	2.7	14	8	5	17	23	61
61	Santa Teresa & Third Street Park	North	2	Irrigation	10pm - 7am	9	2.0	2.7	14	8	2	17	23	61
62	Glen Loma Second Park (Santa Teresa Blvd and Club Dr)	North	2	Irrigation	10pm - 7am	9	2.0	2.7	14	8	2	17	23	61
63	Sydney Casper City Park	North	1	Irrigation	10pm - 7am	9	2.0	2.7	14	8	2	17	23	61
64	City Park (Hecker Pass)	North	2	Irrigation	10pm - 7am	9	2.0	2.7	14	8	2	17	23	61
65	City Park (SW corner of Santa Teresa Blvd and 3rd St)	North	2	Irrigation	10pm - 7am	9	2.0	2.7	14	8	2	17	23	61
66	C & E Farms (Additional Parcel)[7]	South	-	Agricultural	8am-5pm	9	2.5	3.5	74	46	4	115	161	429
67	Christopher Ranch (Existing Turnout)[7]	South	-	Agricultural	12am - 4pm	12	2.5	3.5	375	233	4	582	815	1,630
								Sub Total	873	543		1,246	1,723	
Baseline Users														
2	Gilroy Gardens (formerly Bonafante)	North	2	Irrigation	6am-5pm	12	2.5	3.0	169	105	2	263	316	632
3	Western Tree Nursery I & II	North	2	Irrigation	24hr	24	2.5	3.0	597	371	2	928	1,113	1,113
7	Calpine Power Plant - Additional Demand	North	1	Irrigation	24hr	24	2.0	2.7	23	14	3	28	38	38
69	Gilroy Sports Park Expansion	North	1	Irrigation	10pm - 7am	9	2.0	2.7	16	10	2	20	27	71
								Sub Total	805	500		1,238	1,493	
Limited Term Users														
TC1	United Natural Foods Inc. (Online)[7]	North	1	Construction	Varies (Tank Filling)	10	-	1.0	15	9	2		9	22
TC2	Glen Loma Ranch Development (Online)[7]	North	2	Construction	Varies (Tank Filling)	10	-	1.0	840	522	2		522	1,252
TC3	Meritage Development West (Online)[7]	North	2	Construction	7am-5pm	10	-	1.0	13	8	2		8	19
13	Syngenta	North	2	Irrigation	8am-5pm	9	2.5	3.5	19	12	2	29	41	110
60	Hecker Pass (Agriculture)	North	2	Agricultural	8am-5pm	9	2.5	3.5	45	28	3	70	98	262
								Sub Total	932	579			678	
Potential Future Users														
6	Sundance Landscaping, Inc.[7]				Fill-Station User						2			
10	Bonfante Nurseries	South	-	Agricultural	6am-5pm	9	2.5	3.5	214	133	4	332	465	1,240
20	Temple-Inland Corrugated Packaging	North	1	M&I	8am-5pm	9	2.0	2.7	29	18	3	36	49	131
21	Hoey Development	North	2	Irrigation	10pm - 7am	9	2.0	2.7	18	11	4	23	31	82
22	Vineyard Christian School	North	2	Irrigation	10pm - 7am	9	2.0	2.7	6	4	3	7	10	27
25	Gavilan College, Sports Park, and Golf Course	North	1	Irrigation	10pm - 7am	9	2.0	2.7	39	24	2	49	66	175
26	Forest Street Park	North	1	Irrigation	10pm - 7am	9	2.0	2.7	5	3	3	6	8	20
27	El Roble Park	North	1	Irrigation	10pm - 7am	9	2.0	2.7	18	11	5	23	31	82
28	Miller Park	North	1	Irrigation	10pm - 7am	9	2.0	2.7	22	14	5	28	37	99
29	San Ysidro Park	North	1	Irrigation	10pm - 7am	9	2.0	2.7	58	36	5	72	98	260
30	Las Animas Park	North	2	Irrigation	10pm - 7am	9	2.0	2.7	102	63	3	126	171	455
31	Rainbow Park	North	2	Irrigation	10pm - 7am	9	2.0	2.7	3	2	5	4	5	15
32	Del Rey Park	North	2	Irrigation	10pm - 7am	9	2.0	2.7	17	11	5	22	29	78
33	Gavilan Hills Memorial Park	North	2	Irrigation	10pm - 7am	9	2.0	2.7	43	27	3	53	72	192
34	St. Mary's Cemetery	North	2	Irrigation	10pm - 7am	9	2.0	2.7	5	3	3	6	8	20
35/36	Glen View Elementary/Gateway School	North	1	Irrigation	10pm - 7am	9	2.0	2.7	25	16	5	31	42	113
37	El Roble Elementary	North	1	Irrigation	10pm - 7am	9	2.0	2.7	18	11	5	23	31	81
38	Jordan Elementary	North	1	Irrigation	10pm - 7am	9	2.0	2.7	9	5	5	11	15	39
39	Brownell Academy of Humanities	North	1	Irrigation	10pm - 7am	9	2.0	2.7	9	5	5	11	15	39
40	Eliot Elementary	North	1	Irrigation	10pm - 7am	9	2.0	2.7	4	2	5	5	6	16
41/42/43	South Valley Junior High/Gilroy Community Day/Gilroy Adult Edı	North	1	Irrigation	10pm - 7am	9	2.0	2.7	46	29	5	58	78	207
44	St. Mary's	North	1	Irrigation	10pm - 7am	9	2.0	2.7	13	8	5	16	22	59
46	Christopher High School[7]	North	2	Irrigation	10pm - 7am	9	2.0	2.7	103	64	5	128	172	459
47/48	Rod Kelley Elementary/Mt. Madonna High	North	2	Irrigation	10pm - 7am	9	2.0	2.7	19	12	5	24	32	85
49/50	Adventist Christian/Pacific West Christian Academy	North	2	Irrigation	10pm - 7am	9	2.0	2.7	20	13	5	25	34	90
51	Luigi Aprea Fundamental Elementary	North	2	Irrigation	10pm - 7am	9	2.0	2.7	13	8	5	16	21	57
52	Antonio Del Buono Elementary	North	2	Irrigation	10pm - 7am	9	2.0	2.7	10	6	5	13	17	46
53	San Ysidro Elementary	North	1	Irrigation	10pm - 7am	9	2.0	2.7	9	6	3	11	15	40
54	Obata Farms	North	1	Agricultural	7 am-1pm; 7pm-1am	12	2.5	3.5	67	41	4	104	145	290
55	Sunrise Park	North	2	Irrigation	10pm - 7am	9	2.0	2.7	25	15	4	31	41	110
56	Los Arroyos Park	North	2	Irrigation	10pm - 7am	9	2.0	2.7	12	8	5	15	20	54
57	Carriage Hills Park	North	2	Irrigation	10pm - 7am	9	2.0	2.7	14	9	4	18	24	64
58	Farrell Avenue Park	North	2	Irrigation	10pm - 7am	9	2.0	2.7	11	7	5	14	19	51
59	Gilroy Sports Park (Agriculture)	North	1	Agricultural	6am - 5pm	12	2.5	3.5	34	21	2	53	74	147
68	Lomar Laundry[7]	North	1	M&I	24hr	24	2.0	2.7	163	102	5	203	274	274
70	Future Elementary School[7]	North	2	Irrigation	10pm - 7am	9	2.0	2.7	17	10	3	21	28	75
71	Future Neighborhood Park #1[7]	North	2	Irrigation	10pm - 7am	9	2.0	2.7	12	7	3	15	20	53
72	Future Neighborhood Park #2[7]	North	2	Irrigation	10pm - 7am	9	2.0	2.7	11	7	3	14	19	49
73	Future Community Park[7]	North	2	Irrigation	10pm - 7am	9	2.0	2.7	91	57	3	113	153	408
74	Future Middle School[7]	North	2	Irrigation	10pm - 7am	9	2.0	2.7	30	18	3	37	50	132
75	Future Active Adult Gathering Area #1[7]	North	2	Irrigation	10pm - 7am	9	2.0	2.7	5	3	3	6	8	21
76	Future Active Adult Gathering Area #2[7]	North	2	Irrigation	10pm - 7am	9	2.0	2.7	6	4	3	8	10	27
77	Future Neighborhood Park #3[7]	North	2	Irrigation	10pm - 7am	9	2.0	2.7	10	6	3	13	17	46
78	Cherry Orchard[7]	South	-	Agricultural	8am - 5pm	9	2.5	3.5	49	30	3	76	106	284
79	Frazier Lake Road Agriculture User[7]	North	1	Agricultural	6am-5pm	12	2.5	3.5	108	67	3	168	235	469
80	Rucker Elementary[7]	North	2	Irrigation	10pm - 7am	9	2.0	2.5	18	11	3	22	27	72
81	Mike Steffen[7]	South	-	Agricultural	8am - 5pm	9	2.5	3.5	5	3		8	11	29
82	Village Green	North	2	Irrigation	10pm - 7am	9	2.0	2.5	7	11		22	28	73
								Sub Total	1,573	983		2,115	2,887	
								Total	6,972	4,366		7,765	11,245	

Notes:

12/15/2015

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1. Demand per actual water use or recycled water permit
2. Demand estimate per MWH and District staff
3. Demand estimate per 2004 Master Plan
4. Demand estimate calculated based on acreages of similar use
5. Demand estimate per Billing Records (irrigable percentage was assumed 80% for Schools and 90% for Parks)
6. Demands listed in this table include a unaccounted for water percentage of 13%.
7. New user for the 2015 Master Plan, not in the 2004 Master Plan
8. Customers and demands listed are projections and base upon the 2004 Market Assessment and the 2015 Master Plan customer evaluation criteria as outlined in Section 2.9

Table 3.4 Morgan Hill Potential Recycled Water Customer Summary

Site No.	Site Name	Usage Type	Hours of Operation		Peaking Factors		Usage Estimates		Recycled Water Demand Estimates		
			(period)	(hrs)	Maximum Month Demand	Maximum Day Demand	(AFY)	(gpm)	Maximum Month (gpm)	Maximum Day (gpm)	Peak Hour (gpm)
M-1	Ann Sobrato High School	Irrigation	10PM-7AM	9	2.0	2.7	84	52	104	141	375
M-2	Morgan Hill Growers	Irrigation	24HR	24	2.5	3.5	39	24	61	86	86
M-3	Park	Irrigation	10PM-7AM	9	2.0	2.7	2	1	2	3	9
M-4	Morgan Hill Orthopedics & Sports Medicine	Irrigation	10PM-7AM	9	2.0	2.7	78	49	97	131	350
M-5	Park	Irrigation	10PM-7AM	9	2.0	2.7	12	7	14	20	52
M-6	Park	Irrigation	10PM-7AM	9	2.0	2.7	5	3	7	9	24
M-7	California Color Growers LLC	Irrigation	24HR	24	2.5	3.5	141	87	218	306	306
M-8	El Toro Elementary School	Irrigation	10PM-7AM	9	2.0	2.7	21	13	26	35	94
M-9	PA Walsh Elementary School	Irrigation	10PM-7AM	9	2.0	2.7	17	11	21	29	77
M-10	Central High School	Irrigation	10PM-7AM	9	2.0	2.7	6	4	7	10	27
M-11	Park	Irrigation	10PM-7AM	9	2.0	2.7	7	5	9	13	33
M-12	Park	Irrigation	10PM-7AM	9	2.0	2.7	10	6	13	17	46
M-13	Park	Irrigation	10PM-7AM	9	2.0	2.7	8	5	10	13	36
M-14	Park	Irrigation	10PM-7AM	9	2.0	2.7	3	2	3	4	11
M-15	Jackson Elementary School	Irrigation	10PM-7AM	9	2.0	2.7	13	8	16	22	58
M-16	Park	Irrigation	10PM-7AM	9	2.0	2.7	10	6	12	16	44
M-17	Nordstrom Elementary School	Irrigation	10PM-7AM	9	2.0	2.7	17	10	21	28	75
M-18	St Catherine's School	Irrigation	10PM-7AM	9	2.0	2.7	14	9	17	24	63
M-19	Morgan Hill Community and Cultural Center	Irrigation	10PM-7AM	9	2.0	2.7	22	14	27	37	99
M-20	Morgan Hill Community Park	Irrigation	10PM-7AM	9	2.0	2.7	70	44	87	118	314
M-21	Nursery	Irrigation	24HR	24	2.5	3.5	40	25	63	88	88
M-22	Coyote Valley Nursery	Irrigation	24HR	24	2.5	3.5	53	33	83	116	116
M-23	Valley Orchids Inc	Irrigation	24HR	24	2.5	3.5	67	42	104	145	145
M-24	Hoo Gee Nursery	Irrigation	24HR	24	2.5	3.5	65	40	101	141	141
M-25	Hung's Nursery	Irrigation	24HR	24	2.5	3.5	37	23	57	79	79
M-26	Kajiko Nursery	Irrigation	24HR	24	2.5	3.5	149	93	231	324	324
M-27	Institute Golf Course	Irrigation	9PM-7AM	10	2.0	2.7	494	307	624	842	2,021
M-28	Gabilan Growers	Irrigation	24HR	24	2.5	3.5	13	8	20	28	28
M-29	Farmer's Market	Irrigation	7AM-1PM	6	2.0	2.7	4	2	5	6	26
M-30	Greenfield Nursery	Irrigation	24HR	24	2.5	3.5	70	43	108	151	151
M-31	Lakeside Nursery	Irrigation	24HR	24	2.5	3.5	19	12	29	41	41
M-32	Paradise Park	Irrigation	10PM-7AM	9	2.0	2.7	16	10	20	27	72
M-33	Morgan Hill Outdoor Sports Center	Irrigation	10PM-7AM	9	1.9	2.5	54	33	62	84	225
M-34	Britton Field (Park)	Irrigation	10PM-7AM	9	2.0	2.7	59	37	73	99	264
M-35	Burnett Elementary School	Irrigation	10PM-7AM	9	2.0	2.7	19	12	23	32	85
M-36	Holiday Lake Meadow (Park)	Irrigation	10PM-7AM	9	2.0	2.7	17	10	21	28	75
M-37	Park	Irrigation	10PM-7AM	9	2.0	2.7	3	2	4	5	14
M-38	Nursery	Irrigation	24HR	24	2.5	3.5	52	32	81	113	113
M-39	Barrett Elementary School	Irrigation	10PM-7AM	9	2.0	2.7	16	10	20	27	71
M-40	Park	Irrigation	10PM-7AM	9	2.0	2.7	6	4	8	11	28
M-41	Del Monte Townhomes	Irrigation	10PM-7AM	9	2.0	2.7	17	11	22	29	77
M-42	Park	Irrigation	10PM-7AM	9	2.0	2.7	2	1	2	3	7
M-43	Park	Irrigation	10PM-7AM	9	2.0	2.7	5	3	7	9	24
M-44	Live Oak High School	Irrigation	10PM-7AM	9	2.0	2.7	81	50	101	136	363
M-45	Park	Irrigation	10PM-7AM	9	2.0	2.7	7	5	9	12	32
M-46	Park	Irrigation	10PM-7AM	9	2.0	2.7	6	4	8	10	27
M-47	Park	Irrigation	10PM-7AM	9	2.0	2.7	2	1	3	4	10
M-48	Park (Coyote Estates)	Irrigation	10PM-7AM	9	2.0	2.7	1	1	1	2	5
M-49	Park	Irrigation	10PM-7AM	9	2.0	2.7	7	4	8	11	30
M-50	Park	Irrigation	10PM-7AM	9	2.0	2.7	9	6	11	15	41
M-51	TenCate Advanced Composites	Irrigation	10PM-7AM	9	2.0	2.7	19	12	24	32	85
M-52	Morgan Hill Library	Irrigation	10PM-7AM	7	2.0	2.7	7	4	9	12	40
M-53	Oak Creek Park	Irrigation	10PM-7AM	9	2.0	2.7	9	6	12	16	42
M-54	Oakwood School	Irrigation	10PM-7AM	9	2.0	2.7	44	28	55	74	198
M-55	Howard Wiechert Park	Irrigation	10PM-7AM	9	2.0	2.7	3	2	4	5	14
M-56	Coyote Valley Sporting Clays	Irrigation	7AM-11PM	4	2.1	2.8	1	0	1	1	7
M-57	Wing Mok Nursery	Irrigation	24HR	24	2.5	3.5	49	31	77	107	107
M-58	Nursery	Irrigation	24HR	24	2.5	3.5	66	41	102	143	143
M-59	Farm	Agricultural	8AM-5PM	9	2.5	3.5	36	22	55	78	207
M-60	Park	Irrigation	10PM-7AM	9	2.0	2.7	3	2	4	5	13
M-61	Stratford School	Irrigation	10PM-7AM	9	2.0	2.7	4	2	5	6	17
M-62	Morgan Hill Bible Church	Irrigation	10PM-7AM	9	2.0	2.7	7	4	8	11	30
M-63	Kawahara Nursery Inc	Irrigation	24HR	24	2.5	3.5	353	219	548	767	767
M-64	Madrone Plaza	Irrigation	10PM-7AM	9	2.0	2.7	4	2	5	7	18
M-65	Diana Park	Irrigation	10PM-7AM	9	2.0	2.7	10	6	12	16	43
M-66	Park	Irrigation	10PM-7AM	9	2.0	2.7	3	2	3	5	12
M-67	Park	Irrigation	10PM-7AM	9	2.0	2.7	2	1	2	3	7
M-68	Park	Irrigation	10PM-7AM	9	2.0	2.7	5	3	6	8	20
M-69	Park	Irrigation	10PM-7AM	9	2.0	2.7	2	1	2	3	9
M-70	Park	Irrigation	10PM-7AM	9	2.0	2.7	2	1	2	3	7
M-71	Park	Irrigation	10PM-7AM	9	2.0	2.7	8	5	10	13	34
M-72	Jackson Park	Irrigation	10PM-7AM	9	2.0	2.7	4	3	5	7	18
M-73	William F. James Boys Ranch	Irrigation	10PM-7AM	9	2.0	2.7	185	115	230	310	827
M-74	Galvan Park	Irrigation	10PM-7AM	9	2.0	2.7	23	14	29	39	103
M-75	Nordstrom Park	Irrigation	10PM-7AM	9	2.0	2.7	14	9	17	23	62
M-76	Park	Irrigation	10PM-7AM	9	2.0	2.7	3	2	4	6	15
M-77	Park	Irrigation	10PM-7AM	9	2.0	2.7	11	7	14	19	51
M-78	Park	Irrigation	10PM-7AM	9	2.0	2.7	9	6	11	15	40
M-79	Paradise Valley Elementary School	Irrigation	10PM-7AM	9	2.0	2.7	24	15	30	40	107
						Total	2,877	1,787	3,967	5,453	

Notes:

1. Demand estimate calculated based on acreages of similar use

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9/14/2015

3.3.3 System Performance and Design Criteria

One components of meeting the level of service laid out in Appendix F is to provide appropriate pressures to recycled water customers. Velocity, headlosses, and pressures are important factors in the design of a recycled water distribution system. To meet the required level of service and properly serve customers, the velocities and headlosses need to be limited to a reasonable amount, and the system needs to provide adequate pressure for customer use.

The recycled water distribution system components of the required level of service are listed in Table 3.5. The criteria are intended for maintaining efficient system operation while providing reliable service to the recycled water system customers.

Table 3.5 Recycled Water System Performance Criteria

Distirbution System Performance Criteria	
Pipe Headloss	< 4 ft/kft
Pipe Velocity	< 5 fps
Minimum Pressure[1]	35 psi
Normal Pressure Range[1]	60-120 psi
Pump Station Performance Criteria	
Pressure Zones with Storage	Meet **maximum day** demand with largest unit out of service
Pressure Zones without Storage	Meet **peak hour** demands with largest unit out of service

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Note:

1. AWWA recommends a minimum working pressure of 35 psi and normal working pressure should range from 60-80 psi.

Key: AWWA = American Water Works Association
fps = feet per second
ft/kft = ft/kft feet per 1,000 feet
psi = pounds per square inch

For MDDs and PHDs, the following criteria were used for evaluating the capacity adequacy of pipelines:

- Velocities less than 5 feet per second (fps)
- Headloss less than 4 feet per 1,000 feet (ft/kft)
- Minimum pressures of 35 psi

- Normal operating pressures in the range of 60-120 psi

For pump stations, the following criteria were used for evaluating the capacity adequacy:

- Meet PHDs with largest unit out of service (for pressure zones without storage)
- Meet MDDs with largest unit out of service (for pressure zones with storage)

3.3.4 Identification of System Limitations

The existing North distribution system pipelines have a maximum capacity of approximately 1,200 gpm, while the existing pump station has a firm capacity of 2,400 gpm. During 2014, peak months the north system had a peak day demand of approximately 1,600 gpm (2.3 mgd) with peak hours near 2,000 gpm (2.9 mgd). These high demands increase pipe headlosses (friction), and water velocities in the system are above the recommended criteria of 4 feet per thousand feet and 5 fps, respectively. This increase in headlosses also decreases pressure in the system and results in low pressures at the suction side of the Zone 2 pump station.

The existing South distribution system was designed for approximately 4,800 gpm (6.9 mgd). However, the pump station currently has a firm capacity of only 2,100 gpm (3.0 mgd). During peak summer months in 2014, the system was peaking around 2,800 gpm (4.0 mgd) and causing the pump station to run above its firm design capacity and near peak design limit.

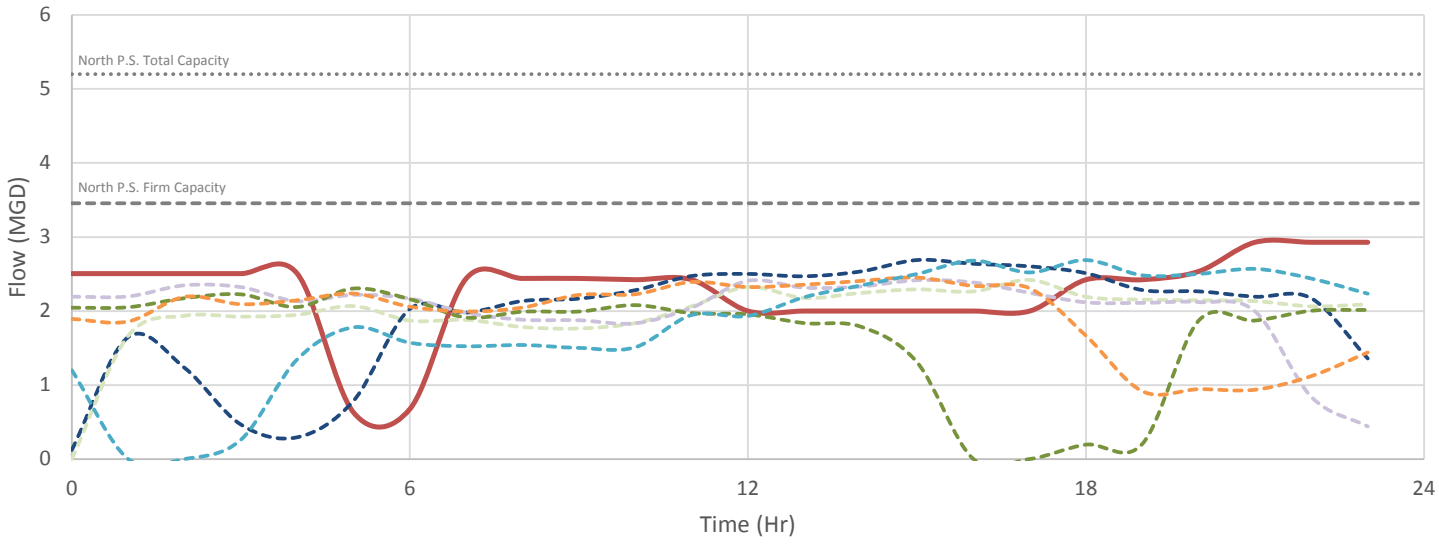
3.3.5 Hydraulic Model Update and Calibration

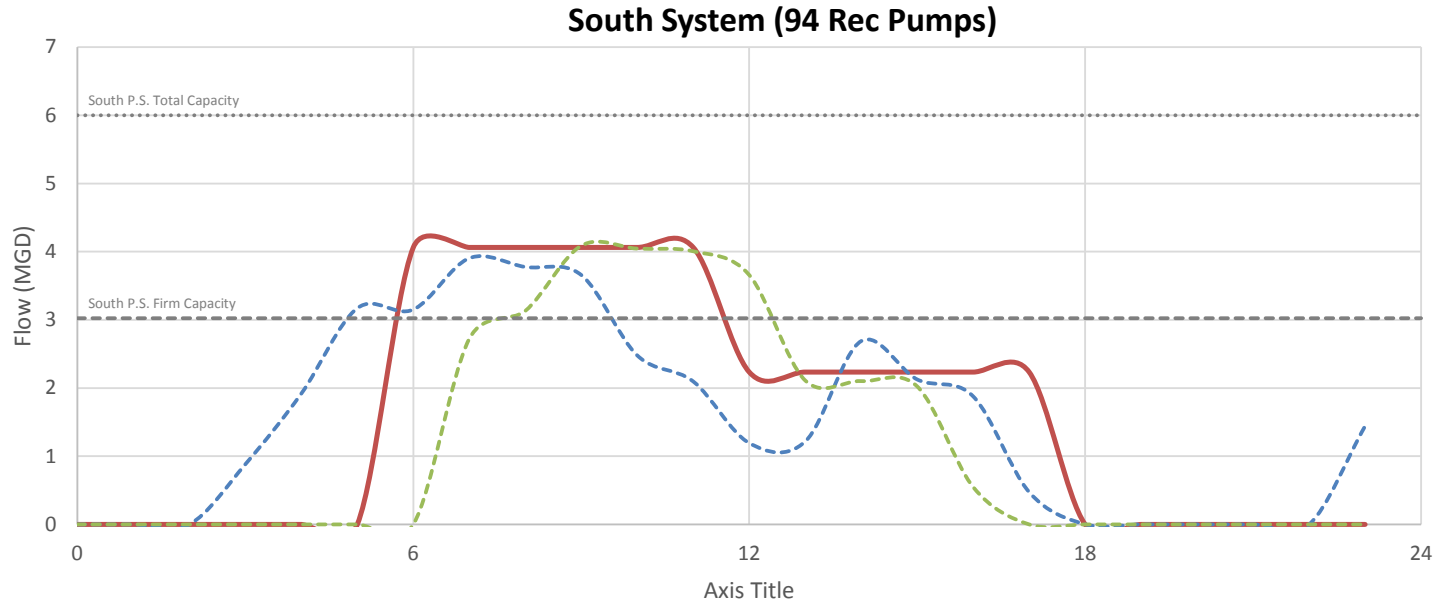
The hydraulic model was updated to reflect current facility improvements and alignments based on as-builts for the South Pipeline as received from the District. Operational controls were updated based on operations staff data and SCADA received for the WWTP pump stations. The SCADA data contained flow and discharge pressures for the Area 93 and Area 94 Pump Stations. The model was updated with current pressure set-points and variable frequency drive (VFD) pumps in order to calibrate the existing system model. Figure 3.6 documents the flows from the Area 93 and Area 94 pumps stations as predicted in the hydraulic model and compared to maximum day demands as recorded in SCADA in June and July of 2014.

3.3.6 Existing System Evaluation

The existing recycled water usage is documented on Table 3.2 and includes the actual 2014 usage along with the estimated demands for each customer based on the Recycled Water Use Permits submitted to the District. Table 3.2 also documents the recycled water system, pressure zone, usage category, and hours of usage for each existing customer. The total demand for 2014 was 1,995 afy, which includes the WWTP utility water.

The hydraulic model was used for evaluating the distribution system for capacity deficiencies for 2014 MDDs. The hydraulic model was calibrated to MDDs for 2014 and the system was evaluated based on the design criteria. The existing system was found to have headlosses exceeding 12 ft/kft in the North System Zone 1 and pressures at the Zone 2 Pump Station around 3 psi. Figure 3.7 documents headlosses and pressures predicted from the hydraulic model and Figure 3.8 documents the flows for each pump station during the 2014 MDD scenario.





LEGEND

- Hydraulic Model: North System
- 6/9/2015
- 6/30/2015
- 7/2/2015
- 7/10/2015
- 7/14/2015
- 7/30/2015
- Ex. Max P.S. (North) Design Flow
- Ex. Firm P.S. (North) Flow

- Hydraulic Model: South System
- 7/9/2015
- 6/11/2015
- Ex. Max P.S. (South) Design Flow
- Ex. Firm P.S. (South) Design Flow

Figure 3.6

Recycled Water Model Results

SCADA Comparison

South County Recycled Water System

Santa Clara Valley Water District/South County Regional Wastewater Authority

September 21, 2015

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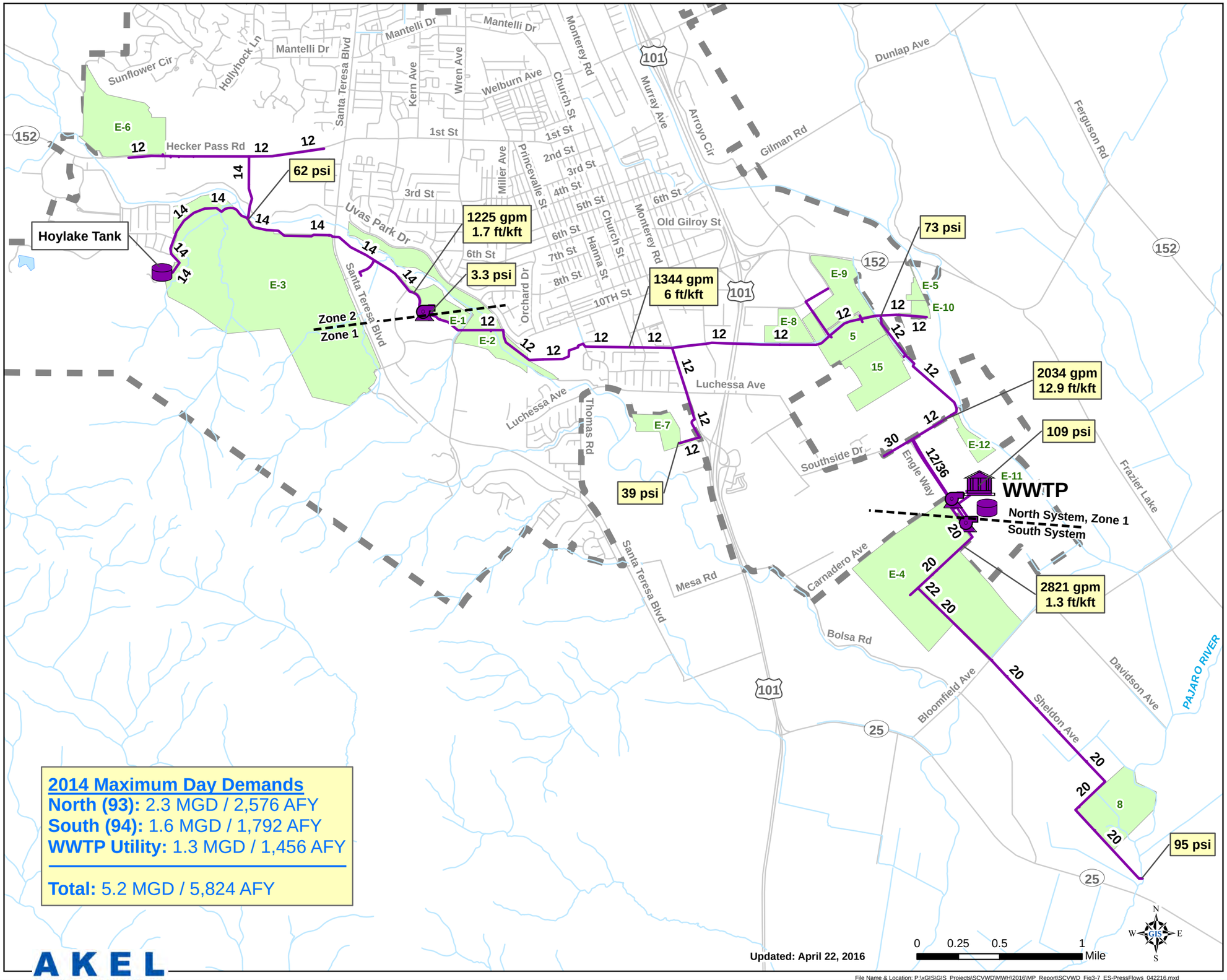

2014 Maximum Day Demands
North (93): 2.3 MGD / 2,576 AFY
South (94): 1.6 MGD / 1,792 AFY
WWTP Utility: 1.3 MGD / 1,456 AFY

Total: 5.2 MGD / 5,824 AFY

Updated: April 22, 2016

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Legend

Existing

- WWTP
- Storage Tanks
- Booster Stations
- Recycled Water Pipelines
- Pressure Zone Line
- Existing Users
- City Limits
- Roads
- Creeks
- Lake

Note 1: 2014 Maximum Day Demands
Note 2: Minimum Pressures + Maximum Flows + Headlosses during Maximum Day Demands shown.
Note 3: Users 5, 8, and15 were not included in the 2014 scenario. These users began service in 2015.

Figure 3.7
Existing System and 2014 Users

South County Recycled Water System

Santa Clara Valley Water District /
South County Regional Wastewater Authority

Santa Clara Valley Water District

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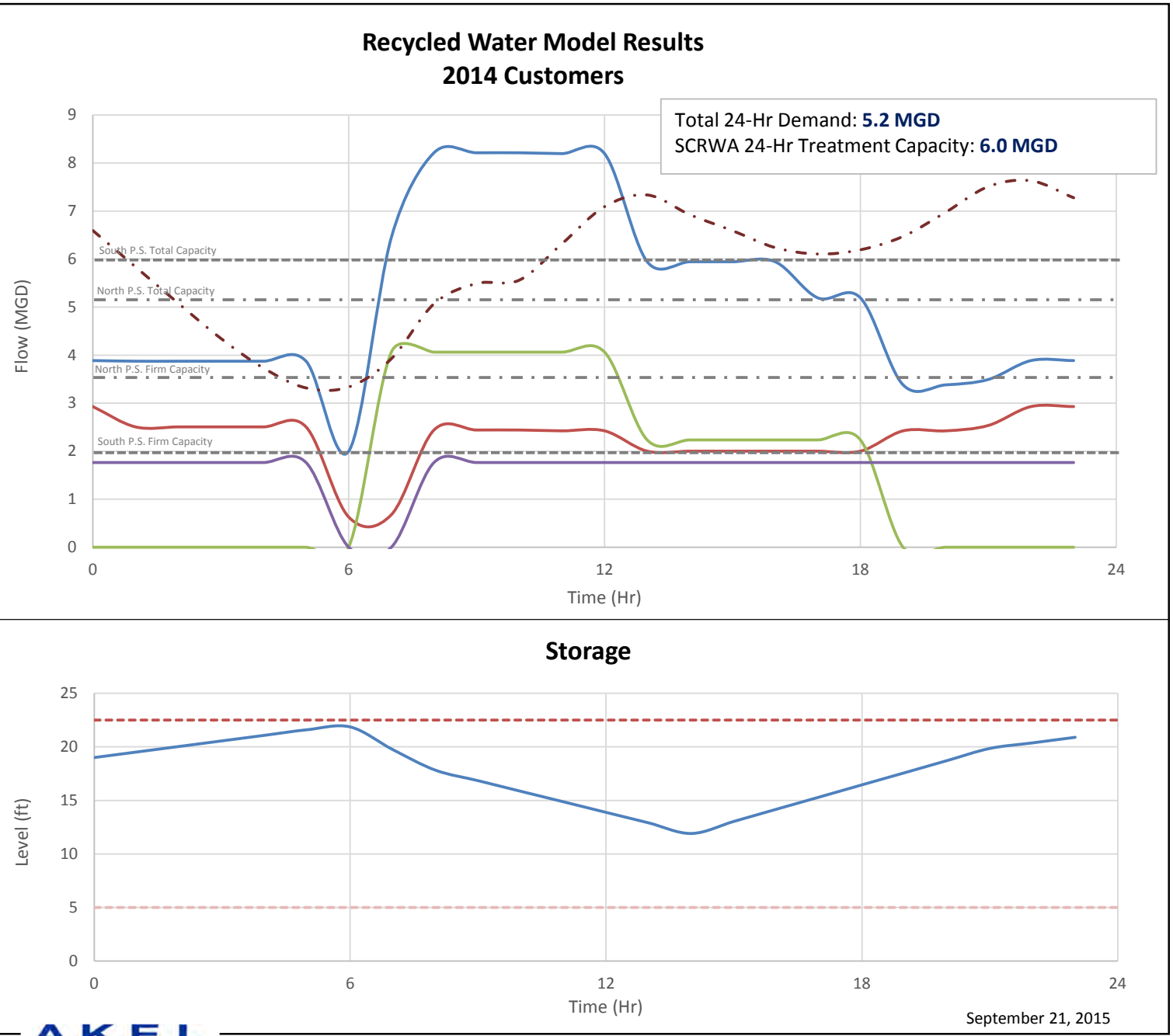

LEGEND

- 2014 Total Demand
- P.S. (North) Discharge
- P.S. (South) Discharge
- P.S. (C. Hill) Discharge
- SCRWA AADF WWTP Inflow

Existing Pump Station Total Capacities:
North: **5.2 MGD**
South: **6.0 MGD**
C. Hill: **5.9 MGD**

- North System Tank (Hoylake)
- Max Level
- Min Level

Figure 3.8

Recycled Water Model Results
2014 Existing System
South County Recycled Water System
Santa Clara Valley Water District/South County Regional Wastewater Authority

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3.4 PRELIMINARY PROJECT ALTERNATIVES DEVELOPMENT

The recycled water system alternatives were developed to mitigate the existing system deficiencies and then to analyze potential alignments to expand the system to potential users. Note that all pipe diameters documented throughout this section and in all maps for the potential improvements refer to the inner diameter of the pipe.

3.4.1 Preliminary Pipeline Alignments

The first step in developing potential alignments was to mitigate deficiencies in the existing recycled water system. Through meetings with the District, a baseline system similar to the 2004 Master Plan proposed baseline alignment was developed to mitigate the high headlosses and low pressures observed in the existing system. Once the baseline system was developed, preliminary alignments through four corridors in the City of Gilroy and three alternatives for the City of Morgan Hill were proposed as a way to expand the recycled water system to new customers.

City of Gilroy Alignments: These alignments and the recycled water system conceptual buildout are shown on Figure 3.9**.**

- **Baseline Alignment:** The baseline alignments were similar to those proposed in the 2004 Master Plan and were revised based on the imminent improvements planned for the Glen Loma and Meritage Developments. These improvements included a new 30-inch main in Luchessa Ave through the Glen Loma Development to the Zone 2 Pump Station and a new 24-inch main to the Meritage Development. The baseline alignment was assumed to be included with the other preliminary expansion alignments.
- **First Street Alignment:** The first preliminary alignment expanded the recycled water system to potential customers in northwest Gilroy along First Street and Santa Teresa Boulevard.
- **Lake Kathryne Alignment:** The second preliminary alignment extended westward from the Meritage Development to Lake Kathryne to service the existing nurseries in west Gilroy. This alignment is similar to the proposed Hecker Pass extension improvements in the 2004 Master Plan to bring service to the users in western Gilroy. This alignment would require either a new tank in Zone 2 with a higher hydraulic grade line (HGL) than the existing Hoylake tank and a new/upgraded pump station, or the formation of a new Zone 3 with a new pump station to fill Lake Kathryne.
- **High Speed Rail Alignment**: This was the third preliminary alignment, and it extended service along the future High Speed Rail easement along Monterey Road to service potential customers in central Gilroy. This alternative was intended to take advantage of construction in conjunction with the High Speed Rail. The High Speed Rail alignment is based on the *California High-Speed Train Alternative Analysis Alignment Maps, San Jose to Merced: Morgan Hill / Gilroy Subsection East of UPRR – Trench Option*, dated April 2010.
- **Cameron Boulevard Alignment:** This was the fourth alignment and it extended service along Cameron Boulevard in east Gilroy to serve customers in central Gilroy similar to the High Speed Rail Alignment.

First St Alternative

Cameron Blvd Alternative

High Speed Rail Alternative

Lake Kathryne Alternative

Hoylake Tank

Baseline Alternative

Existing Treatment Plant

North System, Zone 1

South System

Zone 1

Zone 2

Zone 3

Conceptual Buildout
Maximum Day Demands
North (93): 9.4 MGD / 10,528 AFY
South (94): 4.7 MGD / 5,264 AFY
WWTP Utility: 1.6 MGD / 1,792 AFY

Total: 15.7 MGD / 17,584 AFY

Updated: April 22, 2016

0 0.25 0.5 1 Mile

Legend

Proposed

- Storage Tanks
- Booster Stations
- Buildout Proposed Pipe
- Baseline Alternative
- First St Alternative
- Cameron Blvd Alternative
- High Speed Rail Alternative
- Lake Kathryne Alternative

Existing

- WWTP
- Storage Tanks
- Booster Stations
- Recycled Water Pipelines
- Pressure Zone Line
- Existing Users
- In Progress Users
- Baseline Users
- Potential Users
- City Limits
- Roads
- Creeks
- Lake

Figure 3.9
Existing System + Conceptual Buildout (Gilroy)
South County Recycled Water System

Santa Clara Valley Water District /
South County Regional Wastewater Authority

Santa Clara Valley Water District

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City of Morgan Hill Alternatives: Since Morgan Hill currently does not have a way to bring recycled water from the SCRWA WWTP, the following three alternatives, shown on Figure 3.10, were evaluated and present ways to expand the recycled water system to Morgan Hill. Furthermore, all of these alternatives are refinements of the 2004 Master Plan extensions for service to the City of Morgan Hill.

- **Alternative 1: Morgan Hill (MH) High Speed Rail Transmission Main:** This Morgan Hill alignment extended a Morgan Hill recycled water transmission main along the future High Speed Rail easement along Monterey Road to service potential customers and/or for potential recharge in Morgan Hill. This alternative was intended to take advantage of construction in conjunction with the High Speed Rail.
- **Alternative 2: Joint Trunk Transmission Main:** Similar to the Morgan Hill High Speed Rail Alignment, this transmission main along the existing sewer joint trunk was intended to take advantage of the existing easements to Morgan Hill and the possibility of re-purposing the existing sewer trunk for recycled water purposes if the existing sewer trunk was decommissioned.
- **Scalping Plant:** This alternative included construction of a scalping plant, which would be a decentralized wastewater treatment plant to intercept and treat wastewater before it flowed to the centralized treatment facility. This alternative also included a separate recycled water system to serve potential recycled water customers in Morgan Hill.

The conceptual buildout for the Morgan Hill recycled water system shown on Figure 3.11 documents the potential customers and preliminary system alignments for Morgan Hill.

3.4.2 Distribution System Projects Selected for Implementation

The preliminary pipeline alignments were evaluated to determine the selected alignment moving forward. Table 3.6 shows the evaluation of the preliminary pipeline alignments including advantages and disadvantages of each alignment.

Table 3.6 Evaluation of Preliminary Pipeline Alignments

Alternative	Advantages	Disadvantages
Baseline Alignment	• Increase system reliability • Mitigates system deficiencies • Lowest cost supply (900 $/af) • Peak demand projections greater than existing treatment capacity	• Recycled water service for Morgan Hill resident only available from a potential fill station at the WWTP.
First Street Alignment	• Expansion of recycled water service in western Gilroy.	• Requires completion of Gilroy Baseline Alignment
Lake Kathryne	• Expansion of recycled water service in western Gilroy. • Potentially service two customers with large annual demands	• Requires completion of Gilroy Baseline Alignment • New pump station required to lift recycled water to Lake Kathryne

	• Low cost of supply (1,100 $/af)	
High Speed Rail Alignment	• Expansion of recycled water service in central Gilroy.	• Requires completion of Gilroy Baseline Alignment • Land and easement acquisition tied to future railroad project
Cameron Blvd Alignment	• Expansion of recycled water service in eastern and central Gilroy.	• Requires completion of Gilroy Baseline Alignment
Morgan Hill - Alternative 1 and 2 (Transmission Main)	• Service to Morgan Hill • Dual use opportunity for NPR/IPR (up to 8.5 mgd). • Alternative 2: Potential for joint construction with Morgan Hill sanitary sewer project	• High cost supply (6,100 – 8,800 $/af) • Alternative 1: Land and easement acquisition tied to future railroad project
Morgan Hill – Scalping Plant	• Service to Morgan Hill • Dual use opportunity for NPR/IPR (up to 2.5 mgd)	• Higher cost supply (6,800 – 9,900 $/af) than Baseline Alternative • Inability to meet existing customer demands due to reduced WWTP influent during peak demand periods. • Inadequate flow in sewer collection system could create odor and clogging problems. • Resulting sludge loading and reduced flow could substantially change composition of WWTP influent potentially leading to compliance issues.

Key:
af = acre-foot
IPR = indirect potable reuse
mgd = million gallon per day
NPR = non-potable reuse
WWTP = wastewater treatment plant

The evaluation results of the preliminary alignments shown above, the potential customer rankings in Chapter 2, and with input from SCRWA, the District, and the City of Gilroy resulted with the selection of the Baseline plus the Lake Kathryne Alignments. Table 3.7 documents the evaluation results including the potential annual demands, average market assessment score, and cost per acre-foot of recycled water for the considered alignments. The selected Baseline plus Lake Kathryne alignment is an update to the 2004 Master Plan proposed Baseline Alternative and includes revised alignments through Glen Loma and Hecker Pass based on

updates to the land development plan. This selected alternative will mitigate the existing system deficiencies and allow system expansion for new potential customers to connect.

The First Street, High Speed Rail, and Cameron Boulevard alignments for Gilroy and the Morgan Hill Alternatives were not selected for implementation as these alternatives would not present enough benefit for expansion due to small water demands and the high cost of infrastructure that would be required.

Table 3.7: Summary of Evaluation of Alternatives

	Potential Annual Average Demand (afy)	Market Assessment Average Score (1-25)	Cost (Annual Basis) ($/AF)	
City of Gilroy				
Baseline Alignment	**2,240**	**18**	**900**	**Recommended**
First Street Alignment	1,580	12	-	
Lake Kathryne Alignment	**2,465**	**22**	**1,100**	**Recommended**
High Speed Rail Alignment	1,585	12	-	
Cameron Boulevard Alignment	1,575	12	-	
City of Morgan Hill				
Tranmission Main + Distribution Mains (1 mgd)	345-495	12-13	6,100-8,800	
Scalping Plant (1 MGD) + Distribution Mains	380-495	12	6,800-9,900	

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Morgan Hill Recycled Water (2.25 MGD) Option 1

Indirect Potable Reuse Alternative

Morgan Hill Recycled Water (2.25 MGD) Option 2

Alternative 3 Scalping Plant

Gilroy - Baseline/Lake Kathryne Alternative

Transmission Main Alternative 1

Transmission Main Alternative 2

Proposed Pump Station(s)

Existing Treatment Plant

MORGAN HILL

GILROY

Madrone Channel

Main Ave Ponds

San Pedro Ponds

Church Ave Ponds

Kirby

Hale

Monterey

Diana

Main

Lakeview

Oakwood

Hill

Tennant

Dunne

Spring

Maple

Middle

Edmundson

Watsonville

California

Harding

Highland

San Martin

Sycamore

Center

Foothill

Church

Rucker

Fitzgerald

Buena Vista

Day

New

Marcella

Las Animas

Leavesley

Burchell

Wren

Gilman

Ferguson

4th

Miller

Southside

Bolsa

Santa Teresa

Bloomfield

101

152

24

S-18

S-21

S-24

S-27

S-30

S-33

S-42

12

14

20

22

30

12/36

Legend

Proposed

- Storage Tanks
- Booster Stations
- Alternative Scalping Plant
- Gilroy - Baseline/Lake Kathryne Alternative
- Transmission Main Alternative 1
- Transmission Main Alternative 2
- MH Recycled Water (2.25 MGD) Option 1
- MH Recycled Water (2.25 MGD) Option 2
- Indirect Potable Reuse Alternative
- Sewer Relief Trunk

Existing

- WWTP
- Storage Tanks
- Booster Stations
- Recycled Water Pipelines
- Existing Users
- Recharge Ponds
- Sewer Joint Trunk
- City Limits
- Roads
- Lakes

Updated: April 22, 2016

0 0.25 0.5 1 Mile

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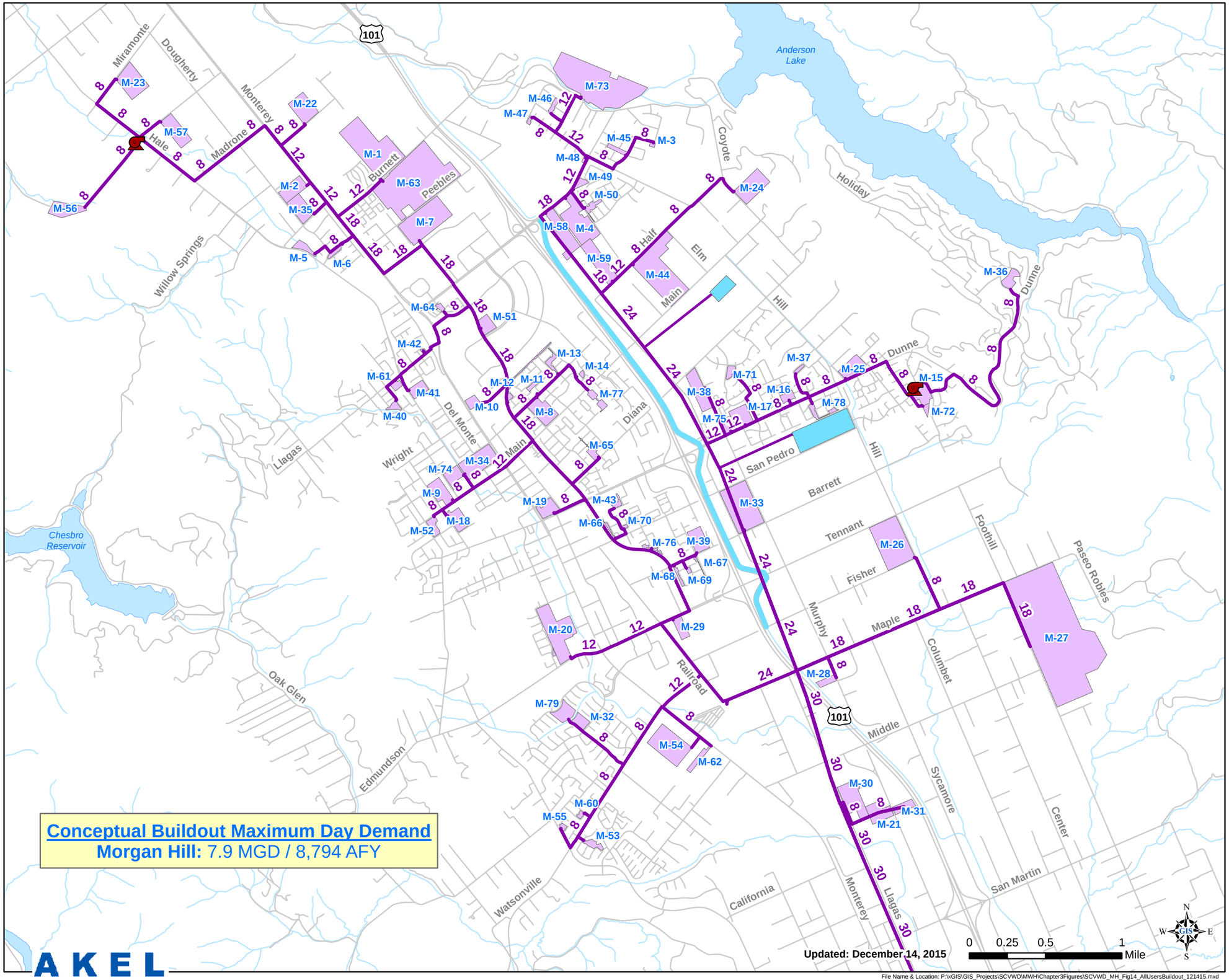
Figure 3.10
Morgan Hill and Gilroy Alternatives

South County Recycled Water System

Santa Clara Valley Water District /
South County Regional Wastewater Authority

Santa Clara Valley Water District



Conceptual Buildout Maximum Day Demand
Morgan Hill: 7.9 MGD / 8,794 AFY

Legend

Proposed

- Booster Stations
- Recycled Water System
- Potential Users

Existing

- Recharge Ponds
- City Limits
- Roads
- Creeks
- Lakes

Figure 3.11
Recycled Water System Conceptual Buildout (Morgan Hill)
South County Recycled Water System
Santa Clara Valley Water District /
South County Regional Wastewater Authority

Santa Clara Valley Water District

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3.5 GILROY ALTERNATIVES EVALUATION

This section presents a summary of the City of Gilroy recycled water system alignments evaluation and identifies improvements needed to mitigate existing deficiencies, as well as improvements needed to expand the system, and expand service to existing and new customers along the selected alignment.

3.5.1 Customer Grouping Summary

The customer rankings documented in Chapter 2 were used to determine the most viable customers to connect to the recycled water system, which aided in the selection of the preferred expansion alignments. Based on the customer rankings, the potential customers ranked between 15 and 25 (color coded in light or dark green in Chapter 2) were deemed the most economical to connect to the existing system. The most economical users were along the existing system or the baseline alignment which also included the nurseries on the west side of Gilroy that feed off of Lake Kathryne. The other potential users in north or central Gilroy currently did not present enough benefit to connect due to small water demands and the high cost of infrastructure that would be required. Therefore, the baseline alignment which mitigates the existing deficiencies plus the Lake Kathryne Alignment was selected for further evaluation.

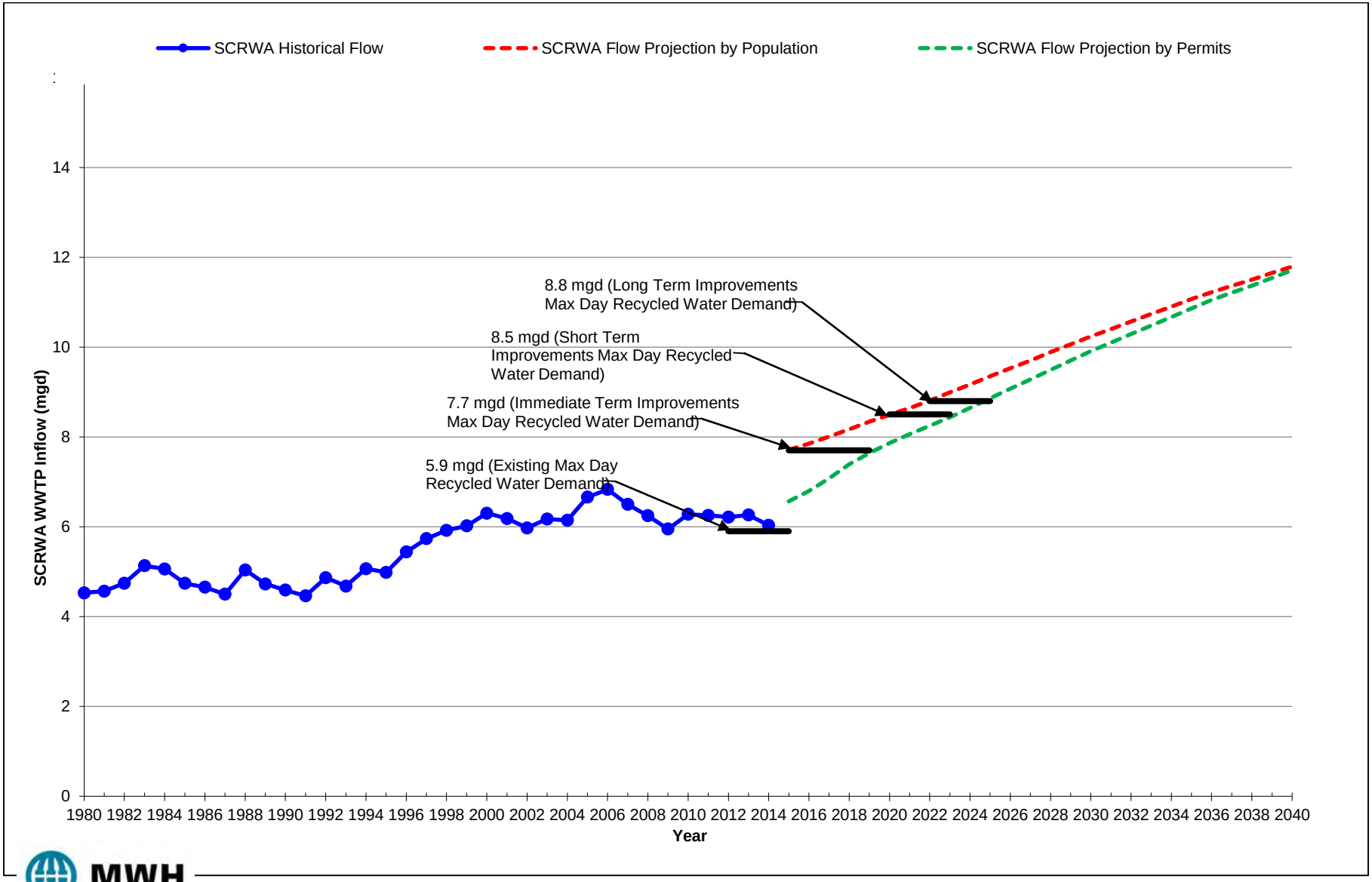
3.5.2 Hydraulic Modeling Analysis of Selected Alternatives

The hydraulic model was used to evaluate the selected alignments in the City of Gilroy. The baseline and Lake Kathryne alignments were split into three segments; Immediate Term Improvements, Short Term Improvements, and Long Term Improvements. The improvement pipe diameters documented for each segment refer to the inner diameter of the pipe. A summary of the potential customers and demands for the City of Gilroy selected alignments is included in Table 3.8. It should be noted that the users listed are not guaranteed a recycled water connection and were used in this analysis to size the proposed infrastructure.

The projected demands documented for each scenario were greater than the current WWTP inflow. New user connections were not based on the completion of the infrastructure but rather reliant upon the inflow at the WWTP. Figure 3.12 documents the existing and projected WWTP inflow versus the recycled water demands for the existing system as well as the Immediate Term, Short Term, and Long Term Improvements. The WWTP inflow projections show the flow projections based on various methodologies and were taken from the 2013 and 2014 SCRWA Wastewater Flow Projections TM dated April, 2015[12].

[12]. For additional information on the 2013 and 2014 SCRWA Wastewater Flow Projections TM, contact the South County Regional Wastewater Authority (http://www.ci.gilroy.ca.us/561/South-County-Regional-Wastewater-Authori or 408-846-0202).

Figure 3.12 SCRWA WWTP Inflow Projections



Baseline - Immediate Term Improvements Evaluation:

The Immediate Term Improvements begin with a new 30-inch main which connects to the existing 30-inch main in Southside Drive. This main continues north to Luchessa Avenue and tees into a proposed 30-inch main to the west and a proposed 18-inch main to the east that jogs north to the Princevalle Drain at Cameron Boulevard and connects to the existing 12-inch pipeline. The 30-inch main heading west continues across Monterey Road and connects to the existing 16-inch main that begins at Greenfield Drive. The existing 16-inch runs from Greenfield Drive to Tenth Street in Luchessa Avenue where the proposed 30-inch main then re-connects and continues west to the intersection of Luchessa Avenue and Miller Avenue. Due to severe construction limitations as reported by the City of Gilroy's current pipeline consultant in 2015, the existing 16-inch main in Luchessa Avenue from Greenfield Drive to Tenth Street is to be left in place and not replaced with a matching 30-inch main. Also included in this scenario are the east cluster pipelines of the Meritage Development, which is comprised of a 24-inch main along 3rd Street and 12-inch mains connecting to the existing 12-inch pipe in Hecker Pass Highway. These immediate term improvements are shown on Figure 3.13.

Since this scenario would mitigate some of the deficiencies, it was determined that new customers could connect based on ranking, location, and as the remaining system capacity limitations allowed. New customers were added from the ranking list for the City of Gilroy, Table 2.16, from Chapter 2. The potential demands that could be served in this scenario are 7.7 mgd during MDDs and are greater than the current inflow to the WWTP. The addition of new customers is reliant upon an increase in inflow at the WWTP and the projected treatment expansion and associated permits for the WWTP. The customers and demands included in this scenario to size the infrastructure are documented on Table 3.8 and also shown in Figure 3.13.

Figure 3.13 also documents the immediate term system headlosses and pressures during peak hour demands. Furthermore, Figure 3.14 documents the scenario demands over maximum day for each of the pump stations.

Other planned improvements at the SCRWA WWTP for this scenario include:

- Area 94 (South) recycled water pump station upgrade (addition of a third 2,100 gpm pump, for a firm station capacity of 4,200 gpm)
- UV treatment facility (9 mgd)

While these improvements at the SCRWA WWTP are included in the alternatives for planning and CIP purposes, more detailed analyses around these improvements are being conducted as a separate effort. More information on the capital improvement projects planned at the SCRWA WWTP can be found in the SCRWA Capital Improvements Strategic Plan[13], dated October 2011.

[13] For additional information on the SCRWA Capital Improvements Strategic Plan and subsequent version, contact the South County Regional Wastewater Authority (http://www.ci.gilroy.ca.us/561/South-County-Regional-Wastewater-Authori or 408-846-0202).

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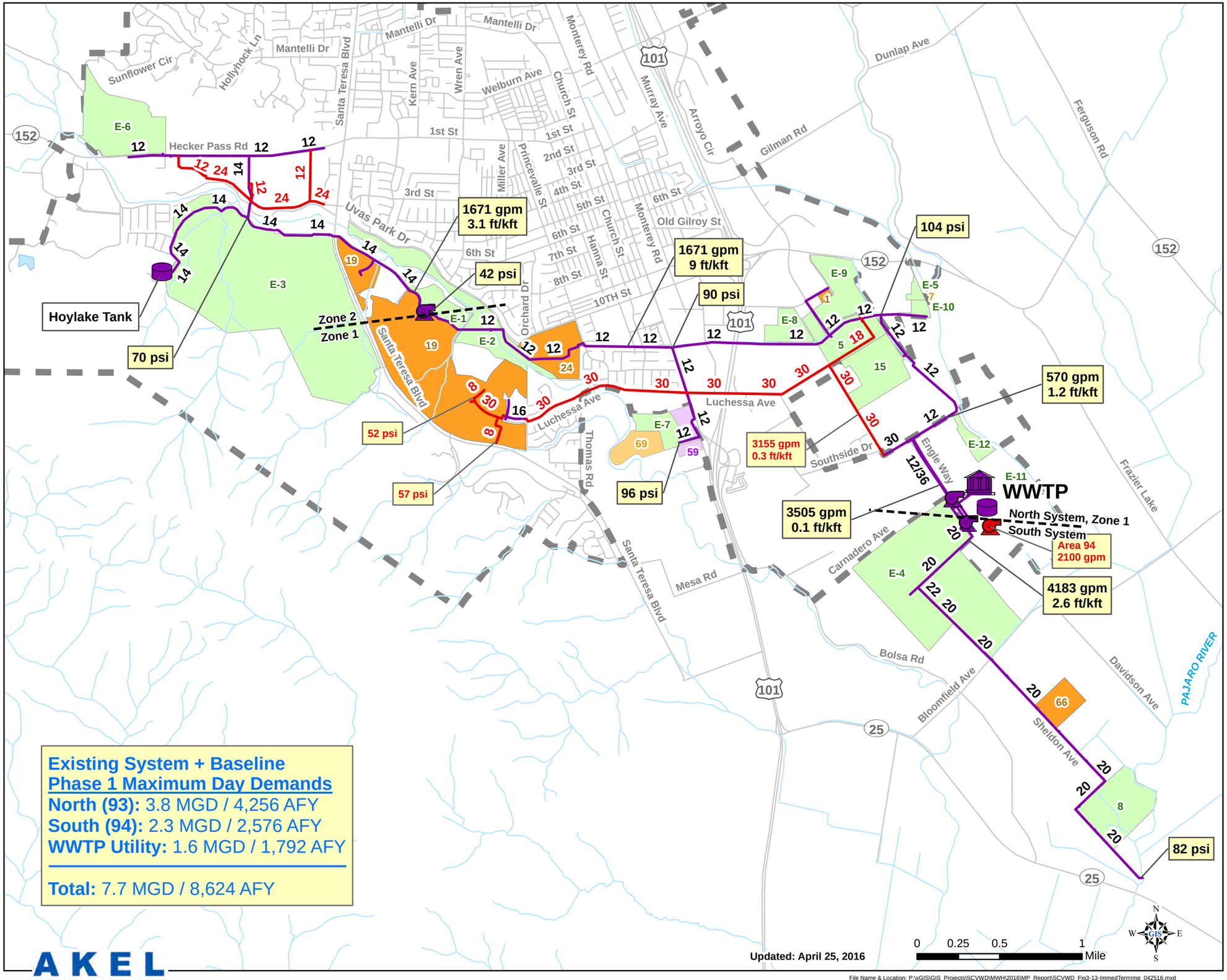
Table 3.8 Potential Customers Used to Determine Infrastructure Sizing for Selected Gilroy Alignments

System	Customers	Average Annual Demand (mgd/afy)	Maximum Day Demand (mgd/afy)	Peak Hour Demand (mgd/afy)
Existing System - 2014				
North System Users				
E-1	Christmas Hill Park - Ranch			
E-2	Christmas Hill Park			
E-3	Eagle Ridge Golf Course			
E-8	Obata Farms (North)			
E-5	Calpine Power Plant - Peaker			
E-10	Calpine Power Plant - Cogen			
E-6	City of Gilroy - Golf Course			
E-7	City of Gilroy - Sports Park			
E-9	McCarthy Business Park			
E-12	City of Gilroy - Shooting Range			
	Sub-Total	1.0 mgd / 1,120 afy	2.3 mgd / 2,528 afy	2.9 mgd / 3,248 afy
South System Users				
E-4	SCRWA Farms (Ag Lease) Turnout #1-#6			
	Sub-Total	0.2 mgd / 224 afy	1.6 mgd / 1,763 afy	4.1 mgd / 4,592 afy
WWTP				
E-11	WWTP Utility Water			
	Total	**2.2 mgd / 2,464 afy**	**5.2 mgd / 5,830 afy**	**8.2 mgd / 9,184 afy**
Baseline Immediate Term Improvements				
North System Users				
E-1	Christmas Hill Park - Ranch	E-9	McCarthy Business Park	
E-2	Christmas Hill Park	E-12	City of Gilroy - Shooting Range	
E-3	Eagle Ridge Golf Course	15	Obata (new turnout)	
E-8	Obata Farms (North)	5	United Natural Food	
E-5	Calpine Power Plant - Peaker	1	Cintas Corporation	
E-10	Calpine Power Plant - Cogen	7	Calpine Power Plant - Additional Demand	
E-6	City of Gilroy - Golf Course	69	Gilroy Sports Park Expansion	
E-7	City of Gilroy - Sports Park	59	Fiorio Farms (Gilroy Sports Park)	
18	Meritage Development	19	Glen Loma Ranch Development	
	Sub-Total	1.4 mgd / 1,568 afy	3.8 mgd / 4,251 afy	5.4 mgd / 6,060 afy
South System Users				
E-4	SCRWA Farms (Ag Lease) Turnout #1-#6			
8	C & E Farms			
66	C & E Farms (Additional Parcel)			
	Sub-Total	0.4 mgd / 448 afy	2.3 mgd / 2,587 afy	6.0 mgd / 6,746 afy
WWTP				
E-11	WWTP Utility Water			
	Total	**2.9 mgd / 3,248 afy**	**7.7 mgd / 8,606 afy**	**13.2 mgd / 14,742 afy**
Baseline Short Term Improvements				
North System Users				
E-1	Christmas Hill Park - Ranch	1	Cintas Corporation	
E-2	Christmas Hill Park	7	Calpine Power Plant - Additional Demand	
E-3	Eagle Ridge Golf Course	69	Gilroy Sports Park Expansion	
E-8	Obata Farms (North)	59	Gilroy Sports Park (Agriculture)	
E-5	Calpine Power Plant - Peaker	19	Glen Loma Ranch Development	
E-10	Calpine Power Plant - Cogen	63	Sydney Casper City Park	
E-6	City of Gilroy - Golf Course	23	Ascension Solorsano Middle School	
E-7	City of Gilroy - Sports Park	62	Glen Loma Second Park (Santa Teresa Blvd and Club Dr)	
E-9	McCarthy Business Park	18	Meritage Development	
E-12	City of Gilroy - Shooting Range	64	City Park (Hecker Pass)	
15	Obata (new turnout)	24	Gilroy High School	
5	United Natural Food	45	Las Animas Elementary	
60	Hecker Pass (Agriculture)	21	Hoey Development	
13	Syngenta	61	Santa Teresa & Third Street Park	
		65	City Park (SW corner of Santa Teresa Blvd and 3rd St)	
	Sub-Total	1.6 mgd/ 1,792 afy	4.6 mgd / 5,107 afy	7.3 mgd / 8,146 afy
South System Users				
E-4	SCRWA Farms (Ag Lease) Turnout #1-#6			
8	C & E Farms			
66	C & E Farms (Additional Parcel)			
	Sub-Total	0.4 mgd / 448 afy	2.3 mgd / 2,587 afy	6.1 mgd / 6,825 afy
WWTP				
E-11	WWTP Utility Water			
	Total	**3.0 mgd / 3,360 afy**	**8.5 mgd / 9,492 afy**	**15.3 mgd / 17,173 afy**
Baseline Long Term Improvements				
North System Users				
E-1	Christmas Hill Park - Ranch	69	Gilroy Sports Park Expansion	
E-2	Christmas Hill Park	59	Gilroy Sports Park (Agriculture)[1]	
E-3	Eagle Ridge Golf Course	19	Glen Loma Ranch Development	
E-8	Obata Farms (North)[1]	63	Sydney Casper City Park	
E-5	Calpine Power Plant - Peaker	23	Ascension Solorsano Middle School	
E-10	Calpine Power Plant - Cogen	62	Glen Loma Second Park (Santa Teresa Blvd and Club Dr)	
E-6	City of Gilroy - Golf Course	18	Meritage Development	
E-7	City of Gilroy - Sports Park	64	City Park (Hecker Pass)	
E-9	McCarthy Business Park	61	Santa Teresa & Third Street Park	
E-12	City of Gilroy - Shooting Range	65	City Park (SW corner of Santa Teresa Blvd and 3rd St)	
15	Obata (new turnout)[1]	2	Gilroy Gardens (formerly Bonafante)	
5	United Natural Food	3	Western Tree Nursery I & II	
1	Cintas Corporation	24	Gilroy High School	
7	Calpine Power Plant - Additional Demand	45	Las Animas Elementary	
60	Hecker Pass (Agriculture)[1]	21	Hoey Development[1]	
13	Syngenta[1]			
	Sub-Total	2.0 mgd / 2,240 afy	5.6 mgd / 6,311 afy	7.6 mgd / 8,484 afy
South System Users				
E-4	SCRWA Farms (Ag Lease) Turnout #1-#6			
8	C & E Farms[1]			
66	C & E Farms (Additional Parcel)[1]			
	Sub-Total	0.2 mgd / 224 afy	1.6 mgd / 1,763 afy	4.1 mgd / 4,550 afy
WWTP				
E-11	WWTP Utility Water			
	Total	**3.3 mgd / 3,696 afy**	**8.8 mgd / 9,843 afy**	**12.1 mgd / 13,499 afy**
Conceptual Buildout - Gilroy				
North System Users				
All Users				
	Sub-Total	3.4 mgd / 3,808 afy	9.4 mgd / 10,528 afy	14.1 mgd / 15,792 afy
South System Users				
All Users				
	Sub-Total	1.0 mgd / 1,120 afy	4.7 mgd / 5,264 afy	11.5 mgd / 12,862 afy
	Total	**5.5 mgd / 6,160 afy**	**15.7 mgd / 17,584 afy**	**23.9 mgd / 26,768 afy**

Note: AKEL ENGINEERING GROUP, INC. 4/26/2016

1. These users were excluded in this scenario to remain under the current recycled water treatment capacity permit of 8.5 MGD.

Key:
MGD = million gallons per day
WWTP = wastewater treatment plant
SCRWA = South County Regional Wastewater Authority



Existing System + Baseline
Phase 1 Maximum Day Demands
North (93): 3.8 MGD / 4,256 AFY
South (94): 2.3 MGD / 2,576 AFY
WWTP Utility: 1.6 MGD / 1,792 AFY

Total: 7.7 MGD / 8,624 AFY

Legend

Proposed

- Booster Stations
- Immediate-Term Proposed Pipe

Existing

- WWTP
- Storage Tanks
- Booster Stations
- Recycled Water Pipelines
- Pressure Zone Line
- Existing Users
- In-Progress Users
- Baseline Users
- Potential Users
- City Limits
- Roads
- Creeks
- Lake

Note 1: Minimum Pressures + Maximum Flows + Headlosses during Maximum Day Demands shown.

Updated: April 25, 2016

0 0.25 0.5 1 Mile

N W GIS E S

Figure 3.13
Existing System + Baseline Immediate-Term Improvements
South County Recycled Water System

Santa Clara Valley Water District /
South County Regional Wastewater Authority

Santa Clara Valley Water District

AKEL ENGINEERING GROUP, INC.

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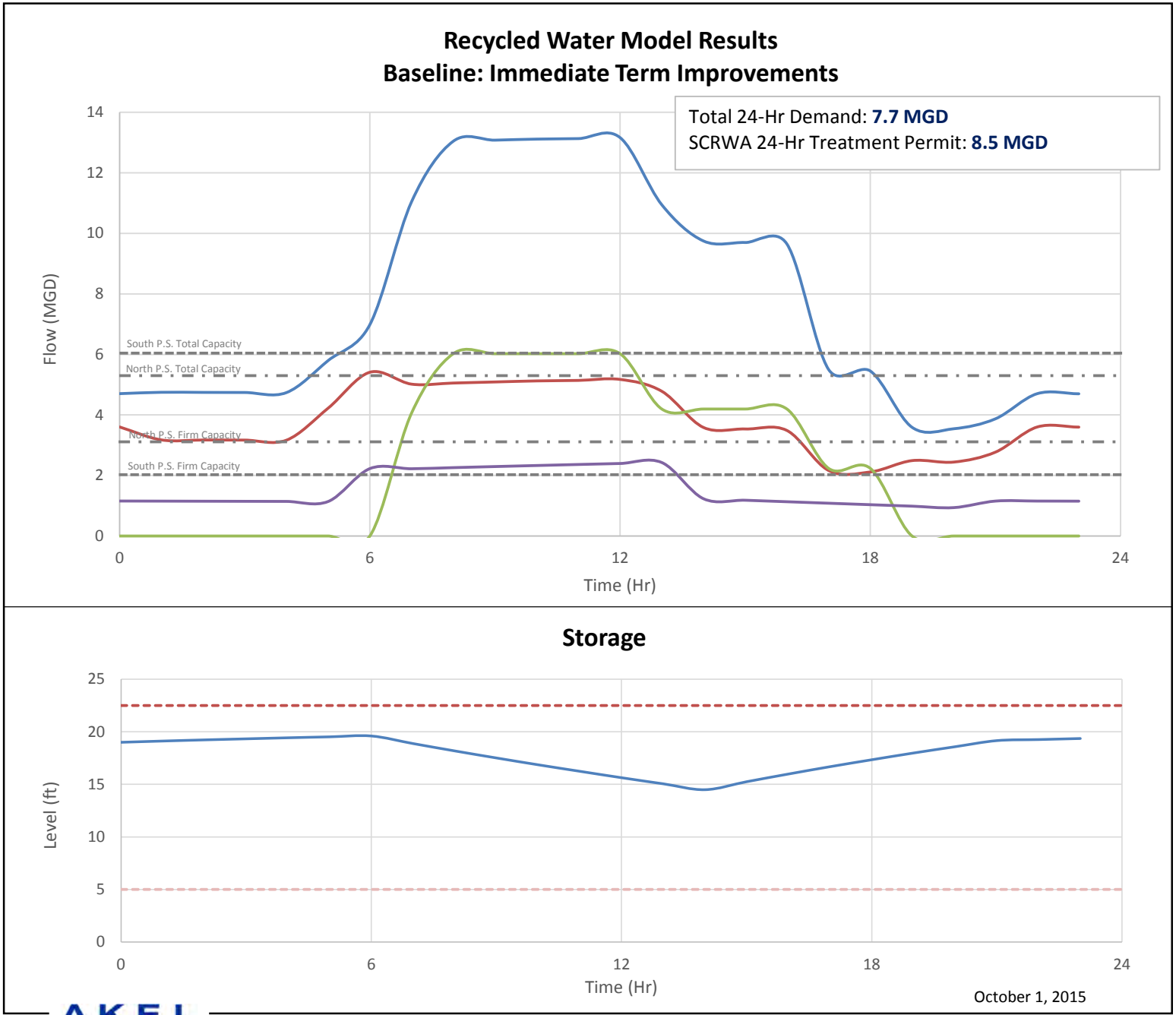

LEGEND

- Projected Total Demand
- P.S. (North) Discharge
- P.S. (South) Discharge
- P.S. (C. Hill) Discharge

Existing Pump Station Total Capacities:
North: **5.2 MGD**
South: **6.0 MGD**
C. Hill: **5.9 MGD**

- North System Tank (Hoylake)
- Max Level
- Min Level

Figure 3.14
Recycled Water Model Results
Baseline: Immediate-Term Improvements
South County Recycled Water System
Santa Clara Valley Water District/South County Regional Wastewater Authority

Santa Clara Valley Water District

AKEL ENGINEERING GROUP, INC.

Baseline - Short Term Improvements Evaluation:

The Short Term Improvements begin with a 30-inch main which connects to the proposed 30-inch main at Miller Avenue and Luchessa Ave and continues through the Glen Loma Development to the intake of the Zone 2 Christmas Hill Pump Station. This also includes a 24-inch main discharge from the Zone 2 Christmas Hill Pump Station heading south west through the Glen Loma Development, then turning north west along Santa Teresa Boulevard to the Third Street intersection, and connecting to the proposed 24-inch main from the immediate term improvements. Furthermore, the recycled water pipelines in the Meritage Development West Cluster section are also included in these improvements.

At the SCRWA WWTP, the Area 93 pump station would require a capacity upgrade to serve the increase in demands in the North System. The proposed pump station upgrade is two 1,600 gpm pumps for a total capacity of 6,800 gpm (9.8 mgd) and firm capacity of 5,200 gpm (7.5 mgd) Lastly, the expansion of the existing 3.0 MG reservoir at the WWTP site for an additional 6.0 MG (9.0 MG total) is included in this scenario. The short term improvements are shown on Figure 3.15.

The hydraulic analysis showed implementation of the immediate plus Short Term pipeline improvements would mitigate the remaining deficiencies in the Zone 1, 12-inch main along the Princevalle Drain alignment. It should be noted that if the existing 16-inch main in Luchessa Avenue from Greenfield Drive to Tenth Street that is to be left in place it would experience headlosses up to 4.3 feet per 1,000 feet of pipe (ft/kft), which would be above the recommended criteria of 4 ft/kft. It would also result in a 1 psi drop downstream along Luchessa Avenue. The 8-inch loop along Santa Teresa Boulevard would experience pressures down to 17 psi during peak hour demands, which would be below the criteria of 35 psi. The low pressures predicted along the 8-inch in Santa Teresa Boulevard are due to a condition of higher elevations. For this reason, the District has designated this segment of the recycled water system as “Additional Conditions Apply.” Customers requesting service will be required, at their expense, to install an on-site booster stations to increase pressures for desired service connections. The headlosses and pressures in the system for the Short Term system evaluation are documented on Figure 3.15**.**

Since this scenario would mitigate the remaining Zone 1 deficiencies, it was determined that new customers could connect based on their ranking and location. Potential customer demands that could be served in this scenario could exceed the 8.5 mgd supply permit amount during maximum day, therefore, new users were added based on the rankings presented in Chapter 2 until the demands reached the 8.5 mgd limit. It should be noted that the recycled water supply permit amount would be greater than the current inflow to the WWTP and the addition of new customers is reliant upon an increase in inflow at the WWTP and the projected treatment expansion and associated permits for the WWTP. The customers and demands included in this scenario to size the infrastructure are documented on Table 3.8 and also shown on Figure 3.15. Furthermore, Figure 3.16 documents the scenario demands during maximum day for each of the pump stations.

Other planned improvements at the SCRWA WWTP for this scenario include:

- Chlorine contact basin and reservoir return pump station upgrade

These improvements at the SCRWA WWTP are included in the alternatives for planning and CIP purposes, but more detailed analyses around these improvements are being conducted as a separate effort. More information on the capital improvement projects planned at the SCRWA WWTP can be found in the SCRWA Capital Improvements Strategic Plan[14], dated October 2011.

Furthermore, automated flow measurement and smart meter conversion is a proposed wholesaler/retailer improvement included in this scenario.

[14] For additional information on the SCRWA Capital Improvements Strategic Plan and subsequent version, contact the South County Regional Wastewater Authority (http://www.ci.gilroy.ca.us/561/South-County-Regional-Wastewater-Authori or 408-846-0202).

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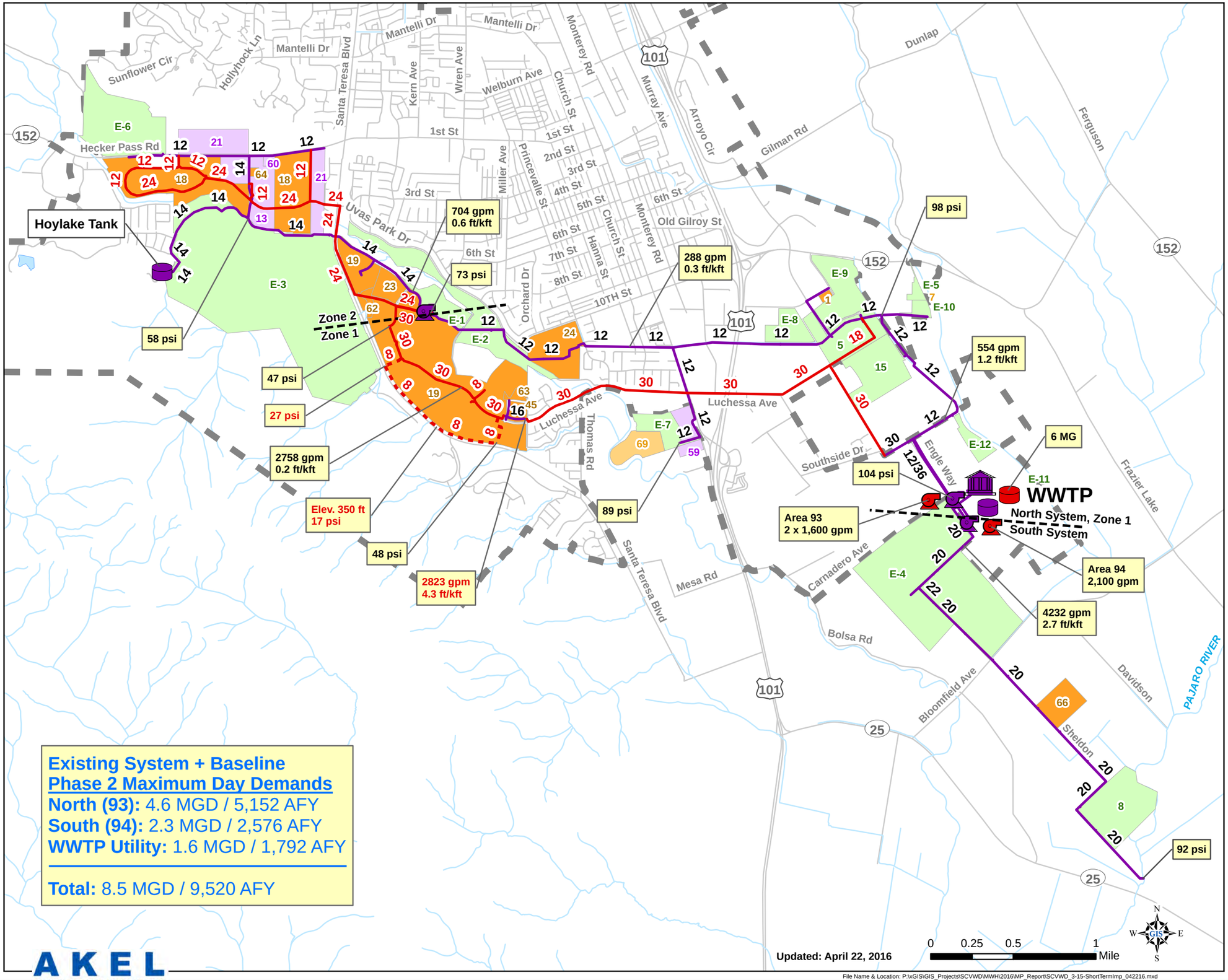

Existing System + Baseline
Phase 2 Maximum Day Demands
North (93): 4.6 MGD / 5,152 AFY
South (94): 2.3 MGD / 2,576 AFY
WWTP Utility: 1.6 MGD / 1,792 AFY

Total: 8.5 MGD / 9,520 AFY

Legend

Proposed

- Storage Tanks
- Booster Stations
- Short-Term Pipes
- Additional Conditions Apply

Existing

- WWTP
- Storage Tanks
- Booster Stations
- Recycled Water Pipelines
- Pressure Zone Line
- Existing Users
- In-Progress Users
- Baseline Users
- Potential Users
- City Limits
- Roads
- Creeks
- Lake

Note 1: Minimum Pressures + Maximum Flows + Headlosses during Maximum Day Demands shown.

Figure 3.15
Existing System + Baseline Short-Term Improvements
South County Recycled Water System
Santa Clara Valley Water District /
South County Regional Wastewater Authority

Santa Clara Valley Water District

AKEL ENGINEERING GROUP, INC.

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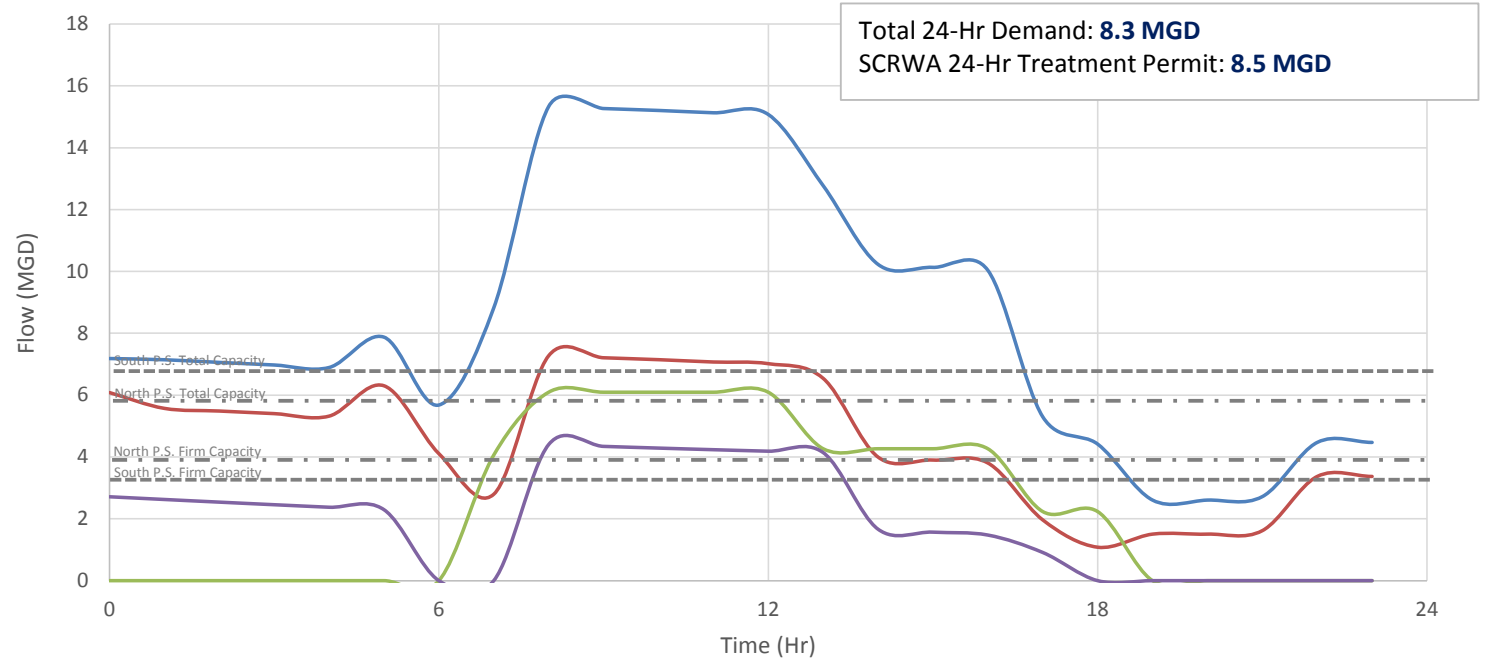
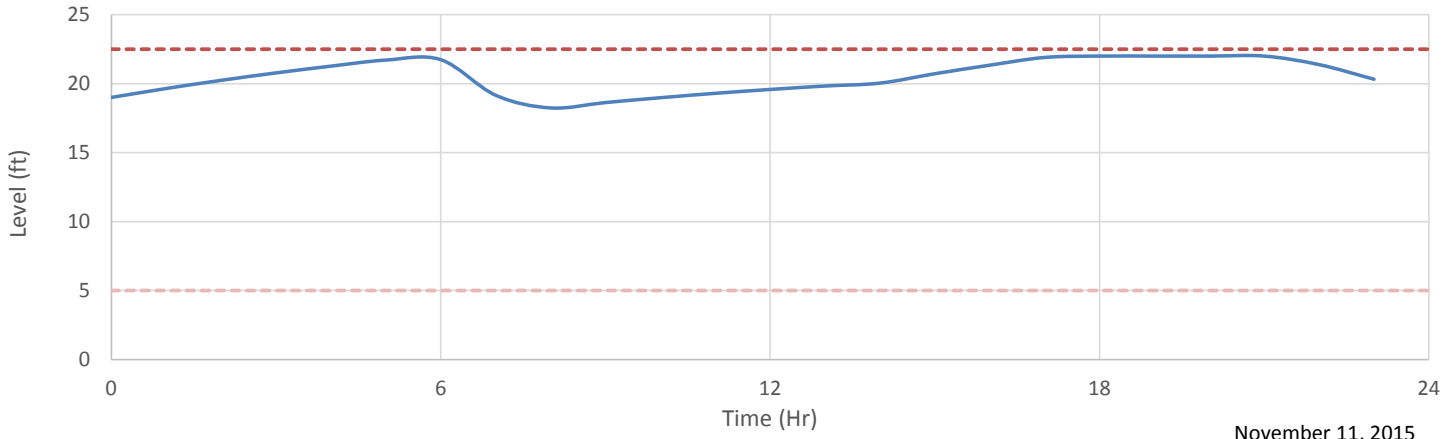
Recycled Water Model Results
Baseline: Near-Short Term Improvements



Storage



November 11, 2015

LEGEND

- Projected Total Demand
- P.S. (North) Discharge
- P.S. (South) Discharge
- P.S. (C. Hill) Discharge

Existing Pump Station Total Capacities:
North: **5.2 MGD**
South: **6.0 MGD**
C. Hill: **5.9 MGD**

- North System Tank (Hoylake)
- Max Level
- Min Level

Figure 3.16

Recycled Water Model Results
Baseline: Short-Term Improvements

South County Recycled Water System
Santa Clara Valley Water District/South County Regional Wastewater Authority

Santa Clara Valley Water District

AKEL ENGINEERING GROUP, INC

Baseline - Long Term Lake Kathryne Improvements Evaluation:

The Long Term Improvements include the Lake Kathryne extension from the west side of the Meritage development and connecting to Lake Kathryne. This scenario also requires a new tank to expand storage in Zone 2 and a new Zone 3 pump station to pump into Lake Kathryne. No additional improvements are required to provide service from Lake Kathryne as the potential customers would have existing private infrastructure in place that could be converted for recycled water use to extract from Lake Kathryne. The Long Term scenario improvements are documented on Figure 3.17.

During this scenario, the existing 16-inch main in Luchessa Avenue from Greenfield Drive to Tenth Street that is to be left in place would experience headlosses up to 7.0 ft/kft, which would be above the recommended criteria of 4 ft/kft. The 8-inch loop along Santa Teresa Boulevard would experience pressures down to 17 psi during peak hour demands, due to the higher elevations along Santa Teresa, which would be below the criteria of 35 psi. Since pressures along this section of proposed pipeline would be outside the system parameters, additional customer conditions would apply to new service connections. The headlosses and pressures for the long term system evaluation are documented on Figure 3.17.

The Long Term improvements extended the system to new large and more consistent water users in western Gilroy. The potential customer demands that could be served in this scenario would exceed 8.5 mgd supply permit amount during MDDs. Since potential customer demands could exceed the WWTP recycled water supply, some lower ranked and highly seasonal users included in the previous scenarios were excluded from this analysis to stay close to the supply capacity permit amount of 8.5 mgd. It should be noted that the recycled water supply permit amount would be greater than the current inflow to the WWTP, and the addition of new customers would be reliant upon an increase in inflow at the WWTP and the projected treatment expansion and associated permits for the WWTP. The customers and demands included in this scenario to size the infrastructure are documented on Table 3.8 and also shown on Figure 3.17. Furthermore, Figure 3.18 documents the scenario demands for maximum day for each of the pump stations.

Other planned improvements at the SCRWA WWTP for this scenario included:

- SCRWA WWTP Proposed Membrane Bioreactor (MBR) Expansion Project (2.5 mgd expansion[15])
- Recycled Water Fill Station

These improvements at the SCRWA WWTP are included in the alternatives for planning and CIP purposes, but more detailed analyses around these improvements are being conducted as a separate effort. More information on the capital improvement projects planned at the SCRWA

[15] The MBR expansion increase secondary treatment capacity as well as expand recycled production capacity. MBR effluent meets quality requirements for filtered effluent and therefore does not need to pass through the filter plant before being used as recycled water.

WWTP can be found in the SCRWA Capital Improvements Strategic Plan[16], dated October 2011.

[16] For additional information on the SCRWA Capital Improvements Strategic Plan and subsequent version, contact the South County Regional Wastewater Authority (http://www.ci.gilroy.ca.us/561/South-County-Regional-Wastewater-Authori or 408-846-0202).

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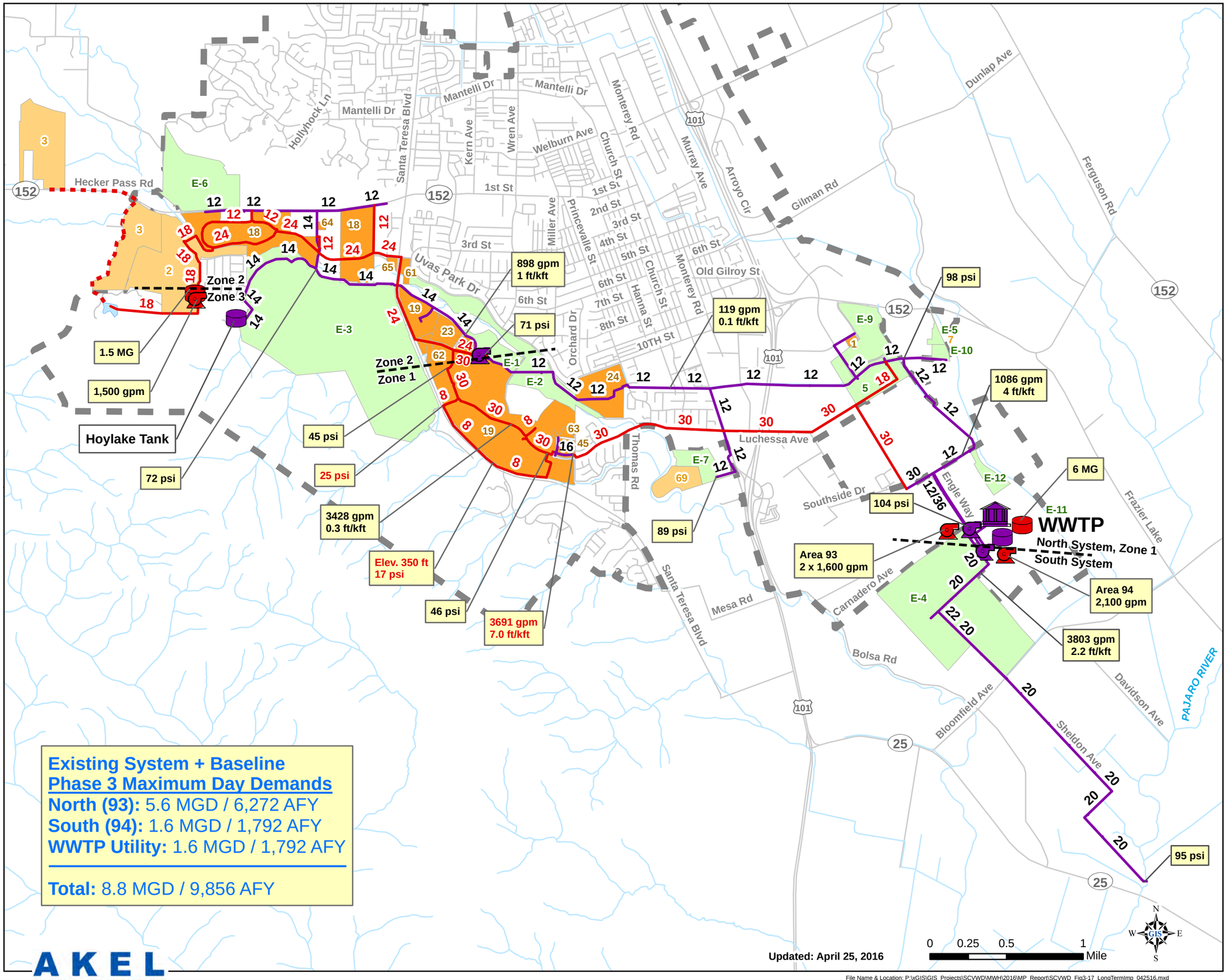

Existing System + Baseline
Phase 3 Maximum Day Demands
North (93): 5.6 MGD / 6,272 AFY
South (94): 1.6 MGD / 1,792 AFY
WWTP Utility: 1.6 MGD / 1,792 AFY

Total: 8.8 MGD / 9,856 AFY

Legend

Proposed

- Storage Tanks
- Booster Stations
- Long-Term Proposed Pipe
- Existing User Infrastructure

Existing

- WWTP
- Storage Tanks
- Booster Stations
- Recycled Water Pipelines
- Pressure Zone Line
- Existing Users
- In-Progress Users
- Baseline Users
- City Limits
- Roads
- Creeks
- Lake

Note 1: Minimum Pressures + Maximum Flows + Headlosses during Maximum Day Demands shown.

Figure 3.17
Existing System + Baseline Long-Term Improvements
South County Recycled Water System

Santa Clara Valley Water District /
South County Regional Wastewater Authority

Santa Clara Valley Water District

Updated: April 25, 2016

0 0.25 0.5 1 Mile

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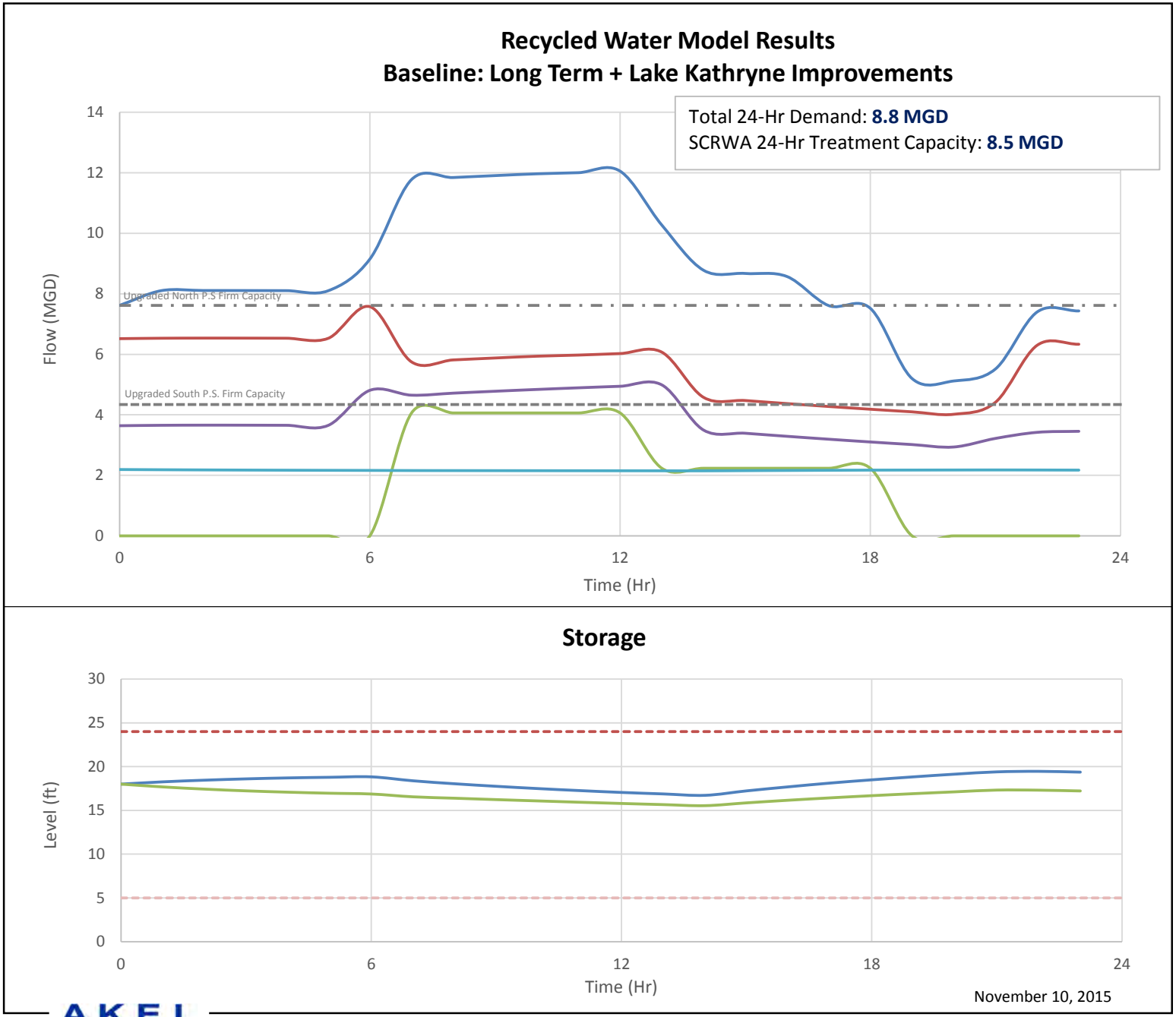


LEGEND

- Projected Total Demand
- P.S. (North) Discharge
- P.S. (South) Discharge
- P.S. (C. Hill) Discharge
- P.S. (Zone 3) Discharge

Recommended Pump Station Firm Capacities:
North: **7.6 MGD**
South: **4.1 MGD**
C. Hill: **5.9 MGD**
Zone 3: **2.2 MGD**

- North System Tank (Hoylake)
- New Recycled Water Tank
- Max Level
- Min Level

Figure 3.18

Recycled Water Model Results
Baseline: Long-Term Improvements

South County Recycled Water System
Santa Clara Valley Water District/South County Regional Wastewater Authority

AKEL ENGINEERING GROUP, INC.

3.6 MORGAN HILL ALTERNATIVES EVALUATION

As part of these master planning efforts, three alternatives for bringing recycled water to the City of Morgan Hill were evaluated:

1. A new pump station and transmission main between the City of Gilroy and City of Morgan Hill that parallels the high speed rail alignment
2. A new pump station and transmission main between the City of Gilroy and City of Morgan Hill that follows the existing joint sewer trunk
3. Construct a scalping plant in the City of Morgan Hill

These Morgan Hill alternatives were evaluated as part of the 2015 Master Plan Update, but were not selected for implementation and thus not included in the CIP. Each of the alternatives are included in Figure 3.10 and discussed in more detail in the following sections.

In addition to these three alternatives, and as part of the Morgan Hill Recycled Water Feasibility Evaluation (Appendix D) Akel Engineering Group and MWH have explored the possibility of importing recycled water from north of Morgan Hill, i.e., from the SBWR recycled water system.

The allocation of recycled water from the Regional Wastewater Facility (RWF) and in the SBWR recycled water system was most recently evaluated in the 2015 South Bay Water Recycling Strategic and Master Plan. The target of this plan is to expand recycled water production from its current county-wide value of 15,000 AFY up to 40,000 AFY by 2025 and 50,000 AFY by 2035. The plan identifies non-potable and potable pathways to achieve this target. This report does not include any provisions for supplying recycled water to users in Morgan Hill. Discussions with the SCVWD have indicated that a future, countywide recycled water master plan will evaluate the potential opportunities for including Morgan Hill recycled water users in the overall recycled water portfolio for the northern portion of the County.

3.6.1 Customer Grouping Summary

The customer rankings documented in Chapter 2 were used to determine the most viable customers to connect to the recycled water system. Based on the rankings, the most economical users in Morgan Hill were those near the south side of Morgan Hill near the proposed scalping plant or the proposed Morgan Hill recycled water transmission main. The total demands the hydraulic analysis were based on 1.0 mgd of recycled water for minimum proposed conditions and 2.25 mgd of recycled water for buildout conditions. These flow projections were based on the volume of existing sewer flows and buildout sewer flows that could be scalped while still providing adequate sewer flows and velocities for the remaining solids to flow to the SCRWA WWTP. Different user groupings or system options were presented for each demand scenario as customer preference, user interest, or connection viability was based on planning level assumptions.

3.6.2 Hydraulic Modeling Analysis of Morgan Hill Alternatives

Alternative 1 and 2 – Hill High Speed Rail or Joint Trunk Sewer Alignment Transmission Mains:

Alternatives 1 and 2 were evaluated together as they are similar in that the recycled water is conveyed from the existing system located in the City of Gilroy, via a new transmission main and pump station. The Morgan Hill recycled water transmission main alternatives are shown on Figure 3.10 and described as follows:

- **Alternative 1:** A 24-inch transmission main begins at the intersection of W. Luchessa Avenue and Monterey Road. From the intersection, the pipeline heads in the north-west direction and parallels the railroad tracks towards Morgan Hill to Maple Avenue. A 1,400 to 5,200 gpm pump station is required in the City of Gilroy and is generally proposed to be near First Street and Monterey Avenue.
- **Alternative 2:** A 24-inch transmission main begins at Luchessa Avenue connecting to the proposed 30-inch main and heading north in the future Cameron Boulevard Road Right-of Way up to Leavesley Road. The alignment jogs north-east to Marcella Avenue and continues north to Las Animas Avenue. The alignment then turns west along Las Animas Avenue and meets the future sewer joint trunk alignment at San Ysidro Avenue. From San Ysidro Avenue the main follows the future joint trunk alignment north-west to Day Road between Santa Teresa Boulevard and Monterey Highway, from there the alignment heads north to Maple Avenue. A 1,400 to 5,200 gpm pump station is required in the City of Gilroy and is generally proposed to be near Gilman Road and the future Cameron Boulevard. This transmission main parallels portions of the existing joint sewer trunk and the intent is to take advantage of the existing easements to Morgan Hill and the possibility of re-purposing the joint sewer trunk if it is decommissioned.

The Morgan Hill recycled water system options for these transmission main alternatives focus on the east side of Morgan Hill and expand from south to north. The recycled water system expansion options for the Morgan Hill alternatives are as follows:

Option 1 (1 mgd) and 3 (2.25 mgd): Option 1 begins with an 18-inch main heading east on Maple from the proposed 24-inch transmission main in Llagas Avenue and connects to the Institute Golf Course as shown in purple on Figure 3.19. Option 3 expands the recycled water system from 1 mgd to 2.25 mgd and includes additional customers along Condit Road as shown in purple on Figure 3.20.

Option 2 (1 mgd) and 4 (2.25 mgd): Option 2 begins with a 24-inch main extending from the proposed 24-inch transmission main in Llagas Avenue to connect customers up to Barrett Avenue as shown in green on Figure 3.19. Option 4 expands the recycled water system from 1 mgd to 2.25 mgd and includes additional customers north along Condit Road and Dunne Avenue up to Cochrane Road as shown in green on Figure 3.20.

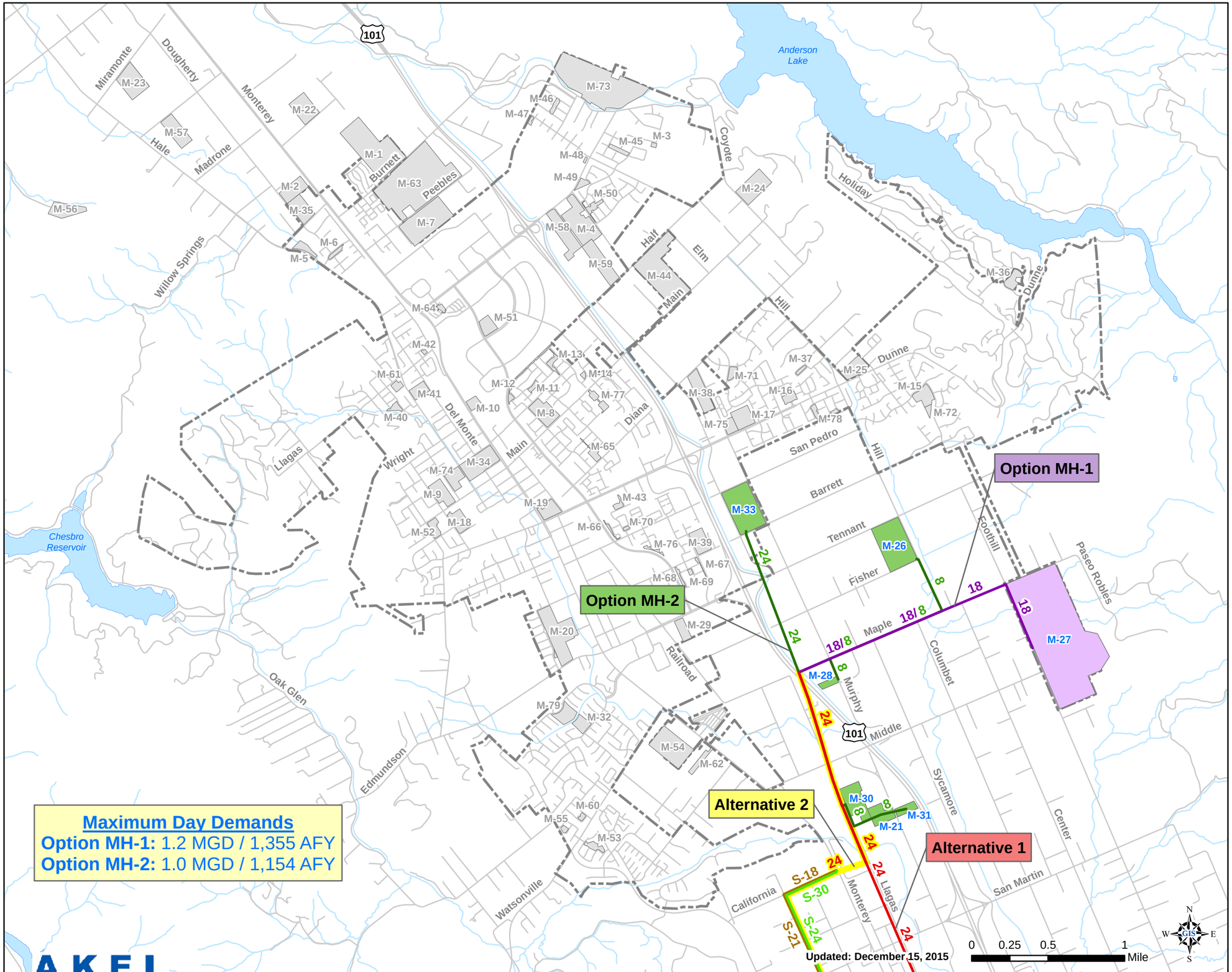
Alternative 3 - Scalping Plant:

This alternative includes the construction of a scalping plant on Maple Avenue near Seymour Avenue. The two proposed options for the scalping plant are to either serve customers on the

east or west side of Highway 101. The potential customer and recycled water system options are similar to Alternative 1 and 2 and are described as follows:

Option 1 (1 mgd) and 7 (2.25 mgd): Option 1 serves customers on the east side of Highway 101 and begins with an 18-inch main heading east on Maple Avenue from the proposed scalping plant and connects to the Institute Golf Course as shown in purple on Figure 3.21. Option 7 expands the recycled water system from 1 mgd to 2.25 mgd and includes additional customers along Condit Road and Dunne Avenue as shown in purple on Figure 3.22.

Option 5 (1 mgd) and 6 (2.25 mgd): Option 5 serves customers on the west side of Highway 101 and begins with an 18-inch main extending north from the proposed scalping plant to connect customers along Butterfield Boulevard up to Main Street as shown in green on Figure 3.21. Option 6 expands the recycled water system from 1 mgd to 2.25 mgd and includes additional customers north along Butterfield Boulevard up to Burnett Avenue as shown in green on Figure 3.22. The demands and potential customers for the Morgan Hill recycled water system options are documented on Table 3.9**.**



Legend

Proposed

- Option MH-1 Alignment
- Option MH-2 Alignment
- Alternative 1
- Alternative 2
- Sewer Relief Trunk
- Sewer Joint Trunk
- Option MH-1 Users
- Option MH-2 Users
- Other Potential Users
- City Limits
- Roads
- Creeks
- Lakes

Figure 3.19
Options MH-1 and MH-2
1 MGD Use
South County Recycled Water System

Santa Clara Valley Water District /
South County Regional Wastewater Authority

Santa Clara Valley Water District

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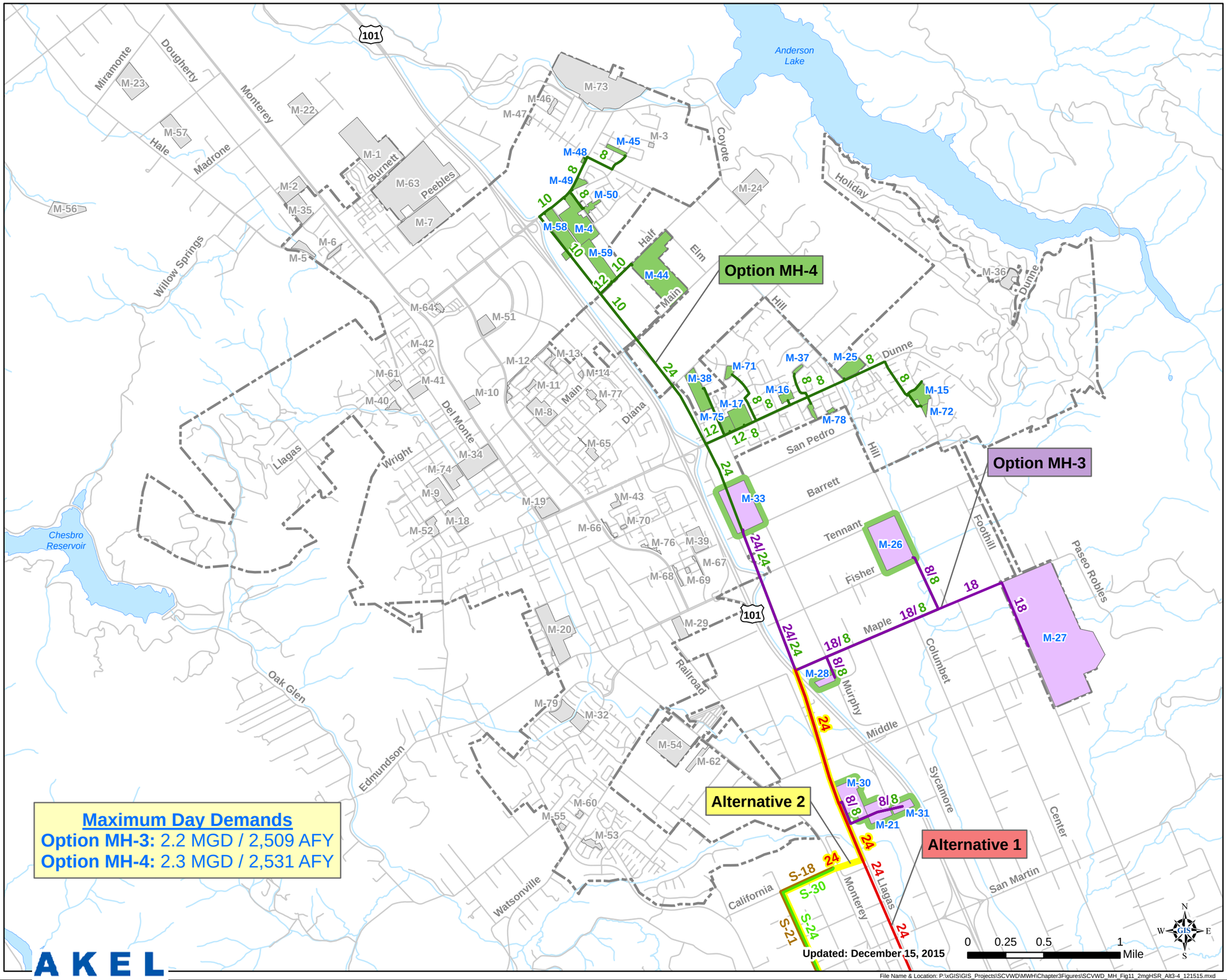

Legend

Proposed

- Option MH-3 Alignment
- Option MH-4 Alignment
- Alternative 1
- Alternative 2
- Sewer Relief Trunk
- Sewer Joint Trunk
- Option MH-3 Users
- Option MH-4 Users
- Opt MH-3 or MH-4 Users
- Other Potential Users
- City Limits
- Roads
- Creeks
- Lakes

Figure 3.20
Options MH-3 and MH-4
2.25 MGD Use
South County Recycled Water System
Santa Clara Valley Water District /
South County Regional Wastewater Authority

Santa Clara Valley Water District

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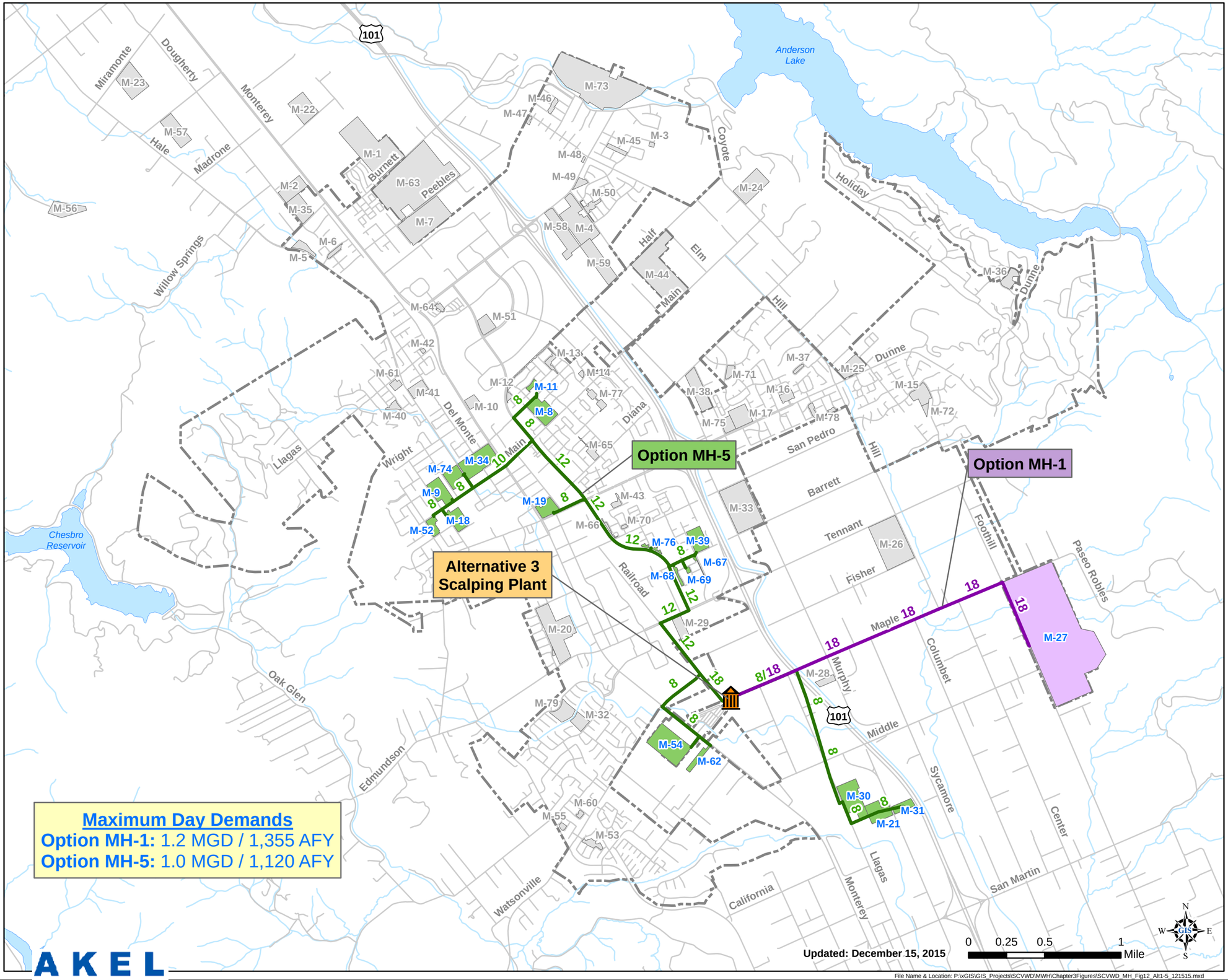

Legend

Proposed

- Alternative 3 Scalping Plant
- Option MH-1 Alignment
- Option MH-5 Alignment
- Option MH-1 Users
- Option MH-5 Users
- Other Potential Users
- City Limits
- Roads
- Creeks
- Lakes

Figure 3.21
Options MH-1 and MH-5
1 MGD Use
South County Recycled Water System

Santa Clara Valley Water District /
South County Regional Wastewater Authority

Santa Clara Valley Water District

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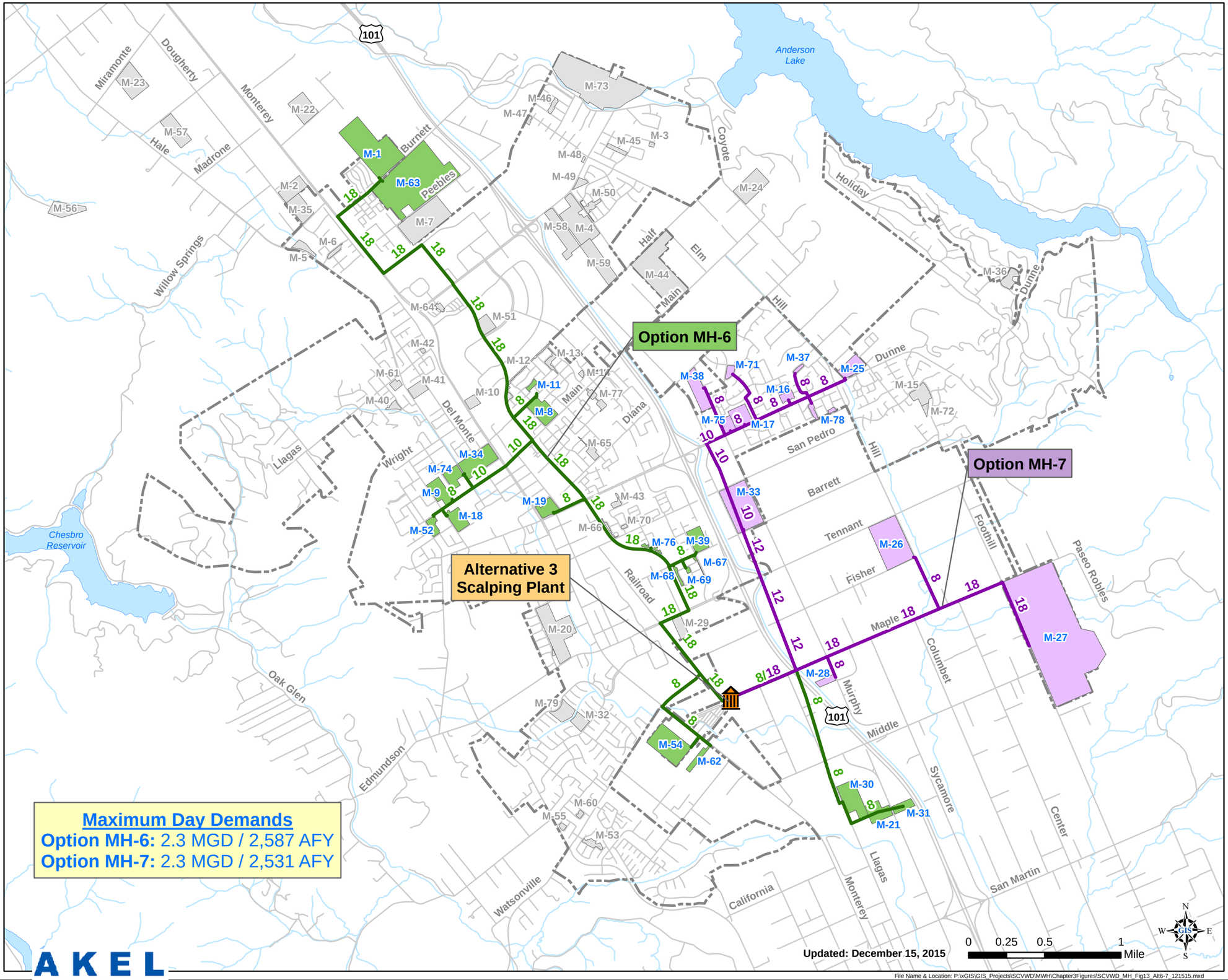

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Proposed

- Alternative 3 Scalping Plant
- Option MH-6 Alignment
- Option MH-7 Alignment
- Option MH-6 Users
- Option MH-7 Users
- Other Potential Users
- City Limits
- Roads
- Creeks
- Lakes

Figure 3.22
Options MH-6 and MH-7
2.25 MGD Use
South County Recycled Water System

Santa Clara Valley Water District /
South County Regional Wastewater Authority

Santa Clara Valley Water District

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Table 3.9 Summary of Demands and Potential Customers used to Determine Infrastructure Sizing for the City of Morgan Hill

Site No.	Site Name		Annual Average (mgd / afy)	Maximum Day Demand (mgd / afy)	Peak Hour Demand (mgd / afy)
Option MH-1[1,2]					
M-27	Institute Golf Course				
		Total	0.4 mgd / 495 afy	1.21 mgd / 1,358 afy	2.91 mgd / 3,260 afy
Option MH-2[1]					
M-21	Nursery		M-30	Greenfield Nursery	
M-26	Kajiko Nursery		M-31	Lakeside Nursery	
M-28	Gabilan Growers		M-33	Morgan Hill Outdoor Sports Center	
		Total	0.3 mgd / 345 afy	1.03 mgd / 1,155 afy	1.23 mgd / 1,381 afy
Option MH-3[1]					
M-27	Institute Golf Course		M-30	Greenfield Nursery	
M-26	Kajiko Nursery		M-31	Lakeside Nursery	
M-21	Nursery		M-33	Morgan Hill Outdoor Sports Center	
M-28	Gabilan Growers				
		Total	0.7 mgd / 840 afy	2.24 mgd / 2,513 afy	4.14 mgd / 4,641 afy
Option MH-4[1]					
M-21	Nursery		M-58	Nursery	
M-26	Kajiko Nursery		M-59	Farm	
M-28	Gabilan Growers		M-15	Jackson Elementary School	
M-30	Greenfield Nursery		M-16	Park	
M-31	Lakeside Nursery		M-17	Nordstrom Elementary School	
M-33	Morgan Hill Outdoor Sports Center		M-25	Hung's Nursery	
M-4	Morgan Hill Orthopedics & Sports Medicine		M-37	Park	
M-44	Live Oak High School		M-38	Nursery	
M-45	Park		M-71	Park	
M-48	Park (Coyote Estates)		M-72	Jackson Park	
M-49	Park		M-75	Nordstrom Park	
M-50	Park		M-78	Park	
		Total	0.7 mgd / 797 afy	2.26 mgd / 2,527 afy	3.4 mgd / 3,805 afy
Option MH-5[2]					
M-11	Park		M-54	Oakwood School	
M-18	St Catherine's School		M-62	Morgan Hill Bible Church	
M-19	Morgan Hill Community and Cultural Center		M-67	Park	
M-21	Nursery		M-68	Park	
M-30	Greenfield Nursery		M-69	Park	
M-31	Lakeside Nursery		M-74	Galvan Park	
M-34	Britton Field (Park)		M-76	Park	
M-39	Barrett Elementary School		M-8	El Toro Elementary School	
M-52	Morgan Hill Library		M-9	PA Walsh Elementary School	
		Total	0.3 mgd / 379 afy	1.0 mgd / 1,125 afy	2.02 mgd / 2,263 afy
Option MH-6[2]					
M-11	Park		M-62	Morgan Hill Bible Church	
M-18	St Catherine's School		M-67	Park	
M-19	Morgan Hill Community and Cultural Center		M-68	Park	
M-21	Nursery		M-69	Park	
M-30	Greenfield Nursery		M-74	Galvan Park	
M-31	Lakeside Nursery		M-76	Park	
M-34	Britton Field (Park)		M-8	El Toro Elementary School	
M-39	Barrett Elementary School		M-9	PA Walsh Elementary School	
M-52	Morgan Hill Library		M-1	Ann Sobrato High School	
M-54	Oakwood School		M-63	Kawahara Nursery Inc	
		Total	0.7 mgd / 816 afy	2.31 mgd / 2,589 afy	3.66 mgd / 4,104 afy
Option MH-7[2]					
M-27	Institute Golf Course		M-33	Morgan Hill Outdoor Sports Center	
M-17	Nordstrom Elementary School		M-37	Park	
M-25	Hung's Nursery		M-38	Nursery	
M-26	Kajiko Nursery		M-71	Park	
M-16	Park		M-75	Nordstrom Park	
M-28	Gabilan Growers		M-78	Park	
		Total	0.8 mgd / 860 afy	2.26 mgd / 2,535 afy	4.41 mgd / 4,935 afy
Conceptual Buildout - Morgan Hill					
All Users					
		Total	2.57 mgd / 2,882 afy	7.9 mgd / 8,848 afy	14.2 mgd / 15,904 afy

Notes:
1. Recycled Water Supplied via Recharge Pipe Line Project
2. Recycled Water Supplied via Scalping Plant

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Key:
MGD = million gallons per day MH = Morgan Hill

3.7 SYSTEM OPERATION

In order to determine the best alternatives to implement in the South County Recycled Water System, the operation of the future system must be considered.

3.7.1 Review of Projected Demands

The projected demands for the baseline projects are shown in Table 3.10 below. The total projected ADDs and MDDs for the Long Term baseline projects are 3.3 mgd and 8.8 mgd, respectively.

Table 3.10 Projected Demands for the Baseline – Long Term Improvements

System	Customers	Average Annual Demand (mgd/afy)	Maximum Day Demand (mgd/afy)	Peak Hour Demand (mgd/afy)
Baseline Long Term Improvements				
North System Users				
E-1	Christmas Hill Park - Ranch	19	Glen Loma Ranch Development	
E-2	Christmas Hill Park - North	63	Sydney Casper City Park	
E-3	Eagle Ridge Golf Course	23	Ascension Solorsano Middle School	
E-5	Calpine Power Plant - Peaker	62	Glen Loma Second Park (Santa Teresa Blvd and Club Dr)	
E-10	Calpine Power Plant - Cogen	18	Meritage Development	
E-6	City of Gilroy - Golf Course	64	City Park (Hecker Pass)	
E-7	City of Gilroy - Sports Park	61	Santa Teresa & Third Street Park	
E-9	McCarthy Business Park	65	City Park (SW corner of Santa Teresa Blvd and 3rd St)	
E-12	City of Gilroy - Shooting Range	2	Gilroy Gardens (formerly Bonafante)	
5	United Natural Food	3	Western Tree Nursery I & II	
1	Cintas Corporation	24	Gilroy High School	
7	Calpine Power Plant - Additional Demand	45	Las Animas Elementary	
69	Gilroy Sports Park Expansion			
	Sub-Total	**2.0 mgd / 2,240 afy**	**5.6 mgd / 6,312 afy**	**7.6 mgd / 8,484 afy**
South System Users				
E-4	SCRWA Farms (Ag Lease) Turnout #1-#6			
	Sub-Total	**0.2 mgd / 224 afy**	**1.6 mgd / 1,763 afy**	**4.1 mgd / 4,550 afy**
WWTP				
E-11	WWTP Utility Water	1.1 mgd / 1,232 afy	1.6 mgd / 1,769 afy	
AKEL ENGINEERING GROUP INC	**Total**	**3.3 mgd / 3,696 afy**	**8.8 mgd / 9,843 afy**	12.1 mgd / 13,499 afy

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Key:
MGD = million gallons per day
SCRWA = South County Regional Wastewater Authority
WWTP = wastewater treatment plant

3.7.1.1 Year-Round Customers

Individual estimated annual average demands for the customers included in the baseline projects that are considered to have year-round usage and consistent high demand are shown in Table 3.11.

Table 3.11 Potential Baseline Long Term Users with Year-round Usage with Consistent High Demand

User	Annual Average Demand (afy)
WWTP Utility Water	1,172
Calpine Power Plant (Peaker)	20
Calpine Power Plant (Cogen)	273
Calpine Power Plant (additional demand)	23
Cintas Corporation	119
Gilroy Gardens	169
Western Tree Nursery I & II	597
Total Year-Round/High Demand User Demand (afy)	**2,373**
Total Baseline Projects (afy)	**4,296**

Key:
afy = acre-feet per year
WWTP = wastewater treatment plant

Year-round customers are important for mitigating seasonal demand peaks and creating smoother operation year-round. For the current Long Term baseline projects, the year round customers make up over half of the total projected average annual demand.

3.7.1.2 Seasonal Customers

The users included in the baseline projects that are considered to have highly seasonal, high demands and their individual respective average annual demands are shown in Table 3.12.

Table 3.12 Potential Baseline Long Term Users with Highly Seasonal with High Demands

User	Annual Average Demand (afy)
SCRWA Farms	151
Total Highly Seasonal/High Demand User Demand (afy)	**151**
Total Baseline Projects (afy)	**4,296**

Key:
afy = acre-feet per year
SCRWA = South County Regional Wastewater Authority

Seasonal customers create high demand peaks in the summer months and have very low demands in the winter months, requiring seasonal operational changes to accommodate for this high variability. For the Long Term baseline projects, it is recommended that the number of users with highly seasonal, high demands be kept low. In the current analysis, the only year round customer that was included in the baseline Long Term scenario was SCRWA Farms in order to keep the MDD below 8.5 mgd. In the existing system, these seasonal customers make up most of the high peaks that put stress on the recycled water system as discussed in Section 3.2.2.1.1.

It is important to note that the users included in the baseline improvements are potential users used in this analysis to size the proposed infrastructure and are subject to change based on available supply (WWTP inflow) and other factors. As discussed in Section 3.5.2, the projected demands documented for the each of the baseline improvements are greater than the current WWTP inflow. New user connections are not based on the completion of the infrastructure but rather reliant upon the inflow at the WWTP.

3.7.1.3 Summary of Projected Demands by Month

The summary of projected demands by month for the baseline Long Term improvements is shown in Table 3.13. Overall, the MDD for the system is 8.5 mgd, which is the current permitted capacity of the SCRWA WWTP. The annual average demand for the baseline Long Term Improvements is 3.3 mgd. Therefore, there is supply available for other uses during the off-peak months. Potential options for use of this additional supply during the low demand season are discussed in Section 3.7.2.1 below.

Table 3.13 Summary of Projected Demands by Month

Project Demands by Month[1]

Off-Peak Months			Peak Months							Off-Peak Months		Maximum Day Demand	Annual Average
January	Feb.	March	April	May	June	July Max Month	August	Sept.	October	Nov.	Dec. Min Month		
1.3 mgd	1.5 mgd	1.6 mgd	2.6 mgd	4.2 mgd	5.9 mgd	7.1 mgd	6.8 mgd	4.0 mgd	2.7 mgd	1.1 mgd	1.0 mgd	8.5 mgd	3.3 mgd
1,413 afy	1,668 afy	1,698 afy	2,868 afy	4,678 afy	6,563 afy	7,898 afy	7,568 afy	4,480 afy	3,029 afy	1,219 afy	1,103 afy	9,520 afy	3,682 afy

Notes:
1. Peaking Factors used for the monthly demands per SCRWA Water Reclamation Facility Order No. 98-052, 2014 Annual report, Table 1: 2014 Reclamation Facility Monthly Averages.

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Key: mgd = million gallons per day

3.7.2 Operating Guidelines

Operational parameters should be identified for both the low demand season and high demand seasons. These operating guidelines are discussed in more detail in the following sections.

3.7.2.1 Low Demand Season

During the low demand season, the recycled water demand is less than production capacity, and there is available supply that can be used elsewhere. Table 3.14 shows the annual average of off-peak supply available for other recycled water uses. Based on the table, the average demand (including the baseline Long Term alternative demands) is approximately 5.2 mgd. Note that this amount assumes that 8.5 mgd (plant permitted capacity) of influent is available for tertiary treatment.

Table 3.14 Potential Available Recycled Water Supply for Other Uses

Available Recycled Water for Other Uses[1]													
Off-Peak Months			Peak Months							Off-Peak Months		Maximum Day Demand	Annual Average
January	Feb.	March	April	May	June	July Max Month	August	Sept.	October	Nov.	Dec. Min Month		
7.2 mgd	7.0 mgd	6.9 mgd	5.9 mgd	4.3 mgd	2.6 mgd	1.4 mgd	1.7 mgd	4.5 mgd	5.8 mgd	7.4 mgd	7.5 mgd	0 mgd	5.2 mgd
8,107 afy	7,852 afy	7,822 afy	6,652 afy	4,842 afy	2,957 afy	1,622 afy	1,952 afy	5,040 afy	6,491 afy	8,301 afy	8,417 afy	0 afy	5,838 afy

Notes:
1. Available amount assumes 8.5 MGD recycled water treatment and includes the Baseline System Customer Demands.

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Key: mgd = million gallons per day

Year-round customer service and recycled water use could be accomplished by adding more users that have recycled water demand year-round to use the excess capacity as discussed in Section 3.7.1.1 above. Other potential uses of excess recycled water capacity include the following:

- **Percolation Ponds:** This is the existing arrangement of the SCRWA WWTP. All secondary treated effluent that is in excess of recycled water demand is sent to the on-site SCRWA percolation ponds. While this remains a viable disposal method of excess treated wastewater, there are other potential uses of this supply.
- **IPR:** Recycled water subjected to advanced treatment can potentially be supplied to underground aquifers to augment groundwater that is used as a drinking water source. Additional treatment will be required to achieve compliance with Title 22 regulations and to meet District Basin Management Objectives. This option could allow the District to take advantage of surplus recycled water capacity from the SCRWA WWTP when the demand for recycled water is low, provided there is adequate basin capacity to accept additional recharge and there are no geochemical compatibility issues. Due to the high density of water supply wells in South County, additional evaluation would also be needed to assess whether state requirements for underground retention time could be met considering the location of existing water supply wells. Further study would be needed to evaluate the feasibility of indirect potable reuse.
- **DPR:** While current recycled water regulations do not allow DPR, this may become a viable option in the future. DPR would also require additional treatment in order to be used as a raw water supply for a drinking water treatment plant. If DPR becomes a viable option, then one option is to supply advanced treated water to the Santa Clara Conduit which is close to the SCRWA WWTP and allows for the use of existing water infrastructure.

Options for implementing IPR or DPR along with RO concentrate disposal options associate with IPR and DPR are discussed in more detail in Section 3.8.

3.7.2.2 High Demand Season

During the high demand season, there are two possible scenarios:

1. Demand less than production capacity
2. Demand higher than production capacity

For scenario 1, the potential uses of excess recycled water capacity discussed in Section 3.7.2.1 can be considered. In scenario 2, operational adjustments to accommodate for or minimize high demands should be implemented. Options for controlling high recycled water demand periods include the following:

- **Schedule Customers:** One option for controlling recycled water peak demands is to develop a schedule for users to spread out demands over a 24 hour period.
- **Prioritization of Customers:** In moving forward, certain users can be prioritized (i.e. year-round customers) in order to smooth out demand peaks in the future.
- **Optimization of Storage:** Operational adjustments to the reservoirs can be implemented in order to optimize use of available reservoir volume and schedule reservoirs to fill during off-peak demand periods.
- **Limitation of Flow Rates:** Another potential option is to reduce supply to selected users during periods of high demand. Existing usage is measured through service meters that are manually read on a monthly basis and do not track hourly usage. Implementation of a meter replacement program with remotely monitored meters could support implementation of this option. This would need to be done in combination with remotely controlled valves. If supply is reduced to selected users, it should be to any users that can reduce recycled water during the peak demand periods. Furthermore, a program and process would need to be established to inform customers of the possibility to participate in the potential limitation of flow rates, on an as-needed basis, and enable a clear means of communication between the customer and system operations to implement the system changes.

3.8 EVALUATION OF EMERGING TECHNOLOGIES AND SUSTAINABILITY

There is increasing interest in expanding the use of recycled water from non-potable to potable applications. Advanced treatment technologies such as AOP and RO have made it possible to treat reclaimed water to drinking water quality standards. Potable reuse of recycled water is classified as either IPR or DPR. IPR has an environmental buffer between the recycled water source and the users. DPR is the practice of putting highly treated recycled water directly into a potable distribution system or raw potable water source without an environmental buffer. In California, regulations only exist for indirect potable reuse projects that utilize an underground aquifer as the environmental buffer. A detailed evaluation of IPR/DPR is presented in Appendix E.

3.8.1 Groundwater Recharge via Existing Recharge Basins

Recycled water subjected to advanced treatment could potentially be supplied to underground aquifers to augment groundwater that is used as a drinking water source. This practice is

categorized as IPR. The underlying aquifer serves as a natural storage reservoir. Storing recycled water in an aquifer could allow the District to take advantage of surplus recycled water capacity from the SCRWA WWTP when the demand for recycled water is low, provided there is adequate basin capacity to accept additional recharge and there are no geochemical compatibility issues. Due to the high density of water supply wells in South County, additional evaluation would also be needed to assess whether state requirements for underground retention time could be met considering the location of existing water supply wells. Further study would be needed to evaluate the feasibility of indirect potable reuse.

Recycled water subjected to advanced treatment could be delivered to the aquifer in two ways. It can be spread across the land surface and allowed to percolate through the ground to the aquifer. This method, referred to as surface spreading, works only when the ground beneath the spreading pond is permeable enough to allow water to percolate through to the aquifer at a reasonable rate and when there is a sufficient distance between ground surface and the water table. Secondly, water can be injected into the groundwater using pressurized injection wells. This technique can be utilized when surface soil properties are not compatible with surface spreading or there is not a suitable site for a percolation pond. Injection wells require highly permeable aquifer formations at depth, which must be confirmed for each site.

Groundwater recharge with recycled water could enable the utilization of recycled water during the low demand season. As noted previously, this would depend on the capacity of the basin to accept additional recharge, determination that there are no geochemical compatibility issues, and evaluation of underground retention times in regard to nearby water supply wells. Table 3.14 shows that most of the surplus recycled water, after current demands are met, is available during these low-demand months. Recycled water could be diverted to the groundwater basins during these periods and then extracted when water demands increase. Water supply system modeling and groundwater modeling would need to evaluate IPR feasibility since the District conducts a comprehensive managed recharge program using local and imported water supplies, which are prioritized for recharge due to lower costs.

Groundwater recharge projects in California are regulated by Article 5.1 of the Title 22 recycled water regulations. These rules require a combination of engineered treatment processes and detention time in the aquifer to provide a specific level of pathogen removal. The level of treatment required increases as the distance between the location of recycled water application and the nearest down-gradient well decreases. Additionally, the water used for recharge should not degrade the quality of the existing groundwater. Due to the high groundwater quality of the aquifer in the South County, implementation of IPR would likely require the use of highly purified recycled water which meets or exceeds Title 22 regulations.

Title 22 regulations and existing groundwater quality should both be considered when selecting the level of additional treatment required for a groundwater recharge project. Typical IPR treatment trains include MF, UF, RO, and AOP.

Figure 3.23 presents potential recharge opportunities in the South Santa Clara County. The recharge ponds shown in this figure are currently used by the District to recharge aquifers with local and/or imported surface water. Recycled water could be transported to the recharge ponds

via the alternatives presented in section 3.6.2 and blended with surface water. Recycled water could potentially be supplied to these existing recharge ponds in addition to local and/or imported surface water, however, this would need to be evaluated further with water supply system modeling, which prioritizes the use of lower-cost local and imported surface water.

A recent high-level assessment by TODD Groundwater (Appendix G) found no suitable locations in the Llagas Subbasin for IPR due to the density of potable supply wells and the response retention time and pathogen reduction times required by the Title 22 recycled water regulations. A calibrated groundwater model could potentially reduce the required retention time and allow for IPR in the far northwest and northeast corners of the basin near Morgan Hill and in the southern portion of the subbasin. If no suitable locations are found, this option may necessitate taking supply wells offline and provide a replacement supply to the users who relied on those wells.

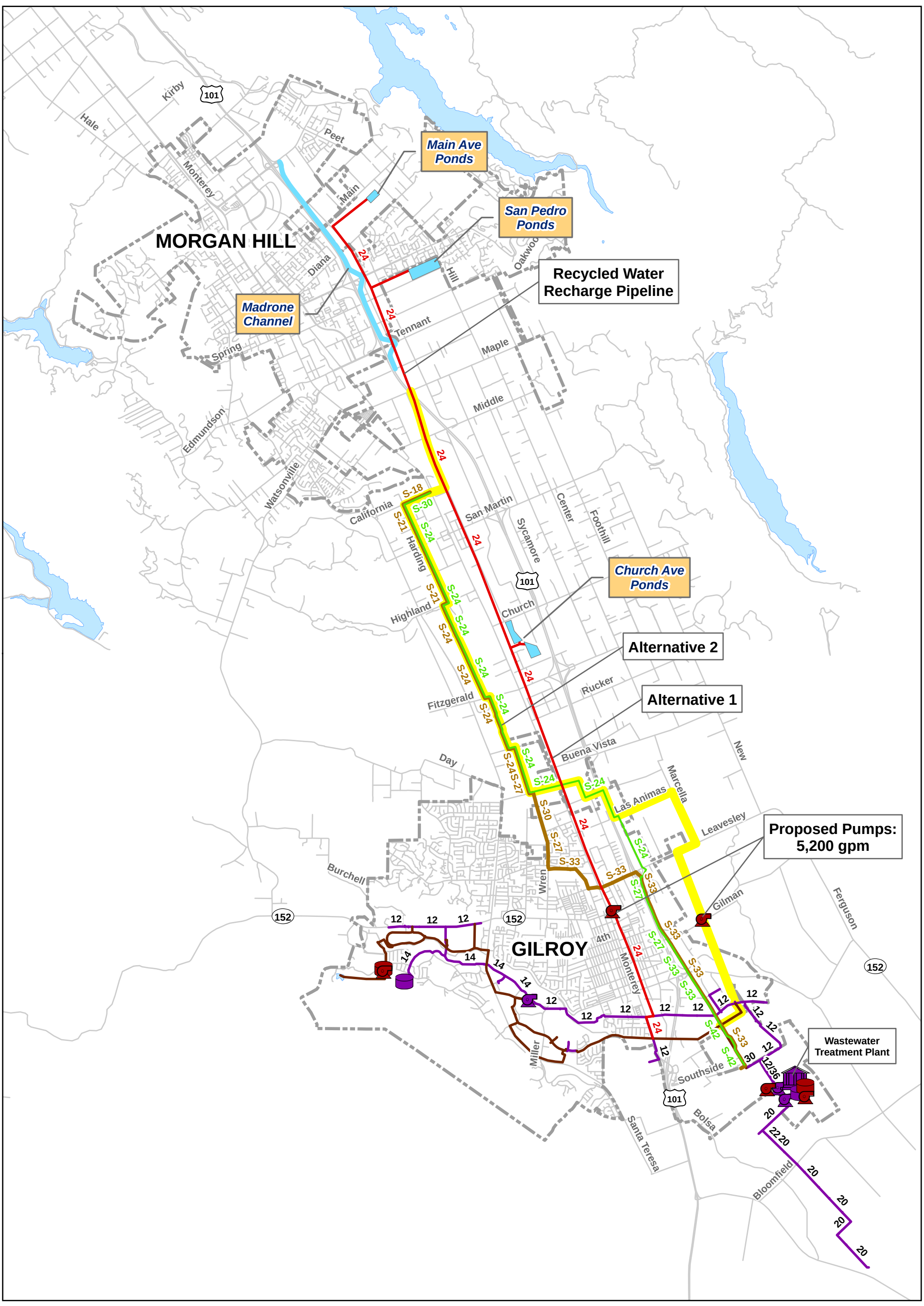

Figure 3.23
Potential Recharge Opportunities

South County Recycled Water System

Santa Clara Valley Water District /
South County Regional Wastewater Authority

Santa Clara Valley Water District

AKEL ENGINEERING GROUP, INC.

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3.8.2 Direct Potable Recharge via Santa Clara Conduit

DPR replaces the environmental buffer, such as an underground aquifer, with an engineered buffer. Regulations do not currently exist for DPR projects in California; however, they are currently under development. After regulations are adopted by the DDW, the District could implement a DPR alternative. DPR is an attractive potable-reuse alternative because it eliminates some of the challenges associated with groundwater recharge, such as percolation pond siting and pumping requirements.

The San Felipe Division Project is part of the U.S. Department of the Interior, Bureau of Reclamation's (Reclamation) Central Valley Project. It delivers water from the San Luis Reservoir to agricultural, industrial, and municipal users in Santa Clara County as shown in Figure 3.24. Water from the Santa Clara Conduit can be put into Anderson Reservoir or Colero Reservoir for storage, released for recharge, diverted to raw water customers, or sent to the Coyote Pumping Plant before being introduced to potable water treatment facilities.

The Santa Clara Conduit is in close proximity to the SCRWA WWTP. Upon the adoption of DPR regulations, a DPR project that diverts tertiary effluent to new advanced water treatment facility, then to the Santa Clara Conduit could be considered. Recycled water diverted to the Santa Clara Conduit would blend with surface water from the Central Valley Project and supplement potable water supplies.

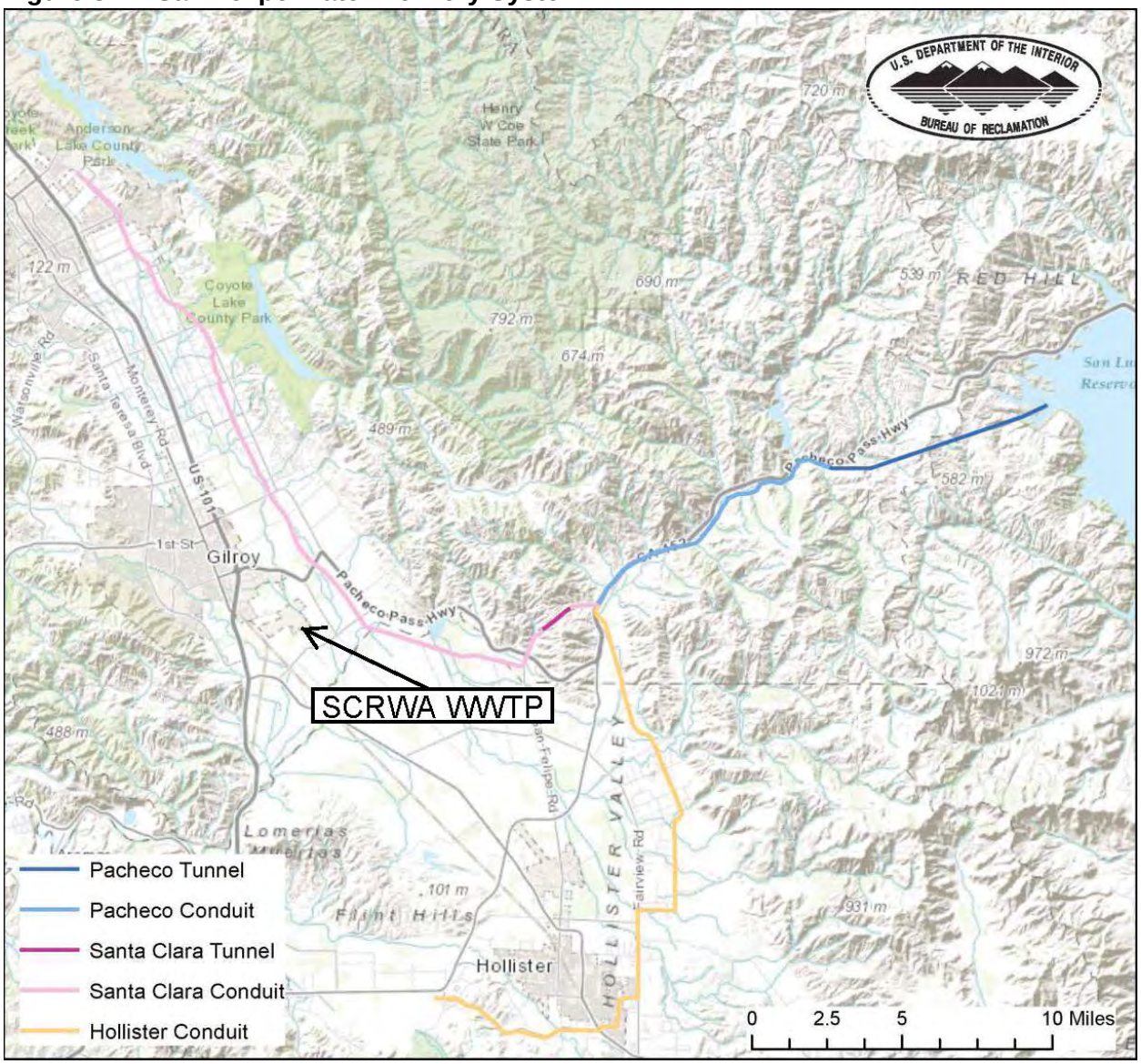
3.8.3 Reverse Osmosis Concentrate Management

RO treatment processes produce a high salinity waste stream referred to as RO concentrate. If not handled appropriately, RO concentrate can cause damage to aquatic ecosystems, degrade water quality, or contribute to the build-up of salts in the aquifer. Special accommodations need to be made to dispose of RO concentrate without causing unacceptable levels of harm to the environment. There is an ongoing effort to develop regional solutions to RO concentrate management in the South Bay region.

The City of San Jose partnered with the District to lead the preparation of the South Bay Water Recycling (SBWR) Strategic and Master Plan. That report was published in December of 2014 and identifies a number of strategies for increasing the use of recycled water in the South Bay. The SBWR Strategic and Master Plan considers multiple RO concentrate disposal alternatives but ultimately recommends returning RO concentrate to the San Jose/Santa Clara Regional Wastewater Facility via existing sewers or discharging RO concentrate directly to the bay via a new outfall to the South Bay at a location south of the Dumbarton Bridge.

More recently, a March 2015 workshop sponsored by SCVWD brought together District staff, consultants, and other stakeholders to prioritize the most feasible alternatives for RO concentrate management, and to establish action items necessary for their implementation. Table 3.15 presents the preferred RO concentrate management alternatives from this workshop. Given the remoteness of the SCRWA WWTP from San Jose, it is unlikely that any of the disposal options would be suitable for RO concentrate disposal, and other options would need to be evaluated (e.g., a pipeline to the Watsonville WWTP outfall to the ocean or a zero liquid discharge system).

Figure 3.24 San Felipe Water Delivery System



Source: 2013 Draining and Inspection of the Pacheco and Santa Clara Tunnels dated November 2013 by the U.S. Department of the Interior, Bureau of Reclamation South-Central California Area Office.

Table 3.15 RO Concentrate Management Alternatives[1]

Disposal Option [2]	Disposal Method	Regional Comments
3	Existing regional deep water outfalls (SVCW or EBDA)	A regional solution using the existing SVCW or EBDA deep water outfalls are potentially feasible. New concentrate pipelines would be needed to connect the ASPFs to the deep water outfalls.
4	Existing regional shallow water outfalls (Combination of Palo Alto, Sunnyvale, and RWF)	Each of the three south Bay outfalls could be used to accommodate an amount of RO concentrated disposal through blending with effluent. However, NPDES permit limitations and toxicity testing may limit the extent of this disposal strategy.
5	New Outfall north of Dumbarton Bridge	This option could be a regional concentrate disposal solution. New concentrate pipelines would be needed to connect the AWPFs to the outfall.
6	New south Bay outfall (to Coyote Point)	This option could be a regional concentrate disposal solution. New concentrate pipelines would be needed to connect the AWPFs to the outfall.
8	Engineered brine wetlands	This option was not carried forward as a potential option in Appendix 6D of the South Bay Water Recycling Master Plan, but could be a potentially feasible regional disposal option. This option could be combined with another disposal option where the engineered wetlands are used to treat the RO concentrate prior to disposal via existing outfalls or a new south SF Bay outfall.
12	Brine conditioning	Treatment strategies could be employed to remove NPDES permit and toxicity-causing constituents from the RO concentrate prior to discharge. Ongoing testing at the SVAWPC and other facilities could ultimately identify the cause of toxicity and provide the basis to identify appropriate conditioning technologies.

Key:

AWPF = advanced water purification facilities
EBDA = East Bay Discharge Authority
NPDES = National Pollutant Discharge Elimination System
RO = reverse osmosis
RWF = Wastewater Facility
SF = San Francisco
SVAWPC = Silicon Valley Advanced Water Purification Center
SVCW = Silicon Valley Clean Water

Notes:

[1] Alternatives table from SCVWD RO Concentrate Workshop on March 9, 2015.
[2] Alternative numbering from SBWR Strategic and Master Plan (December 2014).

3.9 KEY FINDINGS FROM ALTERNATIVES EVALUATION

As discussed in in Section 1.1, the development of the District's recycled water program is guided by the CEO Interpretation of the District Board's Governance Policies. These interpretations include that at least 22,000 acre-feet per year of non-potable recycled water use is sustained. Overall, the District's total water usage in Santa Clara County in calendar year 2014 was 334,600 afy, and the total recycled water use was 22,100 afy (6.6% of total water usage)[17]. Based on the CEO Interpretation of the Ends policies, this recycled water usage should be sustained along with progress towards meeting 2020 and 2025 potable reuse amounts.

Recommendations for proposed capital improvements are based on expanding non-potable recycled water use in South County. Key findings from the evaluations of the preliminary alignments, system operations, and potential customer rankings in Chapter 2 are described below.

3.9.1 City of Gilroy

The First Street, High Speed Rail, and Cameron Boulevard alignments for Gilroy were not selected for implementation as these alternatives do not present enough benefit for expansion due to small water demands and the high cost of infrastructure that would be required.

3.9.2 City of Morgan Hill

The MH High Speed Rail Transmission Main and Joint Trunk Transmission Main alignments for Morgan Hill were not selected for implementation as these alternatives do not present enough benefit for expansion due to small water demands and the high cost of infrastructure that would be required. A transmission main alternative may be feasible in the future, if additional strategies could be developed and implemented to support IPR alternatives improving the cost/benefit ratio, discussed in more detail below, within the vicinity of the City of Morgan Hill. Other factors including water supply policies and governance may also improve the feasibility of this alternative in the future.

While preliminary estimate indicate a scalping plant alternative presents a lower cost per acre-foot of water delivered than a Gilroy/Morgan Hill transmission main alternative, the scalping plant alternative does not present enough benefit for expansion due to small water demands and the high cost of infrastructure that would be required. Based on sanitary flow projections, this alternative is also limited to a maximum potential capacity of 2.5 mgd within the projected 20 year planning horizon.

[17] Information based on the SCVWD Protection and Augmentation of Water Supplies Annual Report, dated February 2015.

3.9.3 System Operation

Operational parameters have been identified for both the low demand season and high demand seasons. During the low and high demand season, when the recycled water demand is less than production capacity, there is available supply that can be used for other non-potable uses or for emerging technologies like IPR and DPR. During the high demand season, when recycled water demand is higher than production capacity, options for controlling high demand must be considered. Options for controlling high demand include: scheduling customers, prioritization of customers, optimization of storage, and limitation of flow rates.

3.9.4 Emerging Technologies/IPR and DPR

The benefits of an IPR option could include the potential to maximize use of excess recycled water during low demand periods, recharge the Llagas Subasin and provide benefit to all members of the communities served by the subbasin, minimal points of connection to operate and maintain. A significant impediment to IPR is the large number and density of potable water supply wells in the subbasin. The number and location of potable water supply wells limits locations where IPR facilities can be sited rendering this option as infeasible at this time based on a screening-level assessment. An IPR option may be feasible in the future, if additional strategies could be developed and implemented to reduce the number and location of existing potable water supply wells by connecting users to municipal supply systems and preventing new wells from being drilled within a set zone near IPR project sites.

While the Santa Clara Conduit is in close proximity to the SCRWA WWTP and recycled water system in South County, and could provide a potential DPR option, additional research, studies, and development of regulations would be required for this potential option to be considered.

3.9.5 Recommendations

The key findings from evaluation of the preliminary alignments, the potential customer rankings in Chapter 2, and input from SCRWA, the District, and the Cities of Gilroy and Morgan Hill resulted in the recommendation to select the Baseline plus the Lake Kathryne alignment for implementation. This 2015 Baseline plus Lake Kathryne alignment is an update to the 2004 Master Plan proposed Baseline Alternative and includes revised alignments through the Glen Loma Development and Hecker Pass based on updates to the land development plan. In addition, planned improvements at the SCRWA WWTP to support the recycled water system and implementation of the Baseline plus Lake Kathryne alignments, including expansion of the on-site recycled water reservoir and expansion of existing pump stations, is recommended. These recommendations will mitigate the existing system deficiencies, improve system reliability, support existing users, and allow system expansion for new potential customers to connect while minimizing investment in infrastructure at a cost of $2,893 per acre-foot of recycled water delivered.

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Chapter 4

Recommended Capital Improvement Program

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4 RECOMMENDED CAPITAL IMPROVEMENT PROGRAM

4.1 FINAL SELECTION OF CUSTOMERS AND CAPITAL IMPROVEMENTS

The purpose of this chapter is to provide a summary of updates to the recommended recycled water system improvements and CIP for the South County Recycled Water System. In addition, this chapter provides cost estimates for CIP planning purposes. This chapter primarily focuses on the recommended recycled water distribution system improvements to mitigate existing capacity deficiencies, to improve system reliability, and to accommodate future system expansion. General information pertaining to planned improvement projects at the SCRWA WWTP in relation to recycled water treatment facilities and their estimated costs are included, but overall upgrades or expansion of the recycled water treatment facilities located at the SCRWA WWTP are being conducted as a separate planning effort.

This chapter also includes discussion of funding options, implementation factors and public outreach, and identification of CEQA documentation requirements. The relation of the improvements identified in this section to existing CEQA documentation is included in Section 4.9.

4.1.1 Capital Improvement Program Alternatives Selection

Based on the evaluation of the preliminary alignments presented in Section 3.4, the potential customer rankings in Chapter 2, and with input from SCRWA, the District, and the City of Gilroy, the Baseline plus the Lake Kathryne Alignment alternative was the selected alternative for the recommended CIP. This selected 2015 Baseline plus Lake Kathryne alignment is an update to the 2004 Master Plan proposed Baseline Alternative and includes revised alignments through Glen Loma and Hecker Pass based on updates to the land development plan. This selected alternative will mitigate the existing system deficiencies and allow system expansion for existing customers and new potential customers to connect as inflow and treatment capacity at the WWTP permit.

The calibrated hydraulic model was used for evaluating the distribution system for capacity deficiencies during both peak hour demand (PHD) and maximum day demand (MDD). As the hydraulic model was calibrated for extended period simulations, the analysis duration was established at 24 hours. The results of the evaluation as documented in Chapter 3 were used to develop the CIP for each improvement scenario.

The CIP for the selected 2015 Baseline plus Lake Kathryne alignment (updated from the 2004 Master Plan) is divided into the following improvement scenarios:

- **Baseline Immediate Term:** These immediate term improvements include the planned pipelines in the Meritage and Glen Loma developments, currently under construction, planned pipeline upgrades to the WWTP and distribution system connection, and pipeline expansion between the WWTP and Uvas Creek. These projects are required to mitigate the low pressures in Pressure Zone 1 and at the Pressure Zone 2 pump station, and relieve high headlosses in the existing system.

- **Baseline Short Term:** These short term improvements include the remaining planned Glen Loma and Meritage Development system pipelines, expansion of the system between Uvas Creek and Hecker Pass, and planned to expand recycled water storage and pump station capacities at the SCRWA WWTP. These improvements mitigate the remaining deficiencies in Pressure Zone 1 and improve system reliability.

- **Baseline Long Term (Lake Kathryne):** This long term scenario includes the pipelines, tank, and pump station for connecting to Lake Kathryne along with a proposed recycled water fill station center for residential and commercial users.

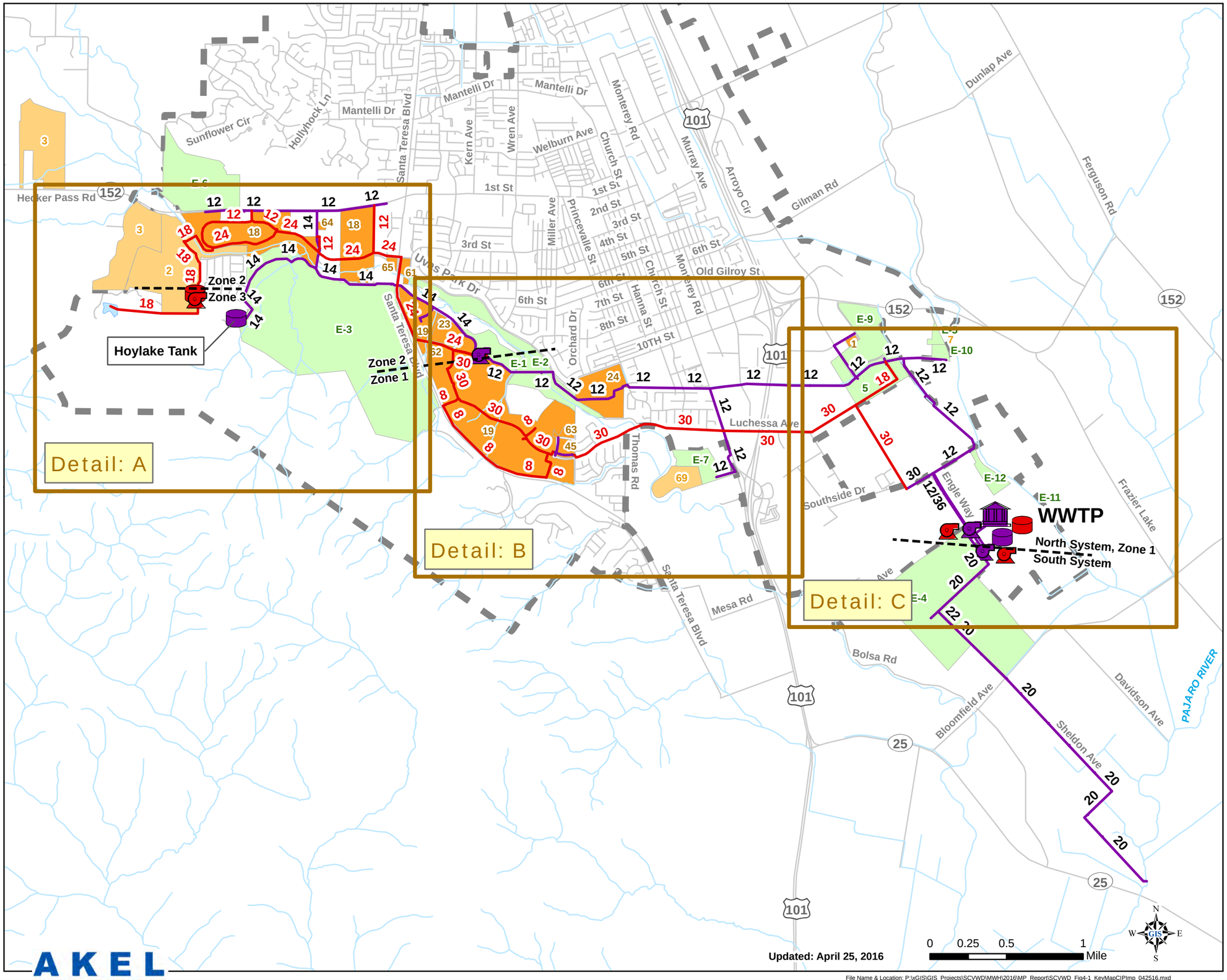
Details on the selected CIP alternative and the division of the CIP into the above improvement scenarios is discussed in the following sections.

4.2 RECYCLED WATER TRANSMISSION/DISTRIBUTION SYSTEM

This section provides a summary of the recommended recycled water distribution system improvements to mitigate existing capacity deficiencies and to accommodate future system expansion. The recommended improvements are shown on Figure 4.1 and summarized on Table 4.1. Figure 4.1 is also a key map for system details shown in Figures 4.2, 4.3, and 4.4. The improvements recommended in this 2015 Master Plan Update are intended to support and refine the 2004 Master Plan CIP and reflect current conditions which include recent pipeline construction, updated pipeline alignments, updated demand projections, and cost estimates.

4.2.1 Pipelines

The proposed pipelines, shown on Figure 4.1, are similar to the 2004 Master Plan baseline scenario and reflect revised alignments based on new planning information for the Glen Loma and Meritage Developments. The proposed pipeline begins with a new 30-inch main which connects to the recently constructed Phase 1A 30-inch main in Southside Drive. This main continues north to Luchessa Avenue and tees into a proposed 30-inch to the west and a proposed 18-inch to the east that jogs north to the Princevalle Drain at Cameron Boulevard and connects to the existing 12-inch pipeline. The 30-inch main heading west continues across Monterey Road and connects to the existing 16-inch main that begins at Greenfield Drive. The existing 16-inch runs from Greenfield Drive to Tenth Street in Luchessa Avenue where the proposed 30-inch main then re-connects and continues west to the to the intake of Zone 2 Christmas Hill Pump Station. Due to severe construction limitations as reported by the City of Gilroy's current pipeline consultant in 2015, the existing 16-inch main in Luchessa Avenue from Greenfield Drive to Tenth Street is to be left in place and not replaced with a matching 30-inch main. From the Zone 2 Christmas Hill Pump Station, a 24-inch discharge main begins heading south west through the Glen Loma Development, then turning north west along Santa Teresa Boulevard to the Third Street intersection. The 24-inch then continues through the Meritage Development along 3rd Street with 12-inch mains connecting to the existing 12-inch pipe in Hecker Pass Highway. Finally the Lake Kathryne pipeline extends from the west side of the Meritage Development with an 18-inch pipe and connects to Lake Kathryne.



Legend

Proposed

- Storage Tanks
- Booster Stations
- Proposed Pipe

Existing

- WWTP
- Storage Tanks
- Booster Stations
- Recycled Water Pipelines
- Pressure Zone Line
- Existing Users
- In-Progress Users
- Baseline Users
- City Limits
- Roads
- Creeks
- Lake

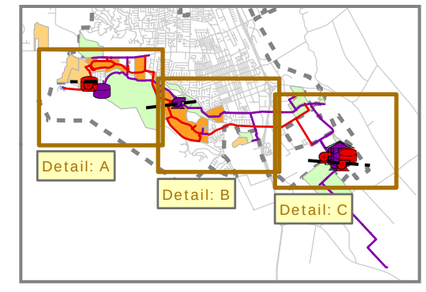


Figure 4.1 - Key Map
CIP Facility Locations

South County Recycled Water System

Santa Clara Valley Water District /
South County Regional Wastewater Authority

Santa Clara Valley Water District

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File Name & Location: P:\xGIS\GIS_Projects\SCVWD\MWH\2016\MP_Report\SCVWD_Fig4-1_KeyMapCIPImp_042516.mxd

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Table 4.1 Summary of Recommended CIP Recommended Improvements

Capital Improvement Program	Demands			Distribution System Improvement Summary
	Average Day (MGD)	Maximum Month (MGD)	Maximum Day (MGD)	
Existing	2.2 mgd / 2,464 afy	3.8 mgd / 4,256 afy	5.2 mgd / 5,830 afy	-
Immediate - Term	2.9 mgd / 3,248 afy	5.1 mgd / 5,712 afy	7.7 mgd / 8,606 afy	**Distribution System Improvements:** • 14,840 feet of 30-inch diameter pipeline • 4,130 feet of 24-inch diameter pipeline • 2,430 feet of 18-inch diameter pipeline • 3,650 feet of 12-inch diameter pipeline • 1,550 feet of 8-inch diameter pipeline **Planned WWTP Recycled Water Projects:** • Area 94 (South) Recycled Water Pump Station Upgrade • UV Treatment Facility (9 MGD)
Short - Term	3.0 mgd / 3,360 afy	5.6 mgd / 6,272 afy	8.5 mgd / 9,492 afy	**Distribution System Improvements:** • 5,810 feet of 30-inch diameter pipeline • 8,150 feet of 24-inch diameter pipeline • 2,630 feet of 12-inch diameter pipeline • 5,270 feet of 8-inch diameter pipeline **Planned WWTP Recycled Water Projects:** • Area 93 (North) Recycled Water Pump Station Upgrade • Reservoir Expansion (Additional 6 MG) • Chlorine Contact Basin and Reservoir Return Pump Station Upgrade • Automated Flow Measurement and Smart Meter Conversion (proposed wholesaler/retailer improvement)
Long - Term	3.3 mgd / 3,696 afy	6.2 mgd / 6,944 afy	8.8 mgd / 9,843 afy	**Distribution System Improvements:** • 7,010 feet of 18-inch diameter pipeline • New 1.5 MG Zone 2 Tank • New 1,500 gpm Zone 3 Pump Station **Planned WWTP Recycled Water Projects:** • SCRWA WWTP Expansion Project, MBR (up to 2.5 MGD) • Recycled Water Fill Station

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4/26/2016

Key:

gpm = gallons per minute
MBR = membrane bioreactor
MG = million gallon
MGD = million gallons per day
SCRWA = South County Regional Wastewater Authority
UV = ultraviolet

The total pipeline improvements summarized on Table 4.1 include:

- 20,650 feet of 30-inch pipeline
- 12,280 feet of 24-inch pipeline
- 9,440 feet of 18-inch pipeline
- 6,280 feet of 12-inch pipeline
- 6,820 feet of 8-inch pipeline

These improvements will mitigate the existing pipeline system deficiencies, improve reliability, and provide capacity for future customers.

4.2.2 Pump Stations

For the purpose of this study, the pump stations are:

- Sized to convey MDD, if operational storage is available;
- Sized to convey PHD, if no operational storage is available, including the tributary higher zone demands.

It should be noted that the pump station firm capacity excludes the capacity of the standby pump. The total number and exact capacity of pumps should be determined during the design phase, as long as the firm capacity and standby criteria are met.

In the North system, the existing Area 93 pump station (Zone 1) is comprised of three pumps each with a variable frequency drive that provides up to 1,200 gpm. Thus, the total existing capacity is 3,600 gpm and the firm capacity is 2,400 gpm. Similar to the 2004 Master Plan, this pump station requires expansion up to a firm capacity of 5,200 gpm plus provisions for standby capacity for the future growth.

The existing Zone 2 pump station in the North Zone is also comprised of three pumps, each with a variable frequency drive that provides up to 1,375 gpm. Thus, the total existing capacity is 4,125 gpm and the firm capacity is 2,750 gpm. This pump station does not require capacity expansions for the future growth in Zone 2.

A new Zone 3 pump station located west of the Meritage Development near Gilroy Gardens is required to connect the recycled water system to Lake Kathryne. The new pump station will have a firm capacity of 1,500 gpm plus provisions for standby.

In the South system, the Area 94 pump station (Zone 1) is comprised of two pumps each with a variable frequency drive that provides up to 2,100 gpm. Thus, the total existing capacity is 4,200 gpm and the firm capacity is 2,100 gpm. This pump station requires a capacity expansion as there is currently no provision for standby. SCRWA is currently constructing a new 2,100 gpm pump station identical to the existing pumps to increase the total capacity to capacity to 6,300 gpm and a firm capacity to 4,200 gpm, thus increasing the reliability of this pump station for existing and future demands. This pump station has two operation scenarios: (1) a high head scenario to serve the recycled water customers, and (2) a low head scenario for WWTP effluent discharges to the Pajaro River. This 2015 Master Plan Update only includes a study of the

requirements of this pump station as they relate to the high head scenario to serve recycled water customers.

4.2.3 Storage

Storage reservoirs are needed for operational and emergency storage in the recycled water system. The existing system currently maintains 1.5 MG of elevated storage which allows for four hours of emergency MDD storage. A new 1.5 MG storage reservoir in Zone 2 is proposed to provide added capacity for peak demands and for operational storage to aid the operation of the new pump station and large user demands to the west of Gilroy. This new tank also increases the emergency storage to 8 hours in case of pump station or WWTP shutdown emergencies. This tank should maintain the same HGL of the existing Hoylake Tank in Zone 2 and be sited on the west side of the Meritage Development near Gilroy Gardens. Appendix F includes an evaluation of the recycled water system reliability that addresses the current system reliability and proposes options to increase the reliability of the recycled water system.

4.3 PLANNED IMPROVEMENTS AT SCRWA WWTP

As discussed in Chapter 3, the recycled water that can be distributed to customers within the South County System is limited by the amount that is able to be produced at the SCRWA WWTP. There are various upgrades that are being considered as a parallel effort to improve the production capacity and reliability at the SCRWA WWTP.

The recycled water projects that are currently being constructed or considered at the SCRWA WWTP include:

- UV Treatment Facility (9 mgd)
- Chlorine Contact Basin and Reservoir Return Pump Station Upgrade
- SCRWA WWTP Reservoir Expansion (additional 6 MG)
- Recycled Water Fill Station
- SCRWA WWTP Proposed MBR Expansion Project[18] (2.5 mgd expansion[19])

These improvements at the SCRWA WWTP are included in the alternatives for planning and CIP purposes, but more detailed analyses around these improvements are being conducted as a separate effort. More information on the capital improvement projects planned at the SCRWA

[18] The MBR Expansion Project was not evaluated as a part of this Recycled Water Master Plan, but was a recommended project in the SCRWA Capital Improvements Strategic Plan, dated October 2011. For additional information on the SCRWA Capital Improvements Strategic Plan and subsequent version, contact the South County Regional Wastewater Authority (http://www.ci.gilroy.ca.us/561/South-County-Regional-Wastewater-Authori or 408-846-0202).

[19] The MBR expansion project will provide additional secondary treatment capacity and may also increase the tertiary treatment capacity if the chlorine contact basin and new UV disinfection facilities are operated in parallel. The operations of these facilities are being investigated as a separate effort.

WWTP can be found in the SCRWA Capital Improvements Strategic Plan[20], dated October 2011.

Furthermore, automated flow measurement and smart meter conversion is a proposed wholesaler/retailer improvement that is in the planning stages. These planned WWTP projects including the status and notes for each of these projects are summarized on Table 4.2.

[20] For additional information on the SCRWA Capital Improvements Strategic Plan and subsequent version, contact the South County Regional Wastewater Authority (http://www.ci.gilroy.ca.us/561/South-County-Regional-Wastewater-Authori or 408-846-0202).

Table 4.2 Summary of Currently Planned Improvements at the SCRWA WWTP

Planned WWTP Recycled Water Projects	Status	Notes
Reclamation Generator Installation (1000 kW)	Completed in 2014	New Backup Power Generator dedicated for Switchgear 3 that powers only the recycled water distribution facilities inside the treatment plant
Area 94 Recycled Water Pump Station Upgrade[2]	Construction in Progress	Providing conveyance, reliability and increasing pump capacity for Area 94 Recycled Water Pump Station
Area 93 Recycled Water Pump Station Upgrade[2]	Planning	Providing conveyance, reliability and increasing pump capacity for Area 93 Recycled Water Pump Station
UV Treatment Facility (9 MGD)	Construction in Progress - Est Completion in March 2016	Design and Construction of UV facility that will provide Title 22 compliant recycled water for distribution
Chlorine Contact Basin and Reservoir Return Pump Station Upgrade	In Planning & Construction	Providing operational modifications for expanded Recycled Water distribution facilities and improve system operational flexibility
Reservoir Expansion (Additional 6 MG) [2]	Planning	Additional on-site Recycled Water Storage Capacity.
Automated Flow Measurement and Smart Meter Conversion (Proposed wholesaler/retailer improvement)	Planning	Improvements on recycled water distribution system and customer billing efficiency
Recycled Water Fill Station	Under Study	Evaluation of opportunities for the installation of residential and/or commercial truck filling station for distribution of recycled water.
SCRWA WWTP Expansion Project, MBR (2.5 MGD Expansion)	Preliminary Design	Expansion of the existing SCRWA WWTP with construction of parallel treatment system utilizing membrane bioreactor (MBR) technology. Utilizing MBR will produce effluent water quality that complies with Title 22 requirements

Notes: 11/10/2015

1. Planned projects extracted from the 'South County Regional Wastewater Authority Capital Improvements Strategic Plan' prepared by MWH, dated October 2011.
2. This project was evaluated as part of this Master Plan

Key:

kW = kilowatt
MBR = membrane bioreactor
MG = million gallons
MG = million gallons per day
SCRWA = South County Regional Wastewater Authority
UV = ultraviolet
WWTP = wastewater treatment plant

4.4 COST ESTIMATE ACCURACY

Cost estimates presented in this CIP were prepared for general master planning purposes and, where relevant, for further project evaluation. Final costs of a project will depend on several factors including the final project scope, costs of labor and materials, and market conditions during construction.

The Association for the Advancement of Cost Engineering (AACE International), formerly known as the American Association of Cost Engineers has defined three classifications of assessing project costs. These classifications are presented in order of increasing accuracy: Order of Magnitude, Budget, and Definitive.

- **Order of Magnitude Estimate.** This classification is also known as an "original estimate," "study estimate," or "preliminary estimate," and is generally intended for master plans and studies.
  This estimate is not supported with detailed engineering data about the specific project, and its accuracy is dependent on historical data and cost indexes. It is generally expected that this estimate would be accurate within -30 percent to +50 percent.

- **Budget Estimate.** This classification is also known as an "official estimate" and generally intended for predesign studies. This estimate is prepared to include flow sheets and equipment layouts and details. It is generally expected that this estimate would be accurate within -15 percent to +30 percent.

- **Definitive Estimate.** This classification is also known as a "final estimate" and prepared during the time of contract bidding. The data include complete plot plans and elevations, equipment data sheets, and complete specifications. It is generally expected that this estimate would be accurate within -5 percent to +15 percent.

Costs developed in this study should be considered "Order of Magnitude" and have an expected accuracy range of **-30 percent** and **+50 percent**.

4.5 COST ESTIMATE METHODOLOGY

Cost estimates presented in this chapter are opinions of probable construction and other relevant costs developed from several sources including the previous 2004 Master Plan, cost curves, and experience on other master planning projects. Where appropriate, costs were escalated to reflect the more current Engineering News-Record Construction Cost Index (ENR-CCI).

The costs estimated for each recommended improvement are included in the CIP, which will then be used by District staff to update the District's Capital Improvement Budget.

It is important to note that the presented capital and O&M cost estimates are updates to the 2004 Master Plan and account for the updates to the pipe alignments, demand projections, cost estimating criteria. Upgrades that are common to the 2004 Master Plan are included in the presented cost estimates.

4.5.1 Unit Costs

The unit cost estimates used in developing the CIP are summarized on Table 4.3. Recycled water pipeline unit costs are based on length of pipes, in feet. Storage reservoir unit costs are based on capacity, per MG. Pump station costs are based on a capacity equation (shown in Table 4.3), per gpm.

The unit costs are intended for developing the Order of Magnitude estimate, and do not account for site specific conditions, labor of material costs during the time of construction, final project scope, implementation schedule, detailed utility and topography surveys for reservoir sites, investigation of alternative routings for pipes, and other various factors.

4.5.2 Construction Cost Index

Costs estimated in this study are adjusted utilizing the ENR-CCI, which is widely used in the engineering and construction industries.

The costs in this 2015 Master Plan Update were calculated using a 20-City national average ENR-CCI of 10,037 reflecting a date of July 2015.

4.5.3 Land Acquisition

Construction of pipelines is generally assumed to be within existing or future street right-of-ways. A land acquisition fee for the construction of storage reservoirs and pump station are assumed based on recent land acquisitions. For planning purposes, it is assumed that a pump station will require 0.5 acre. For estimating storage reservoir land acquisition, costs are assumed at $15 per square foot of the site. For estimating easement acquisition, costs are assumed to be 15 percent of the land acquisition costs.

4.5.4 Estimating Contingency Allowance

Knowledge about site-specific conditions for each proposed project is limited at the master planning stage; therefore construction contingencies were used. In the absence of bid tabulations, the estimated construction cost includes a **20 percent** contingency allowance to account for unforeseen events and unknown field conditions.

4.5.5 Project Related Costs

The capital improvement costs also account for project-related costs, comprised of construction and administration. The construction costs contingency is comprised of engineering design, construction management, and inspection. In the absence of bid tabulations, the construction related costs were estimated by applying an additional 20 percent to the estimating costs. The administration contingency costs are comprised of project administration (developer and City of Gilroy staff) and legal costs and are estimated by applying an additional 30 percent to the estimating and construction costs.

Table 4.3 Summary of Unit Cost Estimates

Pipe Size (Inner Diameter) (in)	Unit Costs[1] ($/lineal foot)
8	132
10	159
12	174
14	198
16	210
18	215
24	261
30	352
36	412
Pump Stations	
Estimated Pumping Station Project Cost = 2.03 * 10^(0.7583*log(Q)+3.1951); where Q is in gpm	
Storage Reservoirs ($/gal)	
≤ 1.0 MG	$2.00
1.1 MG - 3.0 MG	$1.60
3.1 MG - 5.0 MG	$1.15
> 5.0 MG	$0.86
Land and Easement Acquisition Costs ($/sqft)	
Land Acquisition Cost	$15 per sqft
Easement Fees	30% of Land Acquisition Costs
Lot Size for Storage or Pump Stations	0.5 Acres
Operation and Maintenance Costs	
Purchased Power Costs[2]	
Per Kilowatt Hour	$0.20
Distribution System Maintenance Costs[3]	
Per Mile of Pipe	$3,500
General Administration Costs[3]	
Per Mile of Pipe	$1,900
Costs Estimating Contingencies[4]	
Estimating	20%
Construction	20%
Administration	30%

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Notes:

1. Unit Cost estimates per recent bid tabs and are based on the Engineering News Record (ENR) construction cost index (CCI) of 10037 for the 20 cities for July 2015.
2. kWh cost per PG&E rates
3. System maintenance and administration costs per 2004 Master Plan and escalated based on the Engineering News Record (ENR) construction cost index (CCI) for the 20 cities for July 2015.
4. Contingencies:
   - Estimating contingency of 20% to account for unforeseen events and unknown conditions.
   - Construction contingency of 20% to account for engineering design and construction management and inspection.
   - Administration contingency of 30% to account for administration and legal costs.

Key:

CCI = Construct Cost Index
ENR = Engineering News-Record
gal = gallon
gpm = gallons per minute
ID = interior diameter
kWh = kilowatt hour
Q = flow in gpm
sqft = square foot
MG = million gallon

4.6 CAPITAL IMPROVEMENT PROGRAM

Since the 2004 Master Plan, many capital improvement projects have been completed, including:

- 3,000 feet of 12-inch pipe
- 4,800 feet of 20-inch pipe
- Retrofit of the existing Hecker Pass pipe
- 3 MG storage reservoir
- 3 mgd on-site WWTP pump station
- Increased tertiary filtration capacity at WWTP
- Retrofit 7,500 feet of existing 12-inch pipe
- 3,000 feet of 36 and 30-inch pipe
- 2 turnouts

The 2015 Master Plan Update CIP is intended as a revision to the 2004 Master Plan CIP and accounts for the updates to the pipe alignments, demand projections, and cost estimating criteria. The CIP is divided into three improvement scenarios:

- **Baseline Immediate Term:** The immediate term improvements begin with a new 30-inch main which connects to the existing 30-inch main in Southside Drive. This main continues north to Luchessa Avenue and tees into a proposed 30-inch main to the west and a proposed 18-inch main to the east that jogs north to the Princevalle Drain at Cameron Boulevard and connects to the existing 12-inch pipeline. The 30-inch main heading west continues across Monterey Road and connects to the existing 16-inch main that begins at Greenfield Drive. The existing 16-inch runs from Greenfield Drive to Tenth Street in Luchessa Avenue where the proposed 30-inch main then re-connects and continues west to the intersection of Luchessa Avenue and Miller Avenue. Due to severe construction limitations as reported by the City of Gilroy's current pipeline consultant in 2015, the existing 16-inch main in Luchessa Avenue from Greenfield Drive to Tenth Street is to be left in place and not replaced with a matching 30-inch. Also included in this scenario are the east cluster pipelines of the Meritage Development, which is comprised of a 24-inch main along 3rd street and 12-inch mains connecting to the existing 12-inch pipe in Hecker Pass Highway.
- **Baseline Short Term:** The Short Term improvements begin with a 30-inch main which connects to the proposed 30-inch main at Miller Avenue and Luchessa Avenue and continues through the Glen Loma Development to the intake of the Zone 2 Christmas Hill Pump Station. This also includes a 24-inch main discharge from the Zone 2 Christmas Hill Pump Station heading south west through the Glen Loma Development, than turning north west along Santa Teresa Boulevard to the Third Street intersection, and connecting to the proposed 24-inch main from the immediate term improvements.

Furthermore, the recycled water pipelines in the Meritage Development West Cluster section are also included in these improvements.

At the SCRWA WWTP, the Area 93 pump station requires a capacity upgrade to serve the increase of demands in the North System. The proposed pump station upgrade is two 1,600 gpm pumps for a total capacity of 6,800 gpm (9.8 mgd) and firm capacity of 5,200 gpm (7.5 mgd) Lastly, the expansion of the existing 3.0 MG reservoir at the WWTP site for an additional 6.0 MG (9.0 MG total) is included in this scenario.

- **Baseline Long Term (Lake Kathryne):** The Long Term improvements include the Lake Kathryne extension from the west side of the Meritage Development and connecting to Lake Kathryne. This scenario also requires a new tank to expand storage in Zone 2 and a new Zone 3 pump station to pump into Lake Kathryne. No additional improvements are required to provide service from Lake Kathryne as the potential customers have existing private infrastructure in place that can be converted for recycled water use to extract from Lake Kathryne.

The costs for the projects identified in this CIP for mitigating existing system deficiencies and for serving anticipated future expansion as described above are summarized on Table 4.4.

The itemized cost estimates of the recommended improvements for each baseline scenario are documented on Table 4.5. This table includes a detailed CIP and numbering system for ease of reference and for locating the improvements on the CIP Figure 4.1 and corresponding details shown on Figures 4.2, 4.3, and 4.4, below. The detailed cost breakdown for each baseline scenario is included in Appendix H.

For the purposes of future capital construction of the planned improvements, engineering standards and specifications and 10% design of baseline alternative pipeline improvements were developed. Engineering standards and specifications are included in Appendix I. The 10% design of the baseline alternative pipeline improvements is included in Appendix J. This appendix includes documentation of the pipe alignments, diameters, lengths, and major utility crossings. The crossings identified included the existing domestic water pipes, sewer system pipes, storm drainage pipes, creeks or drainage ways, freeways, and railroad crossings.

Table 4.4 Summary of Estimated Costs for Recommended Capital Improvement Program

Description	Capital Improvement Program Scenario		
	Immediate - Term	Short - Term	Long - Term
Distribution System Costs			
Pipelines	$7,664,000	$5,326,000	$1,507,000
Tanks			$2,400,000
Pump Stations	(Costs included in Planned WWTP Projects)		$1,108,000
Land Acquisition			$327,000
Sub Total	**$7,664,000**	**$5,326,000**	**$5,342,000**
Estimating Contingency (20%)	$1,533,000	$1,065,000	$1,069,000
Construction Contingency (20%)	$1,840,000	$1,278,000	$1,282,000
Administration Contingency (30%)	$3,311,000	$2,301,000	$2,308,000
Sub Total (Incremental)	**$14,348,000**	**$9,970,000**	**$10,001,000**
Distribution System Total for Entire CIP		$34,319,000	
Planned WWTP Recycled Water Project Costs			
Planned WWTP Recycled Water Projects[1]	**$4,445,000**	**$8,415,000**	**$50,850,500**
Planned Total for Entire CIP		$63,710,500	
Distribution System and Planned WWTP Recycled Water Projects Costs			
Total Project Costs (Incremental)	**$18,793,000**	**$18,385,000**	**$60,851,500**
Total Project Costs for the Entire CIP		$98,029,500	

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Notes:

1. The planned WWTP Recycled Water Projects include construction plus indirect costs, approximately 35% contingencies per SCRWA staff.
2. The Planned WWTP Recycled Water Projects have been provided by SCRWA for informational purposes and is not apart of the CIP recommended improvements.
3. The Planned WWTP Recycled Water Project improvements include those listed on Table 4.2. More information on the capital improvement projects planned at the SCRWA WWTP can be found in the SCRWA Capital Improvements Strategic Plan , dated October 2011.,

Key:

CIP = Capital Improvement Program

SCRWA = South County Regional Wastewater Authority

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Table 4.5 Itemized Cost Estimate Summary for the Recommended CIP

Improvement Number	Pressure Zone	Type of Improv.	Street	Limits	Pipeline and Appurtenances Costs: Diam. (in)	Length (ft)	Unit Cost[6] ($)	Pipe Cost ($)	Land Acquisition /Easement Cost ($)	Baseline Construction Cost ($)	Estimating Contingency Cost[3] ($)	Construction Contingency Cost[4] ($)	Administration Contingency Cost[5] ($)	Total Estimated Captial Cost ($)	Planning Scenario: Imminent Term ($)	Short Term ($)	Long Term ($)
Immediate Term Improvements																	
Distribution System																	
P-1	North - Zone 1	Pipe	Through Agriculture Fields ROW	Southside Dr. to Luchessa Ave.	30	3,380	352	1,189,760		1,189,760	237,952	285,542	513,976	2,227,000	2,227,000		
P-2	North - Zone 1	Pipe	Luchessa Avenue	Agriculture ROW to Cameron Blvd	18	1,700	215	365,500		365,500	73,100	87,720	157,896	684,000	684,000		
P-3	North - Zone 1	Pipe	Cameron Boulevard	Luchessa Ave to Princevalle Drain	18	730	215	156,950		156,950	31,390	37,668	67,802	294,000	294,000		
P-4	North - Zone 1	Pipe	Luchessa Avenue	Agriculture ROW to Greenfield Dr	30	10,260	352	3,611,520		3,611,520	722,304	866,765	1,560,177	6,761,000	6,761,000		
P-5	North - Zone 1	Pipe	Vista Bella	Luchessa Ave through Vista Bella Development	8	990	132	130,680		130,680	26,136	31,363	56,454	245,000	245,000		
P-6	North - Zone 1	Pipe	West Tenth Street	Luchessa Ave to 140 feet south	8	420	132	55,440		55,440	11,088	13,306	23,950	104,000	104,000		
P-7	North - Zone 1	Pipe	West Tenth Street	Luchessa Ave to 420 feet north	8	140	132	18,480		18,480	3,696	4,435	7,983	35,000	35,000		
P-17	North - Zone 2	Pipe	3rd Street	Isabella Way to Meritage Loop	24	4,130	261	1,077,930		1,077,930	215,586	258,703	465,666	2,018,000	2,018,000		
P-18	North - Zone 2	Pipe	Through east side of Tract 10220	3rd St to Hecker Pass Highway	12	1,630	174	283,620		283,620	56,724	68,069	122,524	531,000	531,000		
P-19	North - Zone 2	Pipe	Through west side of Tract 10220	3rd St to Connection to Existing System	12	640	174	111,360		111,360	22,272	26,726	48,108	208,000	208,000		
P-20	North - Zone 1	Pipe	Upper Meritage Loop	3rd St to Future Meritage Road	12	1,040	174	180,960		180,960	36,192	43,430	78,175	339,000	339,000		
P-21	North - Zone 2	Pipe	Future Meritage Road	Meritage Loop to Hecker Pass Highway	12	340	174	59,160		59,160	11,832	14,198	25,557	111,000	111,000		
P-27	North - Zone 1	Pipe	Luchessa Avenue	Cimino St to Tenth St	30	1,200	352	422,400		422,400	84,480	101,376	182,477	791,000	791,000		
Other Planned WWTP Recycled Water Projects[1]																	
WWTP-1	South (Area 94) Recycled Water Pump Station Upgrade				1 x 2,100 gpm					-	-	-	-	945,000	945,000		
WWTP-3	WWTP Plant Expansion - UV Treatment Facility (9 MGD)									-	-	-	-	3,500,000	3,500,000		
										Subtotal - Existing Deficiencies				**18,793,000**	**18,793,000**		
Short Term Improvements																	
Distribution System																	
P-8	North - Zone 1	Pipe	Luchessa Avenue	Miller Ave to Merlot Dr	30	2,710	352	953,920		953,920	190,784	228,941	412,093	1,786,000		1,786,000	
P-9	North - Zone 1	Pipe	Luchessa Avenue	Merlot Dr to Santa Teresa Blvd	8	590	132	77,880		77,880	15,576	18,691	33,644	146,000		146,000	
P-10	North - Zone 1	Pipe	Merlot Drive	Luchessa Ave to Syrah Dr	30	1,130	352	397,760		397,760	79,552	95,462	171,832	745,000		745,000	
P-11	North - Zone 1	Pipe	Syrah Drive	Merlot Dr to ROW through Home Ranch Development	30	730	352	256,960		256,960	51,392	61,670	111,007	481,000		481,000	
P-12	North - Zone 1	Pipe	ROW through Home Ranch Development	Syrah Dr to Zone 2 Pump Station Inlet	30	1,240	352	436,480		436,480	87,296	104,755	188,559	817,000		817,000	
P-13	North - Zone 1	Pipe	Santa Teresa Boulevard	Luchessa Ave to Tenth St	8	4,680	132	617,760		617,760	123,552	148,262	266,872	1,156,000		1,156,000	
P-14	North - Zone 2	Pipe	ROW through Home Ranch Development	Zone 2 Pump Station Outlet to Santa Teresa Blvd	24	2,080	261	542,880		542,880	108,576	130,291	234,524	1,016,000		1,016,000	
P-15	North - Zone 2	Pipe	Santa Teresa Boulevard	Syrah Dr to 3rd St	24	3,140	261	819,540		819,540	163,908	196,690	354,041	1,534,000		1,534,000	
P-16	North - Zone 2	Pipe	3rd Street	Santa Teresa Blvd to Isabella Way	24	520	261	135,720		135,720	27,144	32,573	58,631	254,000		254,000	
P-22	North - Zone 1	Pipe	Lower Meritage Loop	Lower Loop from 3rd St to Lake Kathryne Stub Out	24	2,410	261	629,010		629,010	125,802	150,962	271,732	1,178,000		1,178,000	
P-23	North - Zone 2	Pipe	Upper Meritage Loop	Upper Loop from Two Oaks Lane to Lake Kathryne Stub Out	12	2,630	174	457,620		457,620	91,524	109,829	197,692	857,000		857,000	
Other Planned WWTP Recycled Water Projects[1]																	
WWTP-5	North (Area 93) Recycled Water Pump Station Upgrade				2 x 1,600 gpm					-	-	-	-	1,500,000		1,500,000	
WWTP-6	6 MGD Distribution Reservoir Expansion at WWTP									-	-	-	-	5,953,500		5,953,500	
WWTP-7	Chlorine Contact Basin and Reservoir Return Pump Station Upgrade									-	-	-	-	661,500		661,500	
WWTP-8	Automated Flow Measurement and Smart Meter Conversion (proposed wholesaler/retailer improvement)									-	-	-	-	300,000		300,000	
										Subtotal - Existing Deficiencies				**18,385,000**		**18,385,000**	
Long Term Improvements																	
Distribution System																	
P-24	North - Zone 2	Pipe	Uvas Creek ROW	Meritage Loop to Gilroy Gardens Service Road	18	1,420	215	305,300		305,300	61,060	73,272	131,890	572,000			572,000
P-25	North - Zone 2	Pipe	Gilroy Gardens Service Road	Uvas Creek ROW to New Zone 2 Tank Site/Zone 3 PS (Elev. 383)	18	2,360	215	507,400		507,400	101,480	121,776	219,197	950,000			950,000
P-26	North - Zone 3	Pipe	Gilroy Gardens ROW	New Zone 2 Tank Site/Zone 3 PS to Lake Kathryne	18	3,230	215	694,450		694,450	138,890	166,668	300,002	1,300,000			1,300,000
T-1	North - Zone 2	Tank[2]	Gilroy Gardens	Zone 2 Storage Expansion	1.5 MG			2,400,000	327,000	2,727,000	545,400	654,480	1,178,064	5,105,000			5,105,000
PS-1	North - Zone 3	Pump Station[2]	2 x 750 gpm Duty + 750 gpm Standby		1,500 gpm (firm)			1,108,000		1,108,000	221,600	265,920	478,656	2,074,000			2,074,000
Other Planned WWTP Recycled Water Projects[1]																	
WWTP-2	Recycled Water Fill Station									-	-	-	-	850,500			850,500
WWTP-10	SCRWA WWTP Expansion Project, MBR (up to 2.5 MGD)									-	-	-	-	50,000,000			50,000,000
										Subtotal - Existing Deficiencies				**60,851,500**			**60,851,500**
Capital Improvement Summary																	
													Estimated Total	**98,029,500**	**18,793,000**	**18,385,000**	**60,851,500**

Note:
1. The Planned WWTP Recycled Water Projects include a built-in 35% contingency per SCRWA staff
2. Tank and pump station pricing can vary widely with site conditions.
3. Baseline construction costs plus 20% to account for unforeseen events and unknown conditions (Estimating Contingency).
4. Estimated construction cost plus 20% to cover other costs including: engineering design, construction management, and inspection (Construction Contingency).
5. Construction cost plus 30% to account for project administration (developer and City staff) and legal costs (Administration Contingency).
6. Cost estimates are based on the Engineering News Record (ENR) construction cost index (CCI) of 10,037 for the 20 cities for July 2015.

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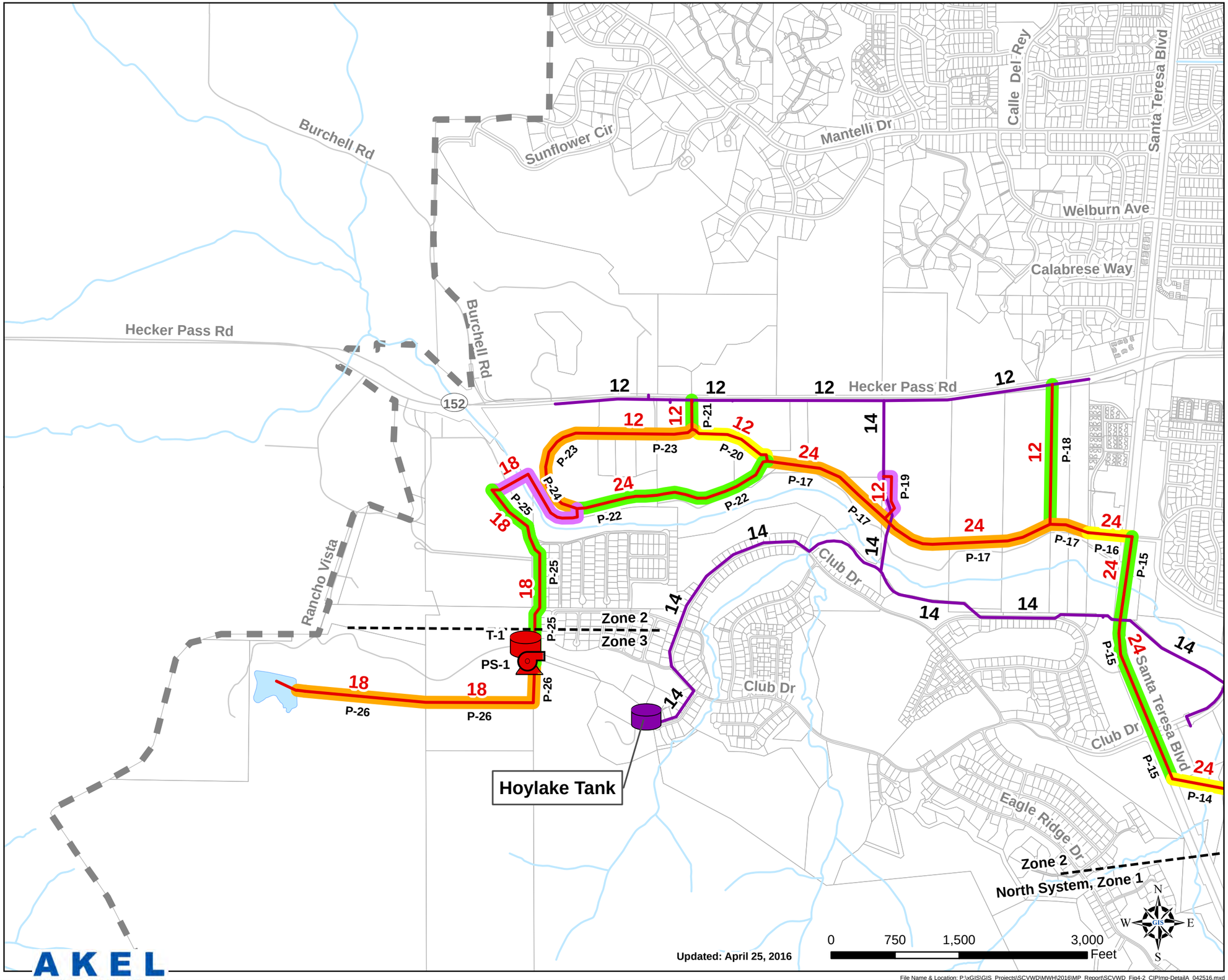
Key:

CIP = Capital Improvement Program
ENR-CCI = Engineering News-Record Construction Cost Index
gpm = gallons per minute
PS = pump station
UV = ultraviolet
WWTP = wastewater treatment plant



Legend

Proposed

- Storage Tanks
- Booster Stations
- Proposed Pipe

Segment Improvement

- 24 — Improvement Size Label
- Highlight of Start & End of Segment
- P-22 — CIP Id Label

Existing

- Storage Tanks
- Recycled Water Pipelines
- Pressure Zone Line
- City Limits
- Parcels
- Roads
- Highways
- Railroads
- Lake
- Creeks

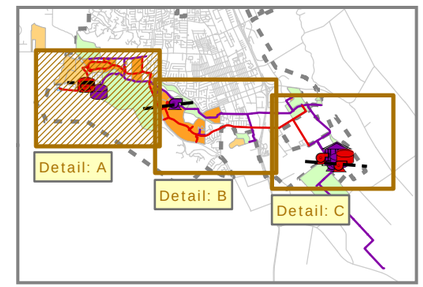


Figure 4.2 - Detail A
CIP Facility Locations

South County Recycled Water System

Santa Clara Valley Water District /
South County Regional Wastewater Authority

Santa Clara Valley Water District

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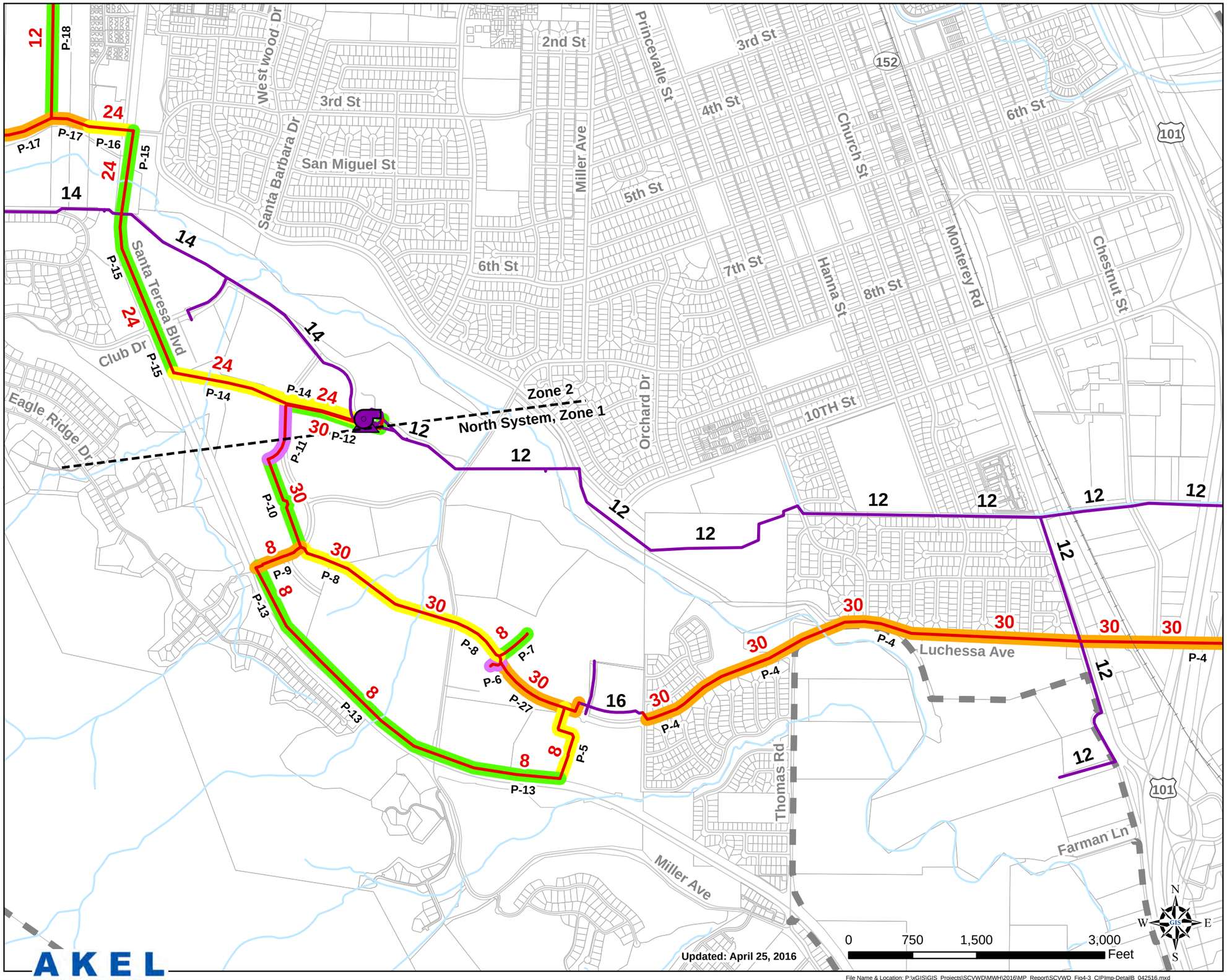
File Name & Location: P:\xGIS\GIS_Projects\SCVWD\MWH\2016\MP_Report\SCVWD_Fig4-2_CIPImp-DetailA_042516.mxd



Legend

Proposed

- Proposed Pipe

Segment Improvement

- 24 — Improvement Size Label
- Highlight of Start & End of Segment
- P-22 — CIP Id Label

Existing

- Booster Stations
- Recycled Water Pipelines
- Pressure Zone Line
- City Limits
- Parcels
- Roads
- Highways
- Railroads
- Creeks

Figure 4.3 - Detail B
CIP Facility Locations

South County Recycled Water System

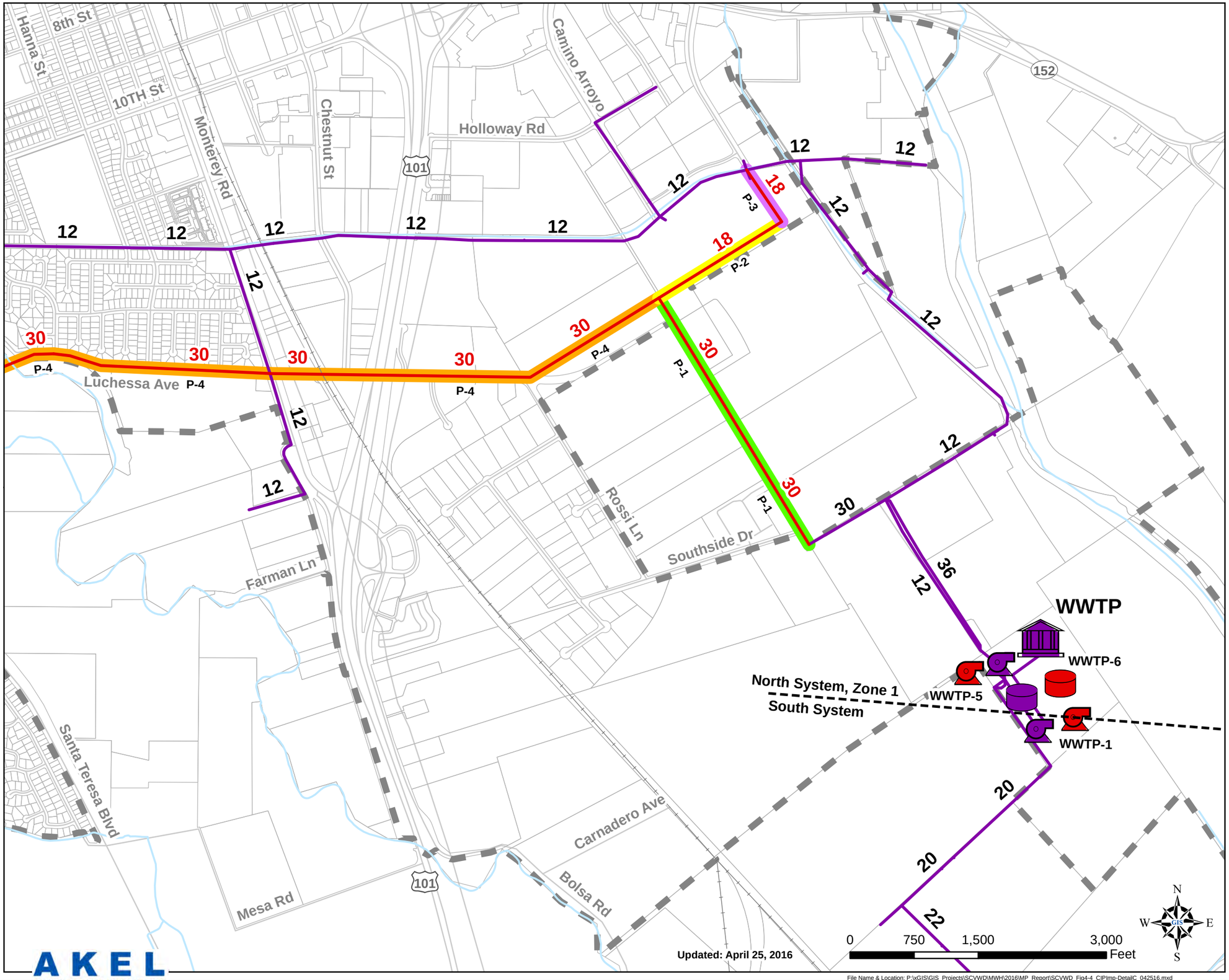
Santa Clara Valley Water District /
South County Regional Wastewater Authority

Santa Clara Valley Water District

AKEL ENGINEERING GROUP, INC.

Updated: April 25, 2016

File Name & Location: P:\xGIS\GIS_Projects\SCVWD\MWH\2016\MP_Report\SCVWD_Fig4-3_CIPImp-DetailB_042516.mxd



Legend

Proposed

- Storage Tanks
- Booster Stations
- Proposed Pipe

Segment Improvement

- 24 — Improvement Size Label
- Highlight of Start & End of Segment
- P-22 — CIP Id Label

Existing

- WWTP
- Storage Tanks
- Booster Stations
- Pressure Zone Line
- Recycled Water Pipelines
- City Limits
- Parcels
- Roads
- Highways
- Railroads
- Creeks

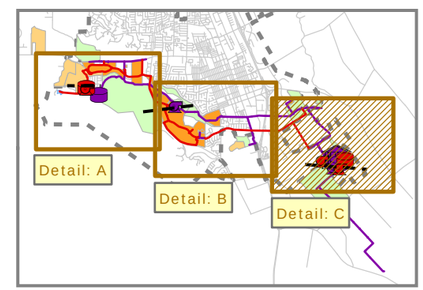


Figure 4.4 - Detail C
CIP Facility Locations

South County Recycled Water System

Santa Clara Valley Water District /
South County Regional Wastewater Authority

Santa Clara Valley Water District

AKEL ENGINEERING GROUP, INC.

File Name & Location: P:\xGIS\GIS_Projects\SCVWD\MWH\2016\MP_Report\SCVWD_Fig4-4_CIPImp-DetailC_042516.mxd

4.6.1 Operation and Maintenance Costs

The O&M costs include the following three components:

- **Purchased Power**: The purchased power accounts for the pump station power consumption. The average yearly flow and a power cost of $0.20 per kilowatt-hour (per PG&E rates) were used to calculate the annual power costs for the pump stations.
- **Distribution System Maintenance**: The annual distribution system maintenance costs were based on $3,500 per mile of pipe. This cost is based on the 2004 Master Plan and escalated based on the ENR-CCI.
- **General Administration**: The annual general administration cost is based on $1,900 per mile of pipe. This cost is based on the 2004 Master Plan and escalated based on the ENR-CCI.

The O&M cost estimates are documented on Table 4.6 for the immediate, near-short, and long term scenarios. A detailed cost breakdown of the O&M costs is included in Appendix H.

Table 4.6 Summary of O&M Cost Estimates

Description	Existing System	Capital Improvement Program Scenario		
		Immediate - Term	Short - Term	Long - Term
Purchased Power	$129,000	$155,000	$160,000	$200,000
Distribution System Maintenance	$51,000	$70,000	$84,000	$89,000
General Administration	$28,000	$38,000	$46,000	$48,000
Estimating Contingency (20%)	$42,000	$53,000	$58,000	$67,000
Total O&M Costs	$250,000	$316,000	$348,000	$404,000

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Note:

1. O&M Costs listed are the total for each scenario and include the costs from the previous scenario

Key:
O&M = operations and maintenance

4.6.2 Cost Summary

The annual cost per acre-foot of water was calculated for the immediate, short term, and long term scenarios using the CIP projects and O&M costs. An interest rate of 5.5 percent over 30 years was used to annualize the CIP project costs. The annual costs per acre-foot of water are summarized for each improvement scenario on Table 4.7.

Furthermore, the planning level alternative costs for both the City of Gilroy and the City of Morgan Hill are included in Table 4.8. This table documents the cost ranges for the Morgan Hill recycled water transmission main, scalping plant, and recycled water system alternatives and system options summarized in Chapter 3. For comparison purposes, the recommended CIP Baseline scenario CIP costs are also included in this table. Furthermore, additional information on potential recycled water improvements and their associated costs for the City of Morgan Hill is provided in Morgan Hill Recycled Water Feasibility Evaluation in Appendix D.

Table 4.7 Summary of Annual Costs per Acre-Foot

Description	Existing System: 2014 Users	Immediate - Term	Short - Term	Long - Term
Annual Distribution System Costs				
Total Distribution System Costs (Present Worth)	-	$14,348,000	$9,970,000	$10,001,000
Annual Capital Project Costs for Distribution System Projects (5.5% interest over 30 years)	-	$987,000	$686,000	$688,000
Incremental O&M Costs	$250,000	$66,000	$32,000	$56,000
Incremental Annual Costs	**$250,000**	**$1,053,000**	**$718,000**	**$744,000**
Total Annual Flow (AFY)[1]	1,344	2,016	2,240	2,464
Incremental Flow (AFY)	-	672	224	224
Cost per additional Acre Foot, Annually	-	$1,567	$3,205	$3,321
Cost per additional Acre Foot, Distribution System CIP		$1,122		
Annual Distribution and Planned WWTP Recycled Water Projects Costs[2]				
Total Distribution System Costs (Present Worth)	-	$14,348,000	$9,970,000	$10,001,000
Total Planned WWTP Recycled Water Projects (Present Worth)	-	$4,445,000	$8,415,000	$50,850,500
Annual Capital Project Costs (5.5% interest over 30 years)	-	$1,293,000	$1,265,000	$4,187,000
Incremental O&M Costs	$250,000	$66,000	$32,000	$56,000
Incremental Annual Costs	**$250,000**	**$1,359,000**	**$1,297,000**	**$4,243,000**
Total Annual Flow (AFY)[1]	1,344	2,016	2,240	2,464
Incremental Flow (AFY)	-	672	224	224
Cost per additional Acre Foot, Annually	-	$2,022	$5,790	$18,942
Cost per additional Acre Foot, Entire CIP		$2,901		

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Note:

1. Annual flow listed excludes the projected WWTP Utility Water demand of 1,172 afy
2. More information on the capital improvement projects planned at the SCRWA WWTP can be found in the SCRWA Capital Improvements Strategic Plan , dated October 2011.

Key:

afy = acre-feet per year
CIP = Capital Improvement Program
O&M = operations and maintenance
SCRWA = South County Regional Wastewater Authority

Table 4.8 City of Gilroy and Morgan Hill Alternatives Cost Summary

	Pipes (millions)	Pump Stations (millions)	Tanks (millions)	Land/Easement Acquisition (millions)	Scalping Plant (millions)	Planned WWTP Recycled Water Projects[3] (millions)	Total[1,2] (millions)
Recommended Gilroy CIP Baseline Alternative							
Immediate - Term	$14.4	-	-	-	-	$4.4	**$18.8**
Short - Term	$10.0	-	-	-	-	$8.4	**$18.4**
Long - Term	$2.8	$2.1	$4.5	$0.6	-	$50.8	**$60.8**
Total	$27.2	$2.1	$4.5	$0.6	$0.0	$63.6	**$98.0**
Expansion to Morgan Hill Alternatives							
Recycled Water Transmission Main	$29.2 - $36.8	$3.9	-	$7.9 - $7.1	-	-	**$41.0 - $47.8**
Option MH-1/ MH-2 (1.0 MGD)	$4.1 - $2.7	-	-	-	-	-	**$4.1 - $2.7**
Option MH-3/ MH-4 (2.25 MGD)	$1.4 - $6.6	-	-	-	-	-	**$1.4 - $6.6**
Total	$34.7 - $46.1	$3.9	-	$7.9 - $7.1			**$46.5 - $57.1**
Morgan Hill Scalping Plant Alternatives							
Option MH-1/ MH-5 (1.0 MGD)	$5.2 - $10.8	$1.9 - $1.5	-	-	$18.0	-	**$25.1 - $30.3**
Option MH-6/ MH-7 (2.25 MGD)	$6.4- $6.1	$2.3 - $2.6	-	-	TBD	-	**$8.7**
Total	$11.3 - $17.2	$2.3 - $2.6	-	-	$18.0	-	**$31.6 - $37.8**

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Notes:

1. Costs include contingencies of 20% for estimating, 20% for construction, and 30% for administration
2. Costs listed under each heading are incremental
3. More information on the capital improvement projects planned at the SCRWA WWTP can be found in the SCRWA Capital Improvements Strategic Plan , dated October 2011.

Key:

MGD = million gallons per day
MH = Morgan Hill
SCRWA = South County Regional Wastewater Authority
TBD = to be determined

4.7 FUNDING OPTIONS

The District currently charges two different rates for recycled water service in the South County. There is an "AG" rate for agricultural customers and an "M&I" (municipal and industrial) rate for non-agricultural customers. The AG rate is lower because it is supplemented by an "Open Space Credit", which is funded by the District's 1 percent property tax revenue. The M&I rate is set at $20/acre-foot (AF) under the District's groundwater production charge. The revenue from M&I rates, AG rates, and the Open Space Credit is insufficient to pay for the cost of providing recycled water service. The resulting "funding gap" is closed with groundwater production charge revenue.

The recommended changes and additions to the 2004 master Plan, and documented in the 2015 Master Plan will expand the District's recycled water system as well as increase annual costs. **Since raising rates alone will not substantially decrease the funding gap, other methods are needed to recover additional revenue.** Table 4.9 summarizes the different rates structures that are discussed in the Funding Assessment Report (Appendix K). Additional rate design options are available, but were excluded for not being applicable to the South County Recycled Water System.

Table 4.9 Summary of Rate Structures

Rate Structure	Intended Effect	Likely Effect
Increasing Existing Rates by Decreasing Price Difference Between Groundwater and Recycled Water	Generate more revenues from existing recycled water sales to close funding gap.	Minimal or negative effect on net revenues since (a) the difference between recycled water and groundwater rates is small and (b) higher prices may drive customers towards using groundwater.
Seasonal Rate	Lower recycled water rate in the winter will encourage more consumption and increase supply utilization.	Minimal or negative effect on net revenue since most customers do not have an economic incentive to use more water, regardless of the price, therefore lowering winter rates will simply decrease total revenue.
Seasonal Peaking Charge	Having a charge for high peak flows in the summer will reduce peaking behavior and make room for more customers.	Certain customer may elect to conserve or use groundwater during peak months, making room for more customers and allowing for more recycled water sales on a year-round basis.
Interruptible Service Agreement	A more drastic form of seasonal peaking charges – negotiating with certain customers to shut down their service during the peak months will create capacity to connect more users.	Certain customers may elect to use groundwater during peak months in exchange for cheaper recycled water, making room for more customers and allowing for more recycled water sales on a year-round basis.

The Funding Assessment Report suggests that the primary opportunity for increasing recycled water revenue is through connecting additional customers to the system because existing customers are unlikely to increase their use during the shoulder months in the winter. However the District's ability to connect additional customers is limited by the system capacity during the peak months in the summer. Therefore, **managing summer demand peaks through a seasonal peaking charge or through interruptible service agreements** may be the most feasible method to achieve greater system utilization to generate more revenue.

4.8 IMPLEMENTATION FACTORS AND PUBLIC OUTREACH

A thoughtful and strategic approach to outreach and communications, for both internal and external audiences, is being conducted to inform management and stakeholders on the proposed recycled water pipelines expansion. Communications efforts are arrayed by four communication layers:

- Macro, Overarching Communications
- Internal Communications, Outreach and Change Management
- External Communications and Outreach
- Communications and Outreach Risk Management

More information on each of these communication layers is presented in Appendix L.

4.8.1 Macro, Overarching Communications

Macro, overarching communications are non-project specific outreach and messaging related to alternative water sources generally and recycled water specifically. These communications may also include recycled water information deployed by others (for different or related purposes) likely to drive public perception or action. In the case of the District, SCRWA, and other sister agencies, there is an overall interest in advancing the use of alternative water sources and recycled water for multiple projects and initiatives far beyond the South County Recycled Water System service area.

Concurrent with macro messaging about alternative water sources, communications will advance the idea that the District and SCRWA are part of the solution. The purpose of this messaging is to emphasize that action is needed and is best taken by local agencies. Additional communications messages can affirm that the District is among the most respected of water agencies in the county and that in collaboration with SCRWA is able to competently execute recycled water projects.

4.8.2 Internal Communications, Outreach, and Change Management

Internal communications refer to interactions with those individuals within the implementing organizations. Internal communications, outreach, and change management are as important as external ones and have additional considerations. There are four primary communications and outreach focuses related to internal audiences:

- Translation of Macro and External Messaging
- Technical Concurrence

- Operational Adjustments
- Project Management

Internal audiences need sufficient information to provide information to others. Equally important is a need for the District and SCRWA personnel to deploy consistent messages. Uneven and consistent messages from internal parties create confusion and add to project risk. Goals are to ensure internal audiences are not surprised by external messages.

Technical concurrence, operational adjustments, and project management are additional areas where internal communications will be emphasized. Organizational members have the greatest understanding of the system, and this institutional knowledge is a tremendous asset. Early consultation will yield improved design and implementation procedures. Plans for training on new skills and methods will be established.

Another critical component of internal communications and outreach is change management. Change management is the application of a structured process and set of tools for leading the people side of change to achieve a desired outcome.

Internal change management communications will include six key steps:

1. Clearly define what changes will occur. This means the actual changes, not the outcomes. For example it may mean one or more new inspection procedures may be implemented, or that people will use new tools or skills.
2. Outline the impact of the change to the individual and the individual's group.
3. Explain the process and methods to be used in implementing the change.
4. Describe the benefits of action and the costs of inaction.
5. Ask for assistance in determining who else may be impacted by the change and how.
6. Ask for improvements that can be made to the change, process, and methods.

Technical concurrence will be sought to ensure consistent project messaging and reduce resistance to new approaches. Similarly early consultation with operations personnel about adjustments to the system will reduce difficulties in later implementation.

Finally, preparation of project management plans and charters will be aligned with overall communications strategies to build consistency and project support.

4.8.3 External Communications and Outreach

External communications and outreach refers to interactions with those outside of the implementing organizations. Communications strategies will be developed for six key issues. Those include:

1. **Market**: Market communications and outreach focus on customer demand. The District and SCRWA will affirm how much water is wanted, at what quality, for what price, and under what conditions. Market communications will also address the following issues and interests:
    - Water Quality – how quality relates to intended use and the safety of treatment technology.

- Pricing – how price ties to reliability and operational flexibility. This includes education on the fact that alternative water sources like groundwater (without recharge) and rainfall have decreasing reliability.

2. **Project Footprint**: The project footprint relates to the physical location where the pipelines and related pumps expansion will be implemented. This is relevant to communications as it helps define the stakeholders that must be engaged and what topics they will be interested in. In this case, topics will include final siting, conflicts with other activities, and the potential to coordinate construction activities with other projects with similar needs (e.g. excavation, movement of utilities, etc.). The planning will also incorporate a detailed assessment of communications and outreach needed to acquire rights-of-way and access.

   A supplemental public outreach plan will be developed for project phases involving construction. The level and duration of the effort will be determined by scale and timing of the project phases.

3. **Regulatory Environment**: The goal of regulatory communications is to facilitate trouble-free project approvals. Project communications will incorporate developing a working relationship with the regulatory agencies to understanding permits requirements for compliance.

4. **Funding:** Project outreach and communications related to funding involve message development on how the project will be paid for, particularly highlighting efforts to acquire funds from external sources, the project return on investment, the ability of the project to achieve larger goals, and how the benefits are extended beyond just the immediate recipients of project water. Explanation should also be provided as to who will pay for specific customer improvements and why.

5. **Governance:** External communications associated with governance has two forms. The first relates to how implementing agencies communicate to their individual stakeholders as to the benefits of joint governance. Stakeholders want assurances that the governance arrangements are beneficial and will not disadvantage future transactions. The second form of governance communications relates to specific actions and agreements involving external parties. This includes topics such as customer agreements, land acquisition, and coordination with developers.

   Implementation activities will include a clear delineation as to communications roles and responsibilities, and how agreements will be managed.

6. **Education & Community Support:** Education and community support communications are similar to macro messaging but are project specific. Prescribed outreach will also be required as part of compliance with CEQA.

4.8.4 Communications and Outreach Risk Management

Risk management is the identification, assessment, and prioritization of risks (defined as the effect of uncertainty on achieving objectives) followed by coordinated, efficient, and economical strategies and actions to minimize, monitor, and control the probability and/or impact of negative events. Strategies and actions may also be used to avert risk by leveraging strengths and opportunities. Using know communications risks factors as a starting point, the District will regularly revisit communications planning to ensure that risks have been eliminated or mitigated.

4.9 IDENTIFICATION OF CEQA DOCUMENTATION REQUIREMENTS

This section identifies CEQA requirements and provides options for CEQA documentation for the 2015 Master Plan Update.

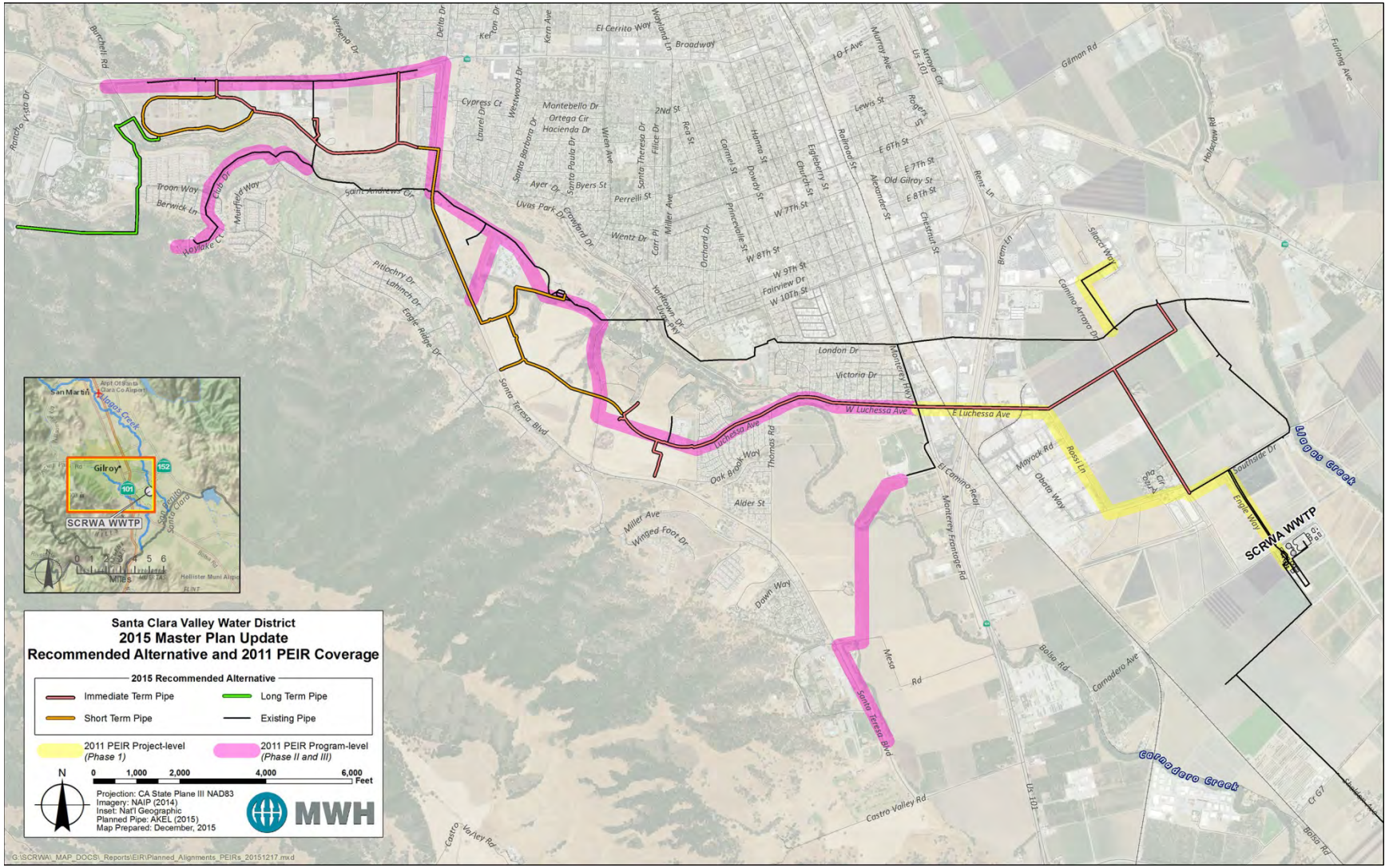
The District's 2004 Master Plan identified immediate-term (Phase IA and Phase IB), Short Term (Phase II), and Long Term (Phase III) recycled water capital investment projects to improve the South County Recycled Water System's reliability and to expand the use of recycled water in the South County. In 2011, the District released the Final Program Environmental Impact Report (2011 PEIR) for CEQA compliance for the 2004 Master Plan.

The 2011 PEIR covered 2004 Master Plan actions at both a project-level and program-level of detail. Those 2004 Master Plan actions that were well-defined were covered at the project-level of detail. In the 2011 PEIR, these actions were called "Phase IA and IB." Those 2004 Master Plan actions that had broad environmental effects and needed the opportunity for flexibility to respond to changing needs and conditions were addressed at a program-level of detail. In the 2011 PEIR, these actions were called "Phase II and Phase III." Potential transmission lines to serve Morgan Hill were discussed as possible alternatives in the 2011 PEIR, but eliminated due to being economically infeasible.

Many project-level actions as described in Phase IA and IB of the 2011 PEIR have been completed as of 2015, including 4,800 feet of a 20-inch distribution pipeline, 3-MG storage reservoir, 3-mgd on-site waste water treatment pump station, increased tertiary filtration capacity at the SCRWA WWTP, and 3,000 feet of a 36-inch and 30-inch distribution pipeline. See Table 1.1 for a complete list of project-level actions completed as of 2015.

This 2015 Master Plan Update is an update to the 2004 Master Plan and presents a strategy for expanding use of recycled water in South Santa Clara County over a 20-year planning horizon. The 2015 Master Plan Update identifies potential new customers and recycled water requirements, an update to regulatory and treatment requirements, develops and evaluates alignment alternatives, recycled water options for Morgan Hill, and other updates. In this report, immediate term, short-near term and long term actions for the recommended improvements have been detailed to a 10% level of design. Figure 4.5 shows the existing pipelines (some constructed under the 2011 PEIR), project- and program-level actions covered under the 2011 PEIR, and the 2015 Master Plan Update recommended pipeline alternative.

Figure 4.5 2015 Master Plan Update Recommended Alternative and 2011 PEIR Coverage



Key:
PEIR = Program Environmental Impact Report
NAD83 = North American Datum of 1983
NAIP = National Agriculture Imagery Program

This document addresses the CEQA coverage options for the recommended alternative described in this 2015 Master Plan Update. First, the CEQA requirements are described, then the potential CEQA coverage options, including tiering from the 2011 PEIR and individual EIR coverage.

This document also addresses potential options for CEQA coverage for the program-level recycled water connections to Morgan Hill and the NEPA requirements. NEPA will be required if the District secures Title XVI and American Recovery and Reinvestment Act of 2009 funding.

4.9.1 CEQA Requirements

CEQA requires that State and local government agencies consider the potential environmental effects of projects over which they have discretionary authority before taking action on those projects (Public Resources Code (PRC) Section 21000 et seq.). The District has discretionary authority over the South County Recycled Water Master Plan and Update, was the CEQA lead agency for the 2011 PEIR, and will be the lead agency for any CEQA documents associated with the 2015 Master Plan Update. In 2011, a PEIR was certified by the District Board of Directors.

Under Section 15168 Guidelines of CEQA Guidelines, a PEIR is prepared on a series of actions that can be characterized as one large project. A PEIR generally establishes a framework for "tiered" or project-level environmental documents that will be subsequently prepared in accordance with the overall program.

A project-level of analysis for CEQA compliance is for actions that are well-defined with respect to project-level details without subsequent CEQA analysis needed and can be addressed in a PEIR. The project-level of analysis can be addressed through an Initial Study/Mitigated Negative Declaration (IS/MND), EIR or a PEIR, depending on the significance of the impacts associated with the project.

The State CEQA Guidelines allow for incorporation by reference when project-specific analysis is tiered from previous analysis (Sections 15150 and 15152). Under Section 15152 of the State CEQA Guidelines, when CEQA documentation has been prepared for a program of projects, project-specific studies for subsequent projects within the program should be limited to effects which:

- Were not examined as significant effects on the environment in the PEIR because appropriate mitigation (when available) would be identified for significant effects identified in the program EIR.
- Were examined as significant effects on the environment in the PEIR, but which could be reduced or avoided through specific revisions in the project (State CEQA Guidelines Section 15152(d)).

Figure 4.6 is a decision tree outlining the possible CEQA options for the recommended alternative.

Figure 4.6 CEQA Decision Tree

Key:
CEQA = California Environmental Quality Act
PEIR = Program Environmental Impact Report
EIR = Environmental Impact Report

4.9.2 Potential CEQA Options for 2015 Master Plan Update Recommended Alternative

This section describes the potential CEQA options for the recommended alternative in the 2015 Master Plan Update. It includes a discussion of CEQA options for those recommended alternative actions covered under the 2011 PEIR and actions not covered in the 2011 PEIR.

4.9.3 Recommended alternative Actions Covered in the 2011 PEIR

The CEQA coverage option for those actions within the recommended alternative that were covered in the 2011 PEIR is addressed below.

4.9.3.1 Tier from 2011 PEIR – IS/MND or EIR

As described above, the 2015 Master Plan Update identifies potential new customers and recycled water requirements, provides an update to regulatory and treatment requirements, and develops and evaluates alignment alternatives. Many of these actions and types of actions are covered under the 2011 PEIR as the PEIR provided broad direction for a wide range of possible future actions while allowing the opportunity for flexibility to respond to changing needs and conditions. In addition, the 2011 PEIR evaluated a range of alternatives and provided mitigation measures to reduce impacts.

Future project-level CEQA documents may incorporate the findings of the PEIR by reference through “tiering,” or incorporating by reference general discussions from the PEIR. Therefore, a large portion of the recommended alternative could tier from the 2011 PEIR. These portions of the recommended alternative would need to be further assessed to determine the type of tiered document (IS/Negative Declaration, EIR or no further action) needed, depending on potential impacts anticipated to occur. It is anticipated that subsequent CEQA documents for the 2015

Master Plan Update will focus solely on issues specific to the tiered project. The development of the tiered IS/Negative Declaration or EIR can usually be prepared quickly as information on these actions are already provided in the PEIR. Tiering off a document usually takes a shorter time to prepare than new EIR/PEIR.

4.9.4 Recommended alternative Actions Not Covered in the 2011 PEIR

As shown in Figure 4.5, there are also portions of the recommended alternative that are not covered under the 2011 PEIR. For example, the 2015 Master Plan Update includes modifications to some of the alignments proposed under the 2011 PEIR, additional pumps, as well as a new storage reservoir Therefore, additional CEQA review will be needed to address those portions of the recommended alternative. This section discusses a Subsequent PEIR and a Subsequent EIR for coverage of the recommended alternative.

4.9.4.1 Subsequent PEIR

A Subsequent PEIR to the 2011 PEIR is an option to cover those actions of the recommended alternative that were not originally covered in the 2011 PEIR. A Subsequent PEIR or EIR is an option even for program-level documents, not only project-level CEQA documents (e.g., EIR).

A Subsequent PEIR is prepared for projects that change substantially due to new information, a changed project description, or changed circumstances within which the project would take place. It is tiered from a PEIR or EIR. Generally, new information requiring a Subsequent PEIR pertains to significant effects that were not previously analyzed. A subsequent PEIR must receive the same circulation and review as the previous EIR (CEQA Guidelines Section 15162).

The benefit to this approach allows for the utilization of an existing document, the 2011 PEIR which is only 4 years old. Since the recommended alternative is developed to a 10% level of design, additional CEQA review will be needed to determine the level of CEQA documentation. If no new impacts or mitigation are required, the proposed activities are within the scope of the 2011 EIR, and no further CEQA document is needed. However, if new impacts or mitigation are required, a subsequent PEIR may be prepared.

The challenge to this approach is that additional analysis would need to occur to see if a Subsequent PEIR could cover the program-level recycled water connections to Morgan Hill, as discussed below. If Morgan Hill cannot be evaluated in the Subsequent PEIR, the theory of segmentation or “independent utility” would need to be evaluated, also discussed below.

4.9.5 Subsequent EIR

A Subsequent EIR could be developed to provide coverage for alternative with new impacts and mitigation measures. This subsequent document would address the recommended alternative and possibly the recycled water connections to Morgan Hill, as discussed below.

The benefits of a Subsequent EIR include the ability to cover both the recommended alternative and Morgan Hill. It would allow the public to comment only to the change to the project as well as new impact and mitigation measures not evaluated in the 2011 PEIR.

As stated above, additional CEQA review will need to be conducted with a new Initial Study leading to a Subsequent EIR or Negative Declaration, or no further action.

4.9.6 Morgan Hill

In order to provide coverage for connections to Morgan Hill, further analysis would be conducted to evaluate the level of CEQA document.

4.9.6.1 Independent Utility

The term “project” refers to the whole of an action that has the potential, directly or ultimately, to result in a physical change to the environment (CEQA Guidelines Section 15378). This includes all phases of a project that are reasonably foreseeable, and all related projects that are directly linked to the project.

A lead agency must fully analyze each “project” in a single PEIR or EIR. Therefore, in performing its analysis, the lead agency should not segment or piecemeal a project by splitting it into two or more segments. An EIR can focus on one project that is arguably part of a larger scheme where that project has “independent utility” that justifies its separate processing and approval. As described in CEQA Guidelines Section 15165, “Where a project is one of several similar projects of a public agency but is not deemed a part of a larger undertaking or a larger project, the agency may prepare one EIR for all projects, or one for each project, but shall in either case comment upon the cumulative effects.”

Additional research would need to occur to determine if recycled water connections to Morgan Hill have independent utility from the recommended alternative and have the potential of being evaluated in a separate document, or if the recycled water connections to Morgan Hill and the recommended alternative would need to be evaluated in one document.

4.9.7 NEPA Requirements

Funding (e.g., Title XVI) for the recommended alternative or connections to Morgan Hill may be provided by Reclamation. Funding is considered a federal action which triggers the need for compliance with NEPA. However, as with the 2011 PEIR, it is assumed that federal funding will only be for a portion of the recommended alternative. In June 2010, Reclamation completed the Final Environmental Assessment Recover Act Funding for the Short Term Phase I Component of the South County Recycled Water Master Plan Project (2010 EA). Therefore, a NEPA Environmental Assessment (EA) will only need to be to be completed for the portion of the recommended alternative receiving federal funds and not already addressed within the 2010 EA.

While a combined CEQA/NEPA could be completed (e.g., combined IS/MND/EA) for those portions of the recommended alternative not covered under the 2011 PEIR or 2010 EA and/or connections to Morgan Hill, it is recommended that, since the federal action may be small in comparison to the District action, NEPA be completed in a separately from CEQA.

Appendices

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APPENDIX A

RECYCLED WATER REGULATIONS

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State Water Resources Control Board
Regulations Related to Recycled Water
July 16, 2015

TITLE 17 CODE OF REGULATIONS

Division 1. State Department of Health Services

Chapter 5. Sanitation (Environmental)

Group 4. Drinking Water Supplies

Article 1. General.

§7583. Definitions.
In addition to the definitions in Section 4010.1 of the Health and Safety Code, the following terms are defined for the purpose of this Chapter:

(a) "Approved Water Supply" is a water supply whose potability is regulated by a State of local health agency.

(b) "Auxiliary Water Supply" is any water supply other than that received from a public water system.

(c) “Air-gap Separation (AG)" is a physical break between the supply line and a receiving vessel.

(d) "AWWA Standard" is an official standard developed and approved by the American Water Works Association (AWWA).

(e) "Cross-Connection" is an unprotected actual or potential connection between a potable water system used to supply water for drinking purposes and any source or system containing unapproved water or a substance that is not or cannot be approved as safe, wholesome, and potable. By-pass arrangements, jumper connections, removable sections, swivel or changeover devices, or other devices through which backflow could occur, shall be considered to be cross-connections.

(f) "Double Check Valve Assembly (DC)" is an assembly of at least two independently acting check valves including tightly closing shut-off valves on each side of the check valve assembly and test cocks available for testing the watertightness of each check valve.

(g) "Health Agency" means the California Department of Health Services, or the local health officer with respect to a small water system.

(h) "Local Health Agency" means the county or city health authority.

(i) "Reclaimed Water" is a wastewater which as a result of treatment is suitable for uses other than potable use.

(j) "Reduced Pressure Principle Backflow Prevention Device (RP)" is a backflow preventer incorporating not less than two check valves, an automatically operated differential relief valve located between the two check valves, a tightly closing shut-off valve on each side of the check valve assembly, and equipped with necessary test cocks for testing.

(k) "User Connection" is the point of connection of a user's piping to the water supplier's facilities.

(l) "Water Supplier" is the person who owns or operates the public water system.

(m) "Water User" is any person obtaining water from a public water supply.

§7584. Responsibility and scope of program.

The water supplier shall protect the public water supply from contamination by implementation of a cross-connection control program. The program, or any portion thereof, may be implemented directly by the water supplier or by means of a contract with the local health agency, or with another agency approved by the health agency. The water supplier's cross-connection control program shall for the purpose of addressing the requirements of Sections 7585 through 7605 include, but not be limited to, the following elements:

(a) The adoption of operating rules or ordinances to implement the cross-connection program.

(b) The conducting of surveys to identify water user premises where cross-connections are likely to occur,

(c) The provisions of backflow protection by the water user at the user's connection or within the user's premises or both,

(d) The provision of at least one person trained in cross-connection control to carry out the cross-connection program,

(e) The establishment of a procedure or system for testing backflow preventers, and

(f) The maintenance of records of locations, tests, and repairs of backflow preventers.

§7585. Evaluation of hazard.

The water supplier shall evaluate the degree of potential health hazard to the public water supply which may be created as a result of conditions existing on a user's premises. The water supplier, however, shall not be responsible for abatement of cross-connections which may exist within a user's premises. As a minimum, the evaluation should consider: the existence of cross-connections, the nature of materials handled on the property, the probability of a backflow occurring, the degree of piping system complexity and the potential for piping system

modification. Special consideration shall be given to the premises of the following types of water users:

(a) Premises where substances harmful to health are handled under pressure in a manner which could permit their entry into the public water system. This includes chemical or biological process waters and water from public water supplies which have deteriorated in sanitary quality.

(b) Premises having an auxiliary water supply, unless the auxiliary supply is accepted as an additional source by the water supplier and is approved by the health agency.

(c) Premises that have internal cross-connections that are not abated to the satisfaction of the water supplier or the health agency.

(d) Premises where cross-connections are likely to occur and entry is restricted so that cross-connection inspections cannot be made with sufficient frequency or at sufficiently short notice to assure that cross-connections do not exist.

(e) Premises having a repeated history of cross-connections being established or re-established.

§7586. User supervisor.

The health agency and water supplier may, at their discretion, require an industrial water user to designate a user supervisor when the water user's premises has a multipiping system that convey various types of fluids, some of which may be hazardous and where changes in the piping system are frequently made. The user supervisor shall be responsible for the avoidance of cross-connections during the installation, operation and maintenance of the water user's pipelines and equipment.

Article 2. Protection of Water System.

§7601. Approval of backflow preventers.

Backflow preventers required by this Chapter shall have passed laboratory and field evaluation tests performed by a recognized testing organization which has demonstrated their competency to perform such tests to the Department.

§7602. Construction of backflow preventers.

(a) Air-gap Separation. An Air-gap separation (AG) shall be at least double the diameter of the supply pipe, measured vertically from the flood rim of the receiving vessel to the supply pipe; however, in no case shall this separation be less than one inch.

(b) Double Check Valve Assembly. A required double check valve assembly (DC) shall, as a minimum, conform to the AWWA Standard C506-78 (R83) adopted on January 28, 1978 for Double Check Valve Type Backflow Preventive Devices which is herein incorporated by reference.

(c) Reduced Pressure Principle Backflow Prevention Device. A required reduced pressure principle backflow prevention device (RP) shall, as a minimum, conform to the AWWA Standard

C506-78 (R83) adopted on January 28, 1978 for Reduced Pressure Principle Type Backflow Prevention Devices which is herein incorporated by reference.

§7603. Location of backflow preventers.

(a) Air-gap Separation. An air-gap separation shall be located as close as practical to the user's connection and all piping between the user's connection and the receiving tank shall be entirely visible unless otherwise approved in writing by the water supplier and the health agency.

(b) Double Check Valve Assembly. A double check valve assembly shall be located as close as practical to the user's connection and shall be installed above grade, if possible, and in a manner where it is readily accessible for testing and maintenance.

(c) Reduced Pressure Principle Backflow Prevention Device. A reduced pressure principle backflow prevention device shall be located as close as practical to the user's connection and shall be installed a minimum of twelve inches (12") above grade and not more than thirty-six inches (36") above grade measured from the bottom of the device and with a minimum of twelve inches (12") side clearance.

§7604. Type of protection required.

The type of protection that shall be provided to prevent backflow into the public water supply shall be commensurate with the degree of hazard that exists on the consumer's premises. The type of protective device that may be required (listed in an increasing level of protection) includes: Double check Valve Assembly--(DC), Reduced Pressure Principle Backflow Prevention Device--(RP) and an Air gap Separation--(AG). The water user may choose a higher level of protection than required by the water supplier. The minimum types of backflow protection required to protect the public water supply, at the water user's connection to premises with various degrees of hazard, are given in Table 1. Situations not covered in Table 1 shall be evaluated on a case-by-case basis and the appropriate backflow protection shall be determined by the water supplier or health agency.

TABLE 1

TYPE OF BACKFLOW PROTECTION REQUIRED

Degree of Hazard	Minimum Type of Backflow Prevention
(a) Sewage and Hazardous Substances	
(1) Premises where there are waste water pumping and/or treatment plants and there is no interconnection with the potable water system. This does not include a single-family residence that has a sewage lift pump. A RP be provided in lieu of an AG if approved by the health agency and water supplier.	AG
(2) Premises where hazardous substances are handled in any manner in which the substances may enter the potable water system. This does not include a single-family residence that has a sewage lift pump. A RP may be provided in lieu of an AG if approved by the health agency and water supplier.	AG

(3) Premises where there are irrigation systems into which fertilizers, herbicides, or pesticides are, or can be, injected. — RP

(b) Auxiliary Water Supplies

(1) Premises where there is an unapproved auxiliary water supply which is interconnected with the public water system. A RP or DC may be provided in lieu of an AG if approved by the health agency and water supplier — AG

(2) Premises where there is an unapproved auxiliary RP water supply and there are no interconnections with the public water system. A DC may be provided in lieu of a RP if approved by the health agency and water supplier. — RP

(c) Recycled water

(1) Premises where the public water system is used to supplement the recycled water supply. — AG

(2) Premises where recycled water is used, other than as allowed in paragraph (3), and there is no interconnection with the potable water system. — RP

(3) Residences using recycled water for landscape irrigation as part of an approved dual plumbed use area established pursuant to sections 60313 through 60316 unless the recycled water supplier obtains approval of the local public water supplier, or the Department if the water supplier is also the supplier of the recycled water, to utilize an alternative backflow protection plan that includes an annual inspection and annual shutdown test of the recycled water and potable water systems pursuant to subsection 60316(a). — DC

(d) Fire Protection Systems

(1) Premises where the fire system is directly supplied from the public water system and there is an unapproved auxiliary water supply on or to the premises (not interconnected). — DC

(2) Premises where the fire system is supplied from the public water system and interconnected with an unapproved auxiliary water supply. A RP may be provided in lieu of an AG if approved by the health agency and water supplier. — AG

(3) Premises where the fire system is supplied from the public water system and where either elevated storage tanks or fire pumps which take suction from private reservoirs or tanks are used. — DC

(4) Premises where the fire system is supplied from the public water system and where recycled water is used in a separate piping system within the same building. — DC

(e) Dockside Watering Points and Marine Facilities

(1) Pier hydrants for supplying water to vessels for any purpose. — RP

(2) Premises where there are marine facilities. — RP

(f) Premises where entry is restricted so that inspections for cross-connections cannot be made with sufficient frequency or at sufficiently short notice to assure that do not exist. — RP

(g) Premises where there is a repeated history of crossconnections being established or re-established. RP RP

§7605. Testing and maintenance of backflow preventers.

(a) The water supplier shall assure that adequate maintenance and periodic testing are provided by the water user to ensure their proper operation.

(b) Backflow preventers shall be tested by persons who have demonstrated their competency in testing of these devices to the water supplier or health agency.

(c) Backflow preventers shall be tested at least annually or more frequently if determined to be necessary by the health agency or water supplier. When devices are found to be defective, they shall be repaired or replaced in accordance with the provisions of this Chapter.

(d) Backflow preventers shall be tested immediately after they are installed, relocated or repaired and not placed in service unless they are functioning as required.

(e) The water supplier shall notify the water user when testing of backflow preventers is needed. The notice shall contain the date when the test must be completed.

(f) Reports of testing and maintenance shall be maintained by the water supplier for a minimum of three years.

TITLE 22 CODE OF REGULATIONS

Division 4. Environmental Health

Chapter 1. Introduction

Article 1. Definitions

§60001. Department.
Whenever the term "department" is used in this division, it means the State Department of Health Services, unless otherwise specified.

§60003. Director.
Whenever the term "director" is used in this division, it means the Director, State Department of Health Services, unless otherwise specified.

Chapter 2. Regulations for the Implementation of the California Environmental Quality

Article 1. General Requirements and Categorical Exemptions

§60100. General requirements.
The Department of Health Services incorporates by reference the objectives, criteria, and procedures as delineated in Chapters 1, 2, 2.5, 2.6, 3, 4, 5, and 6, Division 13, Public Resources Code, Sections 21000 et seq., and the Guidelines for the Implementation of the California Environmental Quality Act, Title 14, Division 6, Chapter 3, California Administrative Code, Sections 15000 et seq.

§60101. Specific activities within categorical exempt classes.
The following specific activities are determined by the Department to fall within the classes of categorical exemptions set forth in Sections 15300 et seq. of Title 14 of the California Administrative Code:

(a) Class 1: Existing Facilities.

(1) Any interior or exterior alteration of water treatment units, water supply systems, and pump station buildings where the alteration involves the addition, deletion, or modification of mechanical, electrical, or hydraulic controls.

(2) Maintenance, repair, replacement, or reconstruction to any water treatment process units, including structures, filters, pumps, and chlorinators.

(b) Class 2: Replacement or Reconstruction.

(1) Repair or replacement of any water service connections, meters, and valves for backflow prevention, air release, pressure regulating, shut-off and blow-off or flushing.

(2) Replacement or reconstruction of any existing water supply distribution lines, storage tanks and reservoirs of substantially the same size.

(3) Replacement or reconstruction of any water wells, pump stations and related appurtenances.

(c) Class 3: New Construction of Small Structures.

(1) Construction of any water supply and distribution lines of less than sixteen inches in diameter, and related appurtenances.

(2) Construction of any water storage tanks and reservoirs of less than 100,000 gallon capacity.

(d) Class 4: Minor Alterations to Land.

(1) Minor alterations to land, water, or vegetation on any officially existing designated wildlife management areas or fish production facilities for the purpose of reducing the environmental potential for nuisances or vector production.

(2) Any minor alterations to highway crossings for water supply and distribution lines.

Chapter 3. Water Recycling Criteria

Article 1. Definitions.

§60301.050. 24-hour Composite Sample.

“24-hour Composite Sample” means an aggregate sample derived from no fewer than eight discrete samples collected at equal time intervals or collected proportional to the flow rate over the compositing period. The aggregate sample shall reflect the average source water quality covering the composite 24-hour sample period.

§60301.080. Added Tracer.

“Added Tracer” means a non-reactive substance, with measureable characteristics distinctly different from the receiving groundwater, intentionally added to the water applied at a Groundwater Replenishment Reuse Project (GRRP) for the purpose of being a tracer such that the tracer can be readily identified in the groundwater downgradient of the GRRP to determine the underground retention time of the applied water.

§60301.100. Approved laboratory.

"Approved laboratory" means a laboratory that has been certified by the Department to perform microbiological analyses pursuant to section 116390, Health and Safety Code.

§60301.160. Coagulated wastewater.

"Coagulated wastewater" means oxidized wastewater in which colloidal and finely divided suspended matter have been destabilized and agglomerated upstream from a filter by the addition of suitable floc-forming chemicals.

§60301.170. Conventional treatment.

"Conventional treatment" means a treatment chain that utilizes a sedimentation unit process between the coagulation and filtration processes and produces an effluent that meets the definition for disinfected tertiary recycled water.

§60301.180. Department.
“Department” means the California Department of Public Health or its successor with authority to regulate public water systems.

§60301.190. Diluent Water.
“Diluent Water” means water, meeting the diluent requirements of this Chapter, used for reducing the recycled municipal wastewater contribution over time.

§60301.200. Direct beneficial use.
"Direct beneficial use" means the use of recycled water that has been transported from the point of treatment or production to the point of use without an intervening discharge to waters of the State.

§60301.220. Disinfected secondary-2.2 recycled water.
"Disinfected secondary-2.2 recycled water" means recycled water that has been oxidized and disinfected so that the median concentration of total coliform bacteria in the disinfected effluent does not exceed a most probable number (MPN) of 2.2 per 100 milliliters utilizing the bacteriological results of the last seven days for which analyses have been completed, and the number of total coliform bacteria does not exceed an MPN of 23 per 100 milliliters in more than one sample in any 30 day period.

§60301.225. Disinfected secondary-23 recycled water.
"Disinfected secondary-23 recycled water" means recycled water that has been oxidized and disinfected so that the median concentration of total coliform bacteria in the disinfected effluent does not exceed a most probable number (MPN) of 23 per 100 milliliters utilizing the bacteriological results of the last seven days for which analyses have been completed, and the number of total coliform bacteria does not exceed an MPN of 240 per 100 milliliters in more than one sample in any 30 day period.

§60301.230. Disinfected tertiary recycled water.
"Disinfected tertiary recycled water" means a filtered and subsequently disinfected wastewater that meets the following criteria:

(a) The filtered wastewater has been disinfected by either:

(1) A chlorine disinfection process following filtration that provides a CT (the product of total chlorine residual and modal contact time measured at the same point) value of not less than 450 milligram-minutes per liter at all times with a modal contact time of at least 90 minutes, based on peak dry weather design flow; or

(2) A disinfection process that, when combined with the filtration process, has been demonstrated to inactivate and/or remove 99.999 percent of the plaque forming units of F-specific bacteriophage MS2, or polio virus in the wastewater. A virus that is at least as resistant to disinfection as polio virus may be used for purposes of the demonstration.

(b) The median concentration of total coliform bacteria measured in the disinfected effluent does not exceed an MPN of 2.2 per 100 milliliters utilizing the bacteriological results of the last

seven days for which analyses have been completed and the number of total coliform bacteria does not exceed an MPN of 23 per 100 milliliters in more than one sample in any 30 day period. No sample shall exceed an MPN of 240 total coliform bacteria per 100 milliliters.

§60301.240. Drift.
"Drift" means the water that escapes to the atmosphere as water droplets from a cooling system.

§60301.245. Drift eliminator.
"Drift eliminator" means a feature of a cooling system that reduces to a minimum the generation of drift from the system.

§60301.250. Dual plumbed system.
"Dual plumbed system" or "dual plumbed" means a system that utilizes separate piping systems for recycled water and potable water within a facility and where the recycled water is used for either of the following purposes:

(a) To serve plumbing outlets (excluding fire suppression systems) within a building or

(b) Outdoor landscape irrigation at individual residences.

§60301.300. F-Specific bacteriophage MS-2.
"F-specific bacteriophage MS-2" means a strain of a specific type of virus that infects coliform bacteria that is traceable to the American Type Culture Collection (ATCC15597B1) and is grown on lawns of E. coli (ATCC 15597).

§60301.310. Facility.
"Facility" means any type of building or structure, or a defined area of specific use that receives water for domestic use from a public water system as defined in section 116275 of the Health and Safety Code.

§60301.320. Filtered wastewater.
"Filtered wastewater" means an oxidized wastewater that meets the criteria in subsection (a) or (b):

(a) Has been coagulated and passed through natural undisturbed soils or a bed of filter media pursuant to the following:

(1) At a rate that does not exceed 5 gallons per minute per square foot of surface area in mono, dual or mixed media gravity, upflow or pressure filtration systems, or does not exceed 2 gallons per minute per square foot of surface area in traveling bridge automatic backwash filters; and

(2) So that the turbidity of the filtered wastewater does not exceed any of the following:

(A) An average of 2 NTU within a 24-hour period;

(B) 5 NTU more than 5 percent of the time within a 24-hour period; and

(C) 10 NTU at any time.

(b) Has been passed through a microfiltration, ultrafiltration, nanofiltration, or reverse osmosis membrane so that the turbidity of the filtered wastewater does not exceed any of the following:

(1) 0.2 NTU more than 5 percent of the time within a 24-hour period; and
(2) 0.5 NTU at any time.

§60301.330. Food crops.
"Food crops" means any crops intended for human consumption.

§60301.370. Groundwater.
“Groundwater” means water below the land surface in a saturated zone.

§60301.390. Groundwater Replenishment Reuse Project or GRRP.
"Groundwater Replenishment Reuse Project” or “GRRP" means a project involving the planned use of recycled municipal wastewater that is operated for the purpose of replenishing a groundwater basin designated in the Water Quality Control Plan [as defined in Water Code section 13050(j)] for use as a source of municipal and domestic water supply.

§60301.400. Hose bib.
"Hose bib" means a faucet or similar device to which a common garden hose can be readily attached.

§60301.450. Indicator Compound.
“Indicator Compound” means an individual chemical in a GRRP's municipal wastewater that represents the physical, chemical, and biodegradable characteristics of a specific family of trace organic chemicals; is present in concentrations that provide information relative to the environmental fate and transport of those chemicals; may be used to monitor the efficiency of trace organic compounds removal by treatment processes; and provides an indication of treatment process failure.

§60301.455. Intrinsic Tracer.
“Intrinsic Tracer” means a substance or attribute present in the recharge water at levels different from the receiving groundwater such that the substance in the water applied at the GRRP can be distinctly and sufficiently detected in the groundwater downgradient of the GRRP to determine the underground retention time of the water.

§60301.550. Landscape impoundment.
"Landscape impoundment" means an impoundment in which recycled water is stored or used for aesthetic enjoyment or landscape irrigation, or which otherwise serves a similar function and is not intended to include public contact.

§60301.575. Maximum Contaminant Level or MCL.
“Maximum Contaminant Level” or “MCL” means the maximum permissible concentration of a contaminant established pursuant to sections 116275(c)(1) and (d) of the Health and Safety Code or established by the U.S. Environmental Protection Agency.

§60301.600. Modal contact time.
"Modal contact time" means the amount of time elapsed between the time that a tracer, such as salt or dye, is injected into the influent at the entrance to a chamber and the time that the highest concentration of the tracer is observed in the effluent from the chamber.

§60301.620. Nonrestricted recreational impoundment.
"Nonrestricted recreational impoundment" means an impoundment of recycled water, in which no limitations are imposed on body-contact water recreational activities.

§60301.625. Notification Level or NL.
“Notification Level” or “NL” means the concentration of a contaminant established by the Department pursuant to section 116455 of the Health and Safety Code.

§60301.630. NTU.
"NTU" (Nephelometric turbidity unit) means a measurement of turbidity as determined by the ratio of the intensity of light scattered by the sample to the intensity of incident light as measured by method 2130 B. in Standard Methods for the Examination of Water and Wastewater, 20th ed.; Eaton, A. D., Clesceri, L. S., and Greenberg, A. E., Eds; American Public Health Association: Washington, DC, 1995; p. 2-8.

§60301.650. Oxidized wastewater.
"Oxidized wastewater" means wastewater in which the organic matter has been stabilized, is nonputrescible, and contains dissolved oxygen.

§60301.660. Peak dry weather design flow.
"Peak Dry Weather Design Flow" means the arithmetic mean of the maximum peak flow rates sustained over some period of time (for example three hours) during the maximum 24-hour dry weather period. Dry weather period is defined as periods of little or no rainfall.

§60301.670. Project Sponsor.
"Project Sponsor" means an entity subject to a Regional Water Quality Control Board’s (Regional Board’s) water recycling requirements for a Groundwater Replenishment Reuse Project (GRRP) and is, in whole or part, responsible for applying to the Regional Board for a permit, obtaining a permit, operation of a GRRP, and complying with the terms and conditions of the permit and the requirements of this Chapter.

§60301.680. Public Water System.
“Public Water System” has the same meaning as defined in section 116275(h) of the Health and Safety Code.

§60301.685. Recharge Water.
“Recharge Water” means recycled municipal wastewater, or the combination of recycled municipal wastewater and credited diluent water, which is utilized by a GRRP for groundwater replenishment.

§60301.690. Recycled Municipal Wastewater.
“Recycled Municipal Wastewater” means recycled water that is the effluent from the treatment of wastewater of municipal origin.

§60301.700. Recycled water agency.
"Recycled water agency" means the public water system, or a publicly or privately owned or operated recycled water system, that delivers or proposes to deliver recycled water to a facility.

§60301.705. Recycled Municipal Wastewater Contribution or RWC.
“Recycled Municipal Wastewater Contribution” or “RWC” means the fraction equal to the quantity of recycled municipal wastewater applied at the GRRP divided by the sum of the quantity of recycled municipal wastewater and credited diluent water.

§60301.710. Recycling plant.
"Recycling plant" means an arrangement of devices, structures, equipment, processes and controls which produce recycled water.

§60301.740. Regulatory agency.
"Regulatory agency" means the California Regional Water Quality Control Board(s) that have jurisdiction over the recycling plant and use areas.

§60301.750. Restricted access golf course.
"Restricted access golf course" means a golf course where public access is controlled so that areas irrigated with recycled water cannot be used as if they were part of a park, playground, or school yard and where irrigation is conducted only in areas and during periods when the golf course is not being used by golfers.

§60301.760. Restricted recreational impoundment.
"Restricted recreational impoundment" means an impoundment of recycled water in which recreation is limited to fishing, boating, and other non-body-contact water recreational activities.

§60301.770. Regional Board.
“Regional Board” means the Regional Water Quality Control Board.

§60301.780. Saturated Zone.
“Saturated Zone” means an underground region or regions in which all interstices in, between, and below natural geologic materials are filled with water, with the uppermost surface of the saturated zone being the water table.

§60301.800. Spray irrigation.
"Spray irrigation" means the application of recycled water from sprinklers to crops or vegetation.

§60301.810. Spreading Area.

“Spreading Area” means a natural or constructed impoundment with a depth equal to or less than its widest surface dimension used by a GRRP to replenish a groundwater basin with recharge water infiltrating and percolating through a zone that, in the absence of a GRRP, would be an unsaturated zone.

§60301.830. Standby unit process.
"Standby unit process" means an alternate unit process or an equivalent alternative process which is maintained in operable condition and which is capable of providing comparable treatment of the actual flow through the unit for which it is a substitute.

§60301.840. Subsurface Application.
"Subsurface Application" means the application of recharge water to a groundwater basin(s) by a means other than surface application.

§60301.850. Surface Application.
"Surface Application" means the application of recharge water to a spreading area.

§60301.855. Surrogate Parameter.
“Surrogate Parameter” means a measurable physical or chemical property that has been demonstrated to provide a direct correlation with the concentration of an indicator compound, can be used to monitor the efficiency of trace organic compounds removal by a treatment process, and/or provides an indication of a treatment process failure.

§60301.860. Total Nitrogen.
“Total Nitrogen” means the sum of concentrations of ammonia, nitrite, nitrate, and organic nitrogen-containing compounds, expressed as nitrogen.

§60301.870. Total Organic Carbon or TOC.
"Total Organic Carbon” or “TOC” means the concentration of organic carbon present in water.

§60301.900. Undisinfected secondary recycled water.
"Undisinfected secondary recycled water" means oxidized wastewater.

§60301.910. Unsaturated Zone.
“Unsaturated Zone” means the volume between the land surface and the uppermost saturated zone.

§60301.920. Use area.
"Use area" means an area of recycled water use with defined boundaries. A use area may contain one or more facilities.

Article 2. Sources of Recycled Water.

§60302. Source specifications.
The requirements in this chapter shall only apply to recycled water from sources that contain domestic waste, in whole or in part.

Article 3. Uses of Recycled Water.

§60303. Exceptions.
The requirements set forth in this chapter shall not apply to the use of recycled water onsite at a water recycling plant, or wastewater treatment plant, provided access by the public to the area of onsite recycled water use is restricted.

§60304. Use of recycled water for irrigation.

(a) Recycled water used for the surface irrigation of the following shall be a disinfected tertiary recycled water, except that for filtration pursuant to Section 60301.320(a) coagulation need not be used as part of the treatment process provided that the filter effluent turbidity does not exceed 2 NTU, the turbidity of the influent to the filters is continuously measured, the influent turbidity does not exceed 5 NTU for more than 15 minutes and never exceeds 10 NTU, and that there is the capability to automatically activate chemical addition or divert the wastewater should the filter influent turbidity exceed 5 NTU for more than 15 minutes:

(1) Food crops, including all edible root crops, where the recycled water comes into contact with the edible portion of the crop,

(2) Parks and playgrounds,

(3) School yards,

(4) Residential landscaping,

(5) Unrestricted access golf courses, and

(6) Any other irrigation use not specified in this section and not prohibited by other sections of the California Code of Regulations.

(b) Recycled water used for the surface irrigation of food crops where the edible portion is produced above ground and not contacted by the recycled water shall be at least disinfected secondary-2.2 recycled water.

(c) Recycled water used for the surface irrigation of the following shall be at least disinfected secondary-23 recycled water:

(1) Cemeteries,

(2) Freeway landscaping,

(3) Restricted access golf courses,

(4) Ornamental nursery stock and sod farms where access by the general public is not restricted,

(5) Pasture for animals producing milk for human consumption, and

(6) Any nonedible vegetation where access is controlled so that the irrigated area cannot be used as if it were part of a park, playground or school yard

(d) Recycled wastewater used for the surface irrigation of the following shall be at least undisinfected secondary recycled water:

(1) Orchards where the recycled water does not come into contact with the edible portion of the crop,

(2) Vineyards where the recycled water does not come into contact with the edible portion of the crop,

(3) Non food-bearing trees (Christmas tree farms are included in this category provided no irrigation with recycled water occurs for a period of 14 days prior to harvesting or allowing access by the general public),

(4) Fodder and fiber crops and pasture for animals not producing milk for human consumption,

(5) Seed crops not eaten by humans,

(6) Food crops that must undergo commercial pathogen-destroying processing before being consumed by humans, and

(7) Ornamental nursery stock and sod farms provided no irrigation with recycled water occurs for a period of 14 days prior to harvesting, retail sale, or allowing access by the general public.

(e) No recycled water used for irrigation, or soil that has been irrigated with recycled water, shall come into contact with the edible portion of food crops eaten raw by humans unless the recycled water complies with subsection (a).

§60305. Use of recycled water for impoundments.

(a) Except as provided in subsection (b), recycled water used as a source of water supply for nonrestricted recreational impoundments shall be disinfected tertiary recycled water that has been subjected to conventional treatment.

(b) Disinfected tertiary recycled water that has not received conventional treatment may be used for nonrestricted recreational impoundments provided the recycled water is monitored for the presence of pathogenic organisms in accordance with the following:

(1) During the first 12 months of operation and use the recycled water shall be sampled and analyzed monthly for *Giardia*, enteric viruses, and *Cryptosporidium*. Following the first 12 months of use, the recycled water shall be sampled and analyzed quarterly for *Giardia*, enteric viruses, and *Cryptosporidium*. The ongoing monitoring may be discontinued after the first two years of operation with the approval of the department. This monitoring shall be in addition to the monitoring set forth in section 60321.

(2) The samples shall be taken at a point following disinfection and prior to the point where the recycled water enters the use impoundment. The samples shal be analyzed by an approved laboratory and the results submitted quarterly to the regulatory agency.

(c) The total coliform bacteria concentrations in recycled water used for nonrestricted recreational impoundments, measured at a point between the disinfection process and the point of entry to the use impoundment, shall comply with the criteria specified in section 60301.230 (b) for disinfected tertiary recycled water.

(d) Recycled water used as a source of supply for restricted recreational impoundments and for any publicly accessible impoundments at fish hatcheries shall be at least disinfected secondary-2.2 recycled water.

(e) Recycled water used as a source of supply for landscape impoundments that do not utilize decorative fountains shall be at least disinfected secondary-23 recycled water.

§60306. Use of recycled water for cooling.

(a) Recycled water used for industrial or commercial cooling or air conditioning that involves the use of a cooling tower, evaporative condenser, spraying or any mechanism that creates a mist shall be a disinfected tertiary recycled water.

(b) Use of recycled water for industrial or commercial cooling or air conditioning that does not involve the use of a cooling tower, evaporative condenser, spraying, or any mechanism that creates a mist shall be at least disinfected secondary-23 recycled water.

(c) Whenever a cooling system, using recycled water in conjunction with an air conditioning facility, utilizes a cooling tower or otherwise creates a mist that could come into contact with employees or members of the public, the cooling system shall comply with the following:

(1) A drift eliminator shall be used whenever the cooling system is in operation.

(2) A chlorine, or other, biocide shall be used to treat the cooling system recirculating water to minimize the growth of *Legionella* and other microorganisms.

§60307. Use of recycled water for other purposes.

(a) Recycled water used for the following shall be disinfected tertiary recycled water, except that for filtration being provided pursuant to Section 60301.320(a) coagulation need not be used as part of the treatment process provided that the filter effluent turbidity does not exceed 2 NTU, the turbidity of the influent to the filters is continuously measured, the influent turbidity does not exceed 5 NTU for more than 15 minutes and never exceeds 10 NTU, and that there is the capability to automatically activate chemical addition or divert the wastewater should the filter influent turbidity exceed 5 NTU for more than 15 minutes:

(1) Flushing toilets and urinals,
(2) Priming drain traps,
(3) Industrial process water that may come into contact with workers,
(4) Structural fire fighting,
(5) Decorative fountains,
(6) Commercial laundries,
(7) Consolidation of backfill around potable water pipelines,
(8) Artificial snow making for commercial outdoor use, and
(9) Commercial car washes, including hand washes if the recycled water is not heated, where the general public is excluded from the washing process.

(b) Recycled water used for the following uses shall be at least disinfected secondary-23 recycled water:

(1) Industrial boiler feed,
(2) Nonstructural fire fighting,
(3) Backfill consolidation around nonpotable piping,
(4) Soil compaction,
(5) Mixing concrete,
(6) Dust control on roads and streets,
(7) Cleaning roads, sidewalks and outdoor work areas and
(8) Industrial process water that will not come into contact with workers.

(c) Recycled water used for flushing sanitary sewers shall be at least undisinfected secondary recycled water.

Article 4. Use Area Requirements.

§60310. Use area requirements.

(a) No irrigation with disinfected tertiary recycled water shall take place within 50 feet of any domestic water supply well unless all of the following conditions have been met:

(1) A geological investigation demonstrates that an aquitard exists at the well between the uppermost aquifer being drawn from and the ground surface.

(2) The well contains an annular seal that extends from the surface into the aquitard.

(3) The well is housed to prevent any recycled water spray from coming into contact with the wellhead facilities.

(4) The ground surface immediately around the wellhead is contoured to allow surface water to drain away from the well.

(5) The owner of the well approves of the elimination of the buffer zone requirement.

(b) No impoundment of disinfected tertiary recycled water shall occur within 100 feet of any domestic water supply well.

(c) No irrigation with, or impoundment of, disinfected secondary-2.2 or disinfected secondary-23 recycled water shall take place within 100 feet of any domestic water supply well.

(d) No irrigation with, or impoundment of, undisinfected secondary recycled water shall take place within 150 feet of any domestic water supply well.

(e) Any use of recycled water shall comply with the following:

(1) Any irrigation runoff shall be confined to the recycled water use area, unless the runoff does not pose a public health threat and is authorized by the regulatory agency.

(2) Spray, mist, or runoff shall not enter dwellings, designated outdoor eating areas, or food handling facilities.

(3) Drinking water fountains shall be protected against contact with recycled water spray, mist, or runoff.

(f) No spray irrigation of any recycled water, other than disinfected tertiary recycled water, shall take place within 100 feet of a residence or a place where public exposure could be similar to that of a park, playground, or school yard.

(g) All use areas where recycled water is used that are accessible to the public shall be posted with signs that are visible to the public, in a size no less than 4 inches high by 8 inches wide, that include the following wording : "RECYCLED WATER - DO NOT DRINK". Each sign shall display an international symbol similar to that shown in figure 60310-A. The Department may accept alternative signage and wording, or an educational program, provided the applicant demonstrates to the Department that the alternative approach will assure an equivalent degree of public notification.

(h) Except as allowed under section 7604 of title 17, California Code of Regulations, no physical connection shall be made or allowed to exist between any recycled water system and any separate system conveying potable water.

(i) Except for use in a cemetery that complies with the requirements of section 8118 of the Health and Safety Code, the portions of the recycled water piping system that are in areas

subject to access by the general public shall not include any hose bibs. Only quick couplers that differ from those used on the potable water system shall be used on the portions of the recycled water piping system in areas subject to public access.

Water Recycling Criteria

FIGURE 60310-A

Article 5. Dual Plumbed Recycled Water Systems.

§60313. General requirements.

(a) No person other than a recycled water agency shall deliver recycled water to a dual plumbed facility.

(b) Except as allowed pursuant to section 13553(d) of the Water Code, a recycled water agency shall not deliver recycled water for any internal use to any individually-owned residential units including free-standing structures, multiplexes, or condominiums.[1]

(c) No recycled water agency shall deliver recycled water for internal use except for fire suppression systems, to any facility that produces or processes food products or beverages. For purposes of this Subsection, cafeterias or snack bars in a facility whose primary function does not involve the production or processing of foods or beverages are not considered facilities that produce or process foods or beverages.

(d) No recycled water agency shall deliver recycled water to a facility using a dual plumbed system unless the report required pursuant to section 13522.5 of the Water Code, and which meets the requirements set forth in section 60314, has been submitted to, and approved by, the regulatory agency.

§60314. Report submittal.

(a) For dual-plumbed recycled water systems, **t**he report submitted pursuant to section13522.5 of the Water Code shall contain the following information in addition to the information required by section 60323:

(1) A detailed description of the intended use area identifying the following:

(A) The number, location, and type of facilities within the use area proposing to use dual plumbed systems,

(B) The average number of persons estimated to be served by each facility on a daily basis,

(C) The specific boundaries of the proposed use area including a map showing the location of each facility to be served,

(D) The person or persons responsible for operation of the dual plumbed system at each facility, and

(E) The specific use to be made of the recycled water at each facility.

(2) Plans and specifications describing the following:

(A) Proposed piping system to be used,

(B) Pipe locations of both the recycled and potable systems,

(C) Type and location of the outlets and plumbing fixtures that will be accessible to the public, and

(D) The methods and devices to be used to prevent backflow of recycled water into the public water system.

(3) The methods to be used by the recycled water agency to assure that the installation and operation of the dual plumbed system will not result in cross connections between the recycled water piping system and the potable water piping system. This shall include a

[1] AB 1406, Chapter 537, Statutes of 2007, Water Code 13553, et seq., allows condominiums to be plumbed with recycled water, subject to a number of provisions.

description of pressure, dye or other test methods to be used to test the system every four years.

(b) A master plan report that covers more than one facility or use site may be submitted provided the report includes the information required by this section. Plans and specifications for individual facilities covered by the report may be submitted at any time prior to the delivery of recycled water to the facility.

§60315. Design requirements.

The public water supply shall not be used as a backup or supplemental source of water for a dual-plumbed recycled water system unless the connection between the two systems is protected by an air gap separation which complies with the requirements of sections 7602 (a) and 7603 (a) of title 17, California Code of Regulations, and the approval of the public water system has been obtained.

§60316. Operation requirements.

(a) Prior to the initial operation of the dual-plumbed recycled water system and annually thereafter, the Recycled Water Agency shall ensure that the dual plumbed system within each facility and use area is inspected for possible cross connections with the potable water system. The recycled water system shall also be tested for possible cross connections at least once every four years. The testing shall be conducted in accordance with the method described in the report submitted pursuant to section 60314. The inspections and the testing shall be performed by a cross connection control specialist certified by the California-Nevada section of the American Water Works Association or an organization with equivalent certification requirements. A written report documenting the result of the inspection or testing for the prior year shall be submitted to the department within 30 days following completion of the inspection or testing.

(b) The recycled water agency shall notify the department of any incidence of backflow from the dual-plumbed recycled water system into the potable water system within 24 hours of the discovery of the incident.

(c) Any backflow prevention device installed to protect the public water system serving the dual-plumbed recycled water system shall be inspected and maintained in accordance with section 7605 of Title 17, California Code of Regulations.

Article 5.1. Indirect Potable Reuse: Groundwater Replenishment – Surface Application.

~~**§60320. Groundwater recharge.** ***(repealed)***~~

~~(a) Reclaimed water used for groundwater recharge of domestic water supply aquifers by surface spreading shall be at all times of a quality that fully protects public health. The State Department of Health Services' recommendations to the Regional Water Quality Control Boards for proposed groundwater recharge projects and for expansion of existing projects will be made on an individual case basis where the use of reclaimed water involves a potential risk to public health.~~

~~(b) The State Department of Health Services' recommendations will be based on all relevant aspects of each project, including the following factors: treatment provided; effluent quality and quantity; spreading area operations; soil characteristics; hydrogeology; residence time; and distance to withdrawal.~~

~~(c) The State Department of Health Services will hold a public hearing prior to making the final determination regarding the public health aspects of each groundwater recharge project. Final recommendations will be submitted to the Regional Water Quality Control Board in an expeditious manner.~~

§60320.100. General Requirements.

(a) The requirements of this Article apply to Groundwater Replenishment Reuse Projects (GRRPs) utilizing surface application, which receive initial permits from the Regional Board after June 18, 2014. Within 12 months after June 18, 2014, a project sponsor for a GRRP permitted on or before June 18, 2014, shall submit a report to the Department and appropriate Regional Board assessing its compliance with the requirements of this Article. For each requirement considered noncompliant and applicable by the Department or Regional Board, a project sponsor shall submit a schedule to the Department and Regional Board, for demonstrating and/or achieving compliance with the applicable requirements of this Article. Unless directed otherwise by the Department, a project sponsor's report for a GRRP permitted on or before June 18, 2014, need not assess compliance with requirements of this Article that are required to be met prior to operation of a GRRP, except subsection (b) of this section. The report is subject to review and approval by the Department and Regional Board.

(b) Prior to operation of a GRRP, the GRRP's project sponsor shall obtain Department approval of a plan describing the steps a project sponsor will take to provide an alternative source of drinking water supply to all users of a producing drinking water well, or a Department-approved treatment mechanism a project sponsor will provide to all owners of a producing drinking water well, that as a result of the GRRP's operation, as determined by the Department:

(1) violates a California or federal drinking water standard;

(2) has been degraded to the degree that it is no longer a safe source of drinking water; or

(3) receives water that fails to meet section 60320.108.

(c) Prior to operating a GRRP, a project sponsor shall collect at least four samples, at least one sample each quarter, from each potentially affected aquifer. The samples shall be representative of water in each aquifer, taking into consideration seasonal variations, and be analyzed for the chemicals, contaminants, and characteristics pursuant to sections 60320.110, 60320.112, 60320.118, and 60320.120.

(d) A GRRP's recycled municipal wastewater shall be retained underground for a period of time no less than the retention time required pursuant to sections 60320.108 and 60320.124. The GRRP shall be designed and operated in a manner that ensures water treated pursuant to this Article, beyond the boundary described in subsection (e)(2), meets the recycled municipal wastewater contributions (RWC) requirements in section 60320.116.

(e) Based on hydrogeologic flowpaths, a GRRP's project sponsor shall provide the Department, Regional Board, and local well-permitting authorities a map of the GRRP site at a scale of 1:24,000 or larger (1 inch equals 2,000 feet or 1 inch equals less than 2,000 feet) or, if necessary, a site sketch at a scale providing more detail, that clearly indicates the criteria in

paragraphs (1) – (4) below. A revised map shall be prepared and provided when conditions change such that the previous map no longer accurately reflects current conditions.

(1) the location and boundaries of the GRRP;

(2) a boundary representing a zone of controlled drinking water well construction, the greatest of the horizontal and vertical distances reflecting the retention times required pursuant to sections 60320.108 and 60320.124;

(3) a secondary boundary representing a zone of potential controlled drinking water well construction, depicting the zone within which a well would extend the boundary in paragraph (2) to include existing or potential future drinking water wells, thereby requiring further study and potential mitigating activities prior to drinking water well construction; and

(4) the location of all monitoring wells established pursuant to section 60320.126, and drinking water wells within two years travel time of the GRRP based on groundwater flow directions and velocities expected under GRRP operating conditions.

(f) Prior to operating a GRRP, a project sponsor shall demonstrate to the Department and Regional Board that a project sponsor possesses adequate managerial and technical capability to assure compliance with this Article.

(g) Prior to replenishing a groundwater basin or an aquifer with recycled municipal wastewater, a GRRP's project sponsor shall demonstrate that all treatment processes have been installed and can be operated by a project sponsor to achieve their intended function. A protocol describing the actions to be taken to meet this subsection shall be included in the engineering report submitted pursuant section 60323.

(h) In the engineering report required pursuant to section 60323, a project sponsor for a GRRP shall include a hydrogeological assessment of the proposed GRRP's setting. The assessment shall include the following:

(1) the qualifications of the individual(s) preparing the assessment;

(2) a general description of geologic and hydrogeological setting of the groundwater basin(s) potentially directly impacted by the GRRP;

(3) a detailed description of the stratigraphy beneath the GRRP, including the composition, extent, and physical properties of the affected aquifers; and

(4) based on at least four rounds of consecutive quarterly monitoring to capture seasonal impacts;

(A) the existing hydrogeology and the hydrogeology anticipated as a result of the operation of the GRRP, and

(B) maps showing quarterly groundwater elevation contours, along with vector flow directions and calculated hydraulic gradients.

(i) If a project sponsor fails to complete compliance monitoring required pursuant to this Article, the Regional Board may determine water quality-related compliance based on available data.

(j) A project sponsor shall ensure that the recycled municipal wastewater used for a GRRP shall be from a wastewater management agency that is not in violation of the effluent limits pertaining to groundwater replenishment pursuant to this Article, as established in the wastewater management agency's Regional Board permit.

(k) If a project sponsor has been directed by the Department or Regional Board to suspend surface application pursuant to this Article, surface application shall not resume until the project sponsor has obtained Department and Regional Board approval.

§60320.102. Public Hearing.

(a) A public hearing for a GRRP shall be held by a project sponsor prior to the Department's submittal of its recommendations to the Regional Board for the GRRP's initial permit and any time an increase in maximum RWC has been proposed but not addressed in a prior public hearing. Prior to a public hearing conducted pursuant to this section, a project sponsor shall provide the Department, for its review and approval, the information a project sponsor intends to present at the hearing. Following the Department's approval of the information, a project sponsor shall place the information on a project sponsor's Web site and in a repository that provides at least 30 days of public access to the information prior to the public hearing.

(b) Prior to placing the information required pursuant to subsection (a) in a repository, a project sponsor shall:

(1) Notify the public of the following;

(A) the location and hours of operation of the repository,

(B) the Internet address where the information may be viewed,

(C) the purpose of the repository and public hearing,

(D) the manner in which the public can provide comments, and

(E) the date, time, and location of the public hearing; and

(2) At a minimum, notify the first downgradient drinking water well owner and well owners whose drinking water well is within 10 years from the GRRP based on groundwater flow directions and velocities.

(c) Unless directed otherwise by the Department, the public notification made pursuant to subsection (b)(2) shall be by direct mail and the notification made pursuant to subsection (b)(1) shall be delivered in a manner to reach persons whose source of drinking water may be impacted by the GRRP, using one or more of the following methods:

(1) local newspaper(s) publication of general circulation;

(2) mailed or direct delivery of a newsletter;

(3) conspicuously placed statement in water bills; and/or

(4) television and/or radio.

§60320.104. Lab Analyses.

(a) Analyses for contaminants having primary or secondary MCLs shall be performed by laboratories approved to perform such analyses by the Department utilizing Department-approved drinking water methods.

(b) Analyses for chemicals other than those having primary or secondary MCLs shall be described in the GRRP's Operation Optimization Plan prepared pursuant to section 60320.122.

§60320.106. Wastewater Source Control.

A project sponsor shall ensure that the recycled municipal wastewater used for a GRRP shall be from a wastewater management agency that:

(a) administers an industrial pretreatment and pollutant source control program; and

(b) implements and maintains a source control program that includes, at a minimum;

(1) an assessment of the fate of Department-specified and Regional Board-specified chemicals and contaminants through the wastewater and recycled municipal wastewater treatment systems,

(2) chemical and contaminant source investigations and monitoring that focuses on Department-specified and Regional Board-specified chemicals and contaminants,

(3) an outreach program to industrial, commercial, and residential communities within the portions of the sewage collection agency's service area that flows into the water reclamation plant subsequently supplying the GRRP, for the purpose of managing and minimizing the discharge of chemicals and contaminants at the source, and

(4) a current inventory of chemicals and contaminants identified pursuant to this section, including new chemicals and contaminants resulting from new sources or changes to existing sources, that may be discharged into the wastewater collection system.

§60320.108. Pathogenic Microorganism Control.

(a) A project sponsor shall design and operate a GRRP such that the recycled municipal wastewater used as recharge water for a GRRP receives treatment that achieves at least 12-log enteric virus reduction, 10-log Giardia cyst reduction, and 10-log Cryptosporidium oocyst reduction. The treatment train shall consist of at least three separate treatment processes. Except as provided in subsection (c), for each pathogen (i.e., virus, Giardia cyst, or Cryptosporidium oocyst), a separate treatment process may be credited with no more than 6-log reduction, with at least three processes each being credited with no less than 1.0-log reduction.

(b) At a minimum, the recycled municipal wastewater applied at a GRRP shall receive treatment that meets:

(1) the definition of filtered wastewater, pursuant to section 60301.320; and

(2) the definition of disinfected tertiary recycled water, pursuant to section 60301.230.

(c) For each month retained underground as demonstrated in subsection (e), the recycled municipal wastewater or recharge water will be credited with 1-log virus reduction. A GRRP meeting subsections (b)(1) and (2) or providing advanced treatment in accordance with section 60320.201 for the entire flow of the recycled municipal wastewater used for groundwater replenishment, that also demonstrates at least six months retention underground pursuant to subsection (e), will be credited with 10-log Giardia cyst reduction and 10-log Cryptosporidium oocyst reduction.

(d) With the exception of log reduction credited pursuant to subsection (c), a project sponsor shall validate each of the treatment processes used to meet the requirements in subsection (a) for their log reduction by submitting a report for the Department's review and approval, or by using a challenge test approved by the Department, that provides evidence of the treatment process's ability to reliably and consistently achieve the log reduction. The report and/or challenge test shall be prepared by an engineer licensed in California with at least five years of experience, as a licensed engineer, in wastewater treatment and public water supply, including the evaluation of treatment processes for pathogen control. With the exception of retention time underground and a soil-aquifer treatment process, a project sponsor shall propose and include in its Operation Optimization Plan prepared pursuant to section 60320.122, on-going monitoring using the pathogenic microorganism of concern or a microbial, chemical, or physical surrogate parameter(s) that verifies the performance of each treatment process's ability to achieve its credited log reduction.

(e) To demonstrate the retention time underground in subsection (c), a tracer study utilizing an added tracer shall be implemented under hydraulic conditions representative of normal GRRP operations. The retention time shall be the time representing the difference from when the water with the tracer is applied at the GRRP to when either; two percent (2%) of the initially

introduced tracer concentration has reached the downgradient monitoring point, or ten percent (10%) of the peak tracer unit value observed at the downgradient monitoring point reached the monitoring point. A project sponsor for a GRRP shall initiate the tracer study prior to the end of the third month of operation. A project sponsor for a GRRP permitted on or before June 18, 2014, that has not already performed such a tracer study shall complete a tracer study demonstrating the retention time underground. With Department approval, an intrinsic tracer may be used in lieu of an added tracer, with no more credit provided than the corresponding virus log reduction in column 2 of Table 60320.108.

(f) For the purpose of siting a GRRP location during project planning and until a GRRP's project sponsor has met the requirements of subsection (e), for each month of retention time estimated using the method in column 1, the recycled municipal wastewater or recharge water shall be credited with no more than the corresponding virus log reduction in column 2 of Table 60320.108.

Table 60320.108

Column 1	Column 2
Method used to estimate the retention time to the nearest downgradient drinking water well	**Virus Log Reduction Credit per Month**
Tracer study utilizing an added tracer.[1]	1.0 log
Tracer study utilizing an intrinsic tracer.[1]	0.67 log
Numerical modeling consisting of calibrated finite element or finite difference models using validated and verified computer codes used for simulating groundwater flow.	0.50 log
Analytical modeling using existing academically-accepted equations such as Darcy's Law to estimate groundwater flow conditions based on simplifying aquifer assumptions.	0.25 log

[1] The retention time shall be the time representing the difference from when the water with the tracer is applied at the GRRP to when either; two percent (2%) of the initially introduced tracer concentration has reached the downgradient monitoring point, or ten percent (10%) of the peak tracer unit value observed at the downgradient monitoring point reached the monitoring point.

(g) A project sponsor shall obtain Department approval for the protocol(s) to be used to establish the retention times in subsections (e) and (f).

(h) Based on changes in hydrogeological or climatic conditions since the most recent demonstration, the Department may require a GRRP's project sponsor to demonstrate that the underground retention times required in this section are being met.

(i) If a pathogen reduction in subsection (a) is not met based on the on-going monitoring required pursuant to subsection (d), within 24 hours of being aware a project sponsor shall immediately investigate the cause and initiate corrective actions. The project sponsor shall immediately notify the Department and Regional Board if the GRRP fails to meet the pathogen reduction criteria longer than 4 consecutive hours, or more than a total of 8 hours during any 7-

day period. Failures of shorter duration shall be reported to the Regional Board by a project sponsor no later than 10 days after the month in which the failure occurred.

(j) If the effectiveness of a treatment train's ability to reduce enteric virus is less than 10-logs, or Giardia cyst or Cryptosporidium oocyst reduction is less than 8-logs, a project sponsor shall immediately notify the Department and Regional Board, and discontinue application of recycled municipal wastewater at the GRRP, unless directed otherwise by the Department or Regional Board.

§60320.110. Nitrogen Compounds Control.

(a) To demonstrate control of the nitrogen compounds, a project sponsor shall:

(1) Each week, at least three days apart as specified in the GRRP's Operation Optimization Plan, collect at least two total nitrogen samples (grab or 24-hour composite) representative of the recycled municipal wastewater or recharge water applied throughout the spreading area. Samples may be collected before or after surface application;

(2) Have the samples collected pursuant to paragraph (1) analyzed for total nitrogen, with the laboratory being required by a project sponsor to complete each analysis within 72 hours and have the result reported to a project sponsor within the same 72 hours if the result of any single sample exceeds 10 mg/L;

(3) If the average of the results of two consecutive samples collected pursuant to paragraph (1) exceeds 10 mg/L total nitrogen;

(A) take a confirmation sample and notify the Department and the Regional Board within 48 hours of being notified of the results by the laboratory,

(B) investigate the cause for the exceedances and take actions to reduce the total nitrogen concentrations to ensure continued or future exceedances do not occur, and

(C) initiate additional monitoring for nitrogen compounds as described in the GRRP's Operation Optimization Plan, including locations in the groundwater basin and spreading area, to identify elevated concentrations and determine whether such elevated concentrations exceed or may lead to an exceedance of a nitrogen-based MCL; and

(4) If the average of the results of four consecutive samples collected pursuant to paragraph (1) exceeds 10 mg/L total nitrogen, suspend the surface application of recycled municipal wastewater. Surface application shall not resume until corrective actions have been taken and at least two consecutive total nitrogen sampling results are less than 10 mg/L.

(b) As determined by the Department and based on a GRRP's operation, including but not limited to the time the spreading area is out of service and utilization of a denitrification process, a project sponsor shall initiate additional monitoring for nitrogen compounds to identify elevated concentrations in the groundwater and determine whether such elevated concentrations exceed or may lead to an exceedance of a nitrogen-based MCL.

(c) Following Department and Regional Board approval, a project sponsor may initiate reduced monitoring frequencies for total nitrogen. A project sponsor may apply to the Department and Regional Board for reduced monitoring frequencies for total nitrogen if, for the most recent 24 months:

(1) the average of all results did not exceed 5 mg/L total nitrogen; and

(2) the average of a result and its confirmation sample (taken within 24 hours of receipt of the initial result) did not exceed 10 mg/L total nitrogen.

(d) If the results of reduced monitoring conducted as approved pursuant to subsection (c) exceed the total nitrogen concentration criteria in subsection (c), a project sponsor shall revert

to the monitoring frequencies for total nitrogen prior to implementation of the reduced frequencies. Reduced frequency monitoring shall not resume unless the requirements of subsection (c) are met.

§60320.112. Regulated Contaminants and Physical Characteristics Control.

(a) Each quarter, as specified in the GRRP's Operation Optimization Plan, a project sponsor shall collect samples (grab or 24-hour composite) representative of the applied recycled municipal wastewater and have the samples analyzed for:

(1) the inorganic chemicals in Table 64431-A, except for nitrogen compounds;
(2) the radionuclide chemicals in Tables 64442 and 64443;
(3) the organic chemicals in Table 64444-A;
(4) the disinfection byproducts in Table 64533-A; and
(5) lead and copper.

(b) Recharge water (including recharge water after surface application) may be monitored in lieu of recycled municipal wastewater to satisfy the monitoring requirements in subsection (a)(4) if the fraction of recycled municipal wastewater in the recharge water is equal to or greater than the average fraction of recycled municipal wastewater in the recharge water applied over the quarter. If the fraction of recycled municipal wastewater in the recharge water being monitored is less than the average fraction of recycled municipal wastewater in the recharge water applied over the quarter, the reported value shall be adjusted to exclude the effects of dilution.

(c) Each year, the GRRP's project sponsor shall collect at least one representative sample (grab or 24-hour composite) of the recycled municipal wastewater or recharge water and have the sample(s) analyzed for the secondary drinking water contaminants in Tables 64449-A and 64449-B.

(d) If a result of the monitoring performed pursuant to subsection (a) exceeds a contaminant's MCL or action level (for lead and copper), a project sponsor shall collect another sample within 72 hours of notification of the result and then have it analyzed for the contaminant as confirmation.

(1) For a contaminant whose compliance with its MCL or action level is not based on a running annual average, if the average of the initial and confirmation sample exceeds the contaminant's MCL or action level, or the confirmation sample is not collected and analyzed pursuant to this subsection, the GRRP's project sponsor shall notify the Department and Regional Board within 24 hours and initiate weekly monitoring until four consecutive weekly results are below the contaminant's MCL or action level. If the running four-week average exceeds the contaminant's MCL or action level, the GRRP's project sponsor shall notify the Department and Regional Board within 24 hours and, if directed by the Department or Regional Board, suspend application of the recycled municipal wastewater.

(2) For a contaminant whose compliance with its MCL is based on a running annual average, if the average of the initial and confirmation sample exceeds the contaminant's MCL, or a confirmation sample is not collected and analyzed pursuant to this subsection, the GRRP shall initiate weekly monitoring for the contaminant until the running four-week average no longer exceeds the contaminant's MCL.

(A) If the running four-week average exceeds the contaminant's MCL, a project sponsor shall describe the reason(s) for the exceedance and provide a schedule for completion of corrective actions in a report submitted to the Department and Regional Board no later than 45 days following the quarter in which the exceedance occurred.

(B) If the running four-week average exceeds the contaminant's MCL for sixteen consecutive weeks, a project sponsor shall notify the Department and Regional Board within 48 hours of knowledge of the exceedance and, if directed by the Department or Regional Board, suspend application of the recycled municipal wastewater.

(e) If the annual average of the results of the monitoring performed pursuant to subsection (c) exceeds a contaminant's secondary MCL in Table 64449-A or the upper limit in Table 64449-B, a project sponsor shall initiate quarterly monitoring of the recycled municipal wastewater for the contaminant and, if the running annual average of quarterly-averaged results exceeds a contaminant's secondary MCL or upper limit, describe the reason(s) for the exceedance and any corrective actions taken in a report submitted to Regional Board no later than 45 days following the quarter in which the exceedance occurred, with a copy concurrently provided to the Department. The annual monitoring in subsection (c) may resume if the running annual average of quarterly results does not exceed a contaminant's secondary MCL or upper limit.

(f) If four consecutive quarterly results for asbestos are below the detection limit in Table 64432-A for asbestos, monitoring for asbestos may be reduced to one sample every three years. Quarterly monitoring shall resume if asbestos is detected.

§60320.114. Diluent Water Requirements.

To be credited with diluent water used in calculating an RWC pursuant to section 60320.116, the GRRP shall comply with the requirements of this section and receive Department approval. For diluent water that is a Department-approved drinking water source, the GRRP's project sponsor is exempt from subsections (a) and (b). The GRRP's project sponsor shall:

(a) Monitor the diluent water quarterly for nitrate and nitrite and, within 72 hours of being informed by the laboratory of a nitrate, nitrite, or nitrate plus nitrite result exceeding a maximum contaminant level (MCL), collect a confirmation sample. If the average of the two samples is greater than an MCL;

(1) notify the Department and the Regional Board within 48 hours of receiving the confirmation sample result,

(2) investigate the cause(s) and implement corrective actions, and

(3) each week, collect and analyze two grab samples at least three days apart as specified in the GRRP's Operation Optimization Plan. If the average of the results for a two-week period exceeds the MCL, surface application of the diluent water shall not be used in the calculation of RWC until corrective actions are made. Quarterly monitoring may resume if four consecutive results are below the MCL.

(b) Conduct a source water evaluation per the California-Nevada Section of American Water Works Association's Watershed Sanitary Survey Guidance Manual (1993), as it may be amended, or other Department-approved evaluation, of the diluent water for Department review and approval that includes, but is not limited to:

(1) a description of the source of the diluent water;

(2) delineation of the origin and extent of the diluent water;

(3) the susceptibility of the diluent water to contamination;

(4) the identification of known or potential contaminants; and

(5) an inventory of the potential sources of diluent water contamination.

(c) Ensure diluent water does not exceed a primary MCL, a secondary MCL upper limit (if not historically used to recharge the basin), or a notification level (NL), and implement a

Department-approved water quality monitoring plan for Department-specified contaminants to demonstrate compliance with the primary MCLs, secondary MCLs (except turbidity, color, and odor), and NLs. The plan shall also include:

(1) except for Department-approved drinking water sources used as a diluent water, monitoring of any chemicals or contaminants required pursuant to section 60320.120, based on the source water evaluation performed in subsection (b); and

(2) actions to be taken in the event of non-compliance with a primary MCL, secondary MCL, or exceedance of a NL.

(d) Develop a method for determining the volume of diluent water to be credited and demonstrate that the diluent water will be introduced in a manner such that the diluent water volume will not result in the GRRP's 120-month running monthly average RWC exceeding its maximum RWC at or beyond the boundary established pursuant to section 60320.100(e)(2). The method shall be submitted to the Department for review and approval, and be conducted at a frequency specified in the engineering report prepared pursuant to section 60323. The method shall address all conditions that influence how and when the recycled municipal wastewater and diluent water arrive at all points along the boundary. The conditions must include, but are not limited to, temporal variability in the diluent water supply and regional groundwater gradients, the difference in the distribution of the recycled municipal wastewater and diluent water between individual aquifers where more than one aquifer is replenished, and the difference in travel-time when recycled municipal wastewater and diluent water are introduced at different locations and/or times.

(e) For credit prior to the operation of the GRRP, but not to exceed 120 months:

(1) demonstrate that the diluent water met the nitrate, nitrite, and nitrate plus nitrite MCLs, NLs, and the water quality requirements in section 60320.112;

(2) provide evidence that the quantity of diluent water has been accurately determined and was distributed such that the proposed or permitted maximum RWC would not have been exceeded; and

(3) conduct a source water evaluation of the diluent water pursuant to subsection (b).

(f) In the Operation Optimization Plan prepared pursuant to section 60320.122, include a description of:

(1) how the diluent water will be distributed in a manner that ensures that the maximum RWC will not be exceeded during normal operations; and

(2) the actions to be taken in the event the diluent water is curtailed or is no longer available.

(g) If approved by the Department, recharge water may be monitored in lieu of a diluent water source if the diluent water source cannot be monitored directly in a manner that provides samples representative of the diluent water being applied.

§60320.116. Recycled Municipal Wastewater Contribution (RWC) Requirements.

(a) Each month, for each surface application GRRP used for replenishing a groundwater basin, the GRRP's project sponsor shall calculate the running monthly average (RMA) RWC based on the total volume of the recycled municipal wastewater and credited diluent water for the preceding 120 months. For GRRPs in operation less than 120 months, calculation of the

RMA RWC shall commence after 30 months of recycled municipal wastewater application, based on the total volume of the recycled municipal wastewater and credited diluent water introduced during the preceding months.

(b) The GRRP's RMA RWC, as determined in subsection (a), shall not exceed the maximum RWC specified for the GRRP by the Department.

(c) The initial maximum RWC shall not exceed 0.20 or an alternative initial RWC approved by the Department. An alternative initial RWC up to 1.0 may be approved by the Department based on, but not limited to, the Department's review of the engineering report, the information obtained as a result of the public hearing(s), and a project sponsor's demonstration that the treatment processes preceding the soil-aquifer treatment process will reliably achieve total organic carbon (TOC) concentrations no greater than 0.5 mg/L divided by the proposed initial RWC.

(d) A GRRP may increase its maximum RWC, provided:

(1) the increase has been approved by the Department and Regional Board;

(2) for the previous 52 weeks, the TOC 20-week running average, as monitored pursuant to section 62320.118, has not exceeded 0.5 mg/L divided by the proposed maximum RWC; and

(3) the GRRP has received a permit from the Regional Board that allows operation of the GRRP at the increased maximum RWC.

(e) In addition to the requirements in subsection (d), prior to operating a GRRP at an RWC greater than 0.50 or 0.75, which must be achieved sequentially, a project sponsor shall:

(1) provide a proposal to the Department prepared and signed by an engineer licensed in California with at least three years of experience in wastewater treatment and public water supply;

(2) submit an updated engineering report and Operation Optimization Plan; and

(3) provide evidence of compliance with section 60320.126(a).

(f) If the RMA RWC exceeds its maximum RWC, the GRRP's project sponsor shall:

(1) notify the Department and Regional Board in writing within seven days of knowledge of the exceedance; and

(2) within 60 days of knowledge of the exceedance, implement corrective action(s) and additional actions that may be required by the Department or Regional Board, and submit a report to the Department and Regional Board describing the reason(s) for the exceedance and the corrective action(s) taken to avoid future exceedances.

§60320.118. Total Organic Carbon (TOC) and Soil-Aquifer Treatment (SAT) Process Requirements.

For each surface application GRRP used for replenishing a groundwater basin, the GRRP's project sponsor shall assess the SAT process through the monitoring of TOC, indicator compounds, and surrogate parameters, as approved by the Department.

(a) At least once each week, a project sponsor shall analyze TOC from representative 24-hour composite samples of the following:

(1) the undiluted recycled municipal wastewater, prior to application or within the zone of percolation;

(2) the diluted percolated recycled municipal wastewater, with the value amended to negate the effect of the diluent water; or

(3) the undiluted recycled municipal wastewater prior to application, with the value amended using a soil-aquifer treatment factor approved by the Department and based on demonstration studies, which reliably predicts the removal efficiency of the process.

(b) Grab samples may be used in lieu of the 24-hour composite samples required in subsection (a) if:

(1) the GRRP demonstrates that a grab sample is representative of the water quality throughout a 24-hour period; or

(2) the entire recycled municipal wastewater stream has been treated by reverse osmosis meeting the criteria in sections 60320.201(a) and (b).

(c) Analytical results of the TOC monitoring performed pursuant to subsection (a) shall not exceed 0.5 mg/L divided by the RMA RWC based on:

(1) the 20-week running average of all TOC results; and

(2) the average of the last four TOC results.

(d) If the GRRP exceeds the limit in subsection (c)(1) or its approved increased TOC limit obtained pursuant to section 60320.130(c), based on a 20-week running average, a project sponsor shall take the following actions upon being notified of the results:

(1) immediately suspend the addition of recycled municipal wastewater until at least two consecutive results, three days apart, are less than the limit;

(2) notify the Department and Regional Board within seven days of suspension; and

(3) within 60 days, submit a report to the Department and Regional Board describing the reasons for the exceedance and the corrective actions to avoid future exceedances. At a minimum, the corrective actions shall include;

(A) a reduction of RWC sufficient to comply with the limit, and/or

(B) additional treatment demonstrated to the Department to remove TOC and chemicals or contaminants of concern to public health.

(e) If the GRRP exceeds the limit in subsection (c)(2) or its approved increased TOC limit obtained pursuant to section 60320.130(c), based on the average of the last four results, a project sponsor shall, within 60 days of being notified of the results, submit a report to the Department and Regional Board describing the reasons for the exceedance and the corrective actions taken to avoid future exceedances.

(f) Prior to a GRRP beginning initial operation and at five-year intervals thereafter, a project sponsor shall conduct a study to determine the occurrence of indicator compounds in the recycled municipal wastewater to be applied at the GRRP. Following completion of the study, a project sponsor shall propose at least three indicator compounds for use in meeting subsection (g). The protocol for the occurrence study, the study's results, and the indicator compounds to be used shall be reviewed and approved by the Department.

(g) Quarterly, a project sponsor shall monitor the GRRP's recycled municipal wastewater or recharge water prior to the SAT process and the water after the SAT process, but at a point no farther than 30 days downgradient of the spreading area. The monitoring shall include at least three indicator compounds based on the results of an occurrence study approved by the Department. If the monitoring results do not indicate a reduction of at least 90 percent in the concentration of indicator compounds by the SAT, excluding the effects of dilution from diluent water that may be present, a project sponsor shall investigate the reason for the low reduction and report the indicator compound and investigative results within 90 days of receipt of the analytical results.

(h) If the result of the investigation in subsection (g) concludes that the 90 percent reduction could not be demonstrated because the concentration of indicator compounds prior to the SAT process was not sufficient, a project sponsor shall consult with the Department and comply with an alternative monitoring plan approved by the Department. If a project sponsor demonstrates that there are not three compounds available and suitable for indicating a 90 percent reduction pursuant to subsection (g), a project sponsor may utilize an indicator compound that achieves a reduction less than 90 percent, with Department approval of the alternative indicator compound and reduction criteria.

(i) To use one or more wastewater chemicals in lieu of TOC, a project sponsor shall obtain approval from the Department. At a minimum, the chemical(s) used in lieu of TOC shall:

(1) be quantifiable in the wastewater, recycled municipal wastewater, groundwater, and throughout the treatment processes; and

(2) have identifiable treatment performance standards as protective of public health as the TOC standards in this Article.

§60320.120. Additional Chemical and Contaminant Monitoring.

(a) Each quarter, the GRRP's project sponsor shall sample and analyze the recycled municipal wastewater and the groundwater (from the downgradient monitoring wells established pursuant to section 60320.126) for the following:

(1) Priority Toxic Pollutants (chemicals listed in 40 CFR section 131.38, "Establishment of numeric criteria for priority toxic pollutants for the State of California," as the foregoing may be amended) specified by the Department, based on the Department's review of the GRRP's engineering report; and

(2) Chemicals that the Department has specified, based on a review of the GRRP's engineering report, the affected groundwater basin(s), and the results of the assessment performed pursuant to section 60320.106(b)(1).

(b) Each quarter, the GRRP's project sponsor shall sample and analyze the recycled municipal wastewater for Department-specified chemicals having notification levels (NLs). Recharge water (including recharge water after surface application) may be monitored in lieu of recycled municipal wastewater if the fraction of recycled municipal wastewater in the recharge water is equal to or greater than the average fraction of recycled municipal wastewater in the recharge water applied over the quarter. If the fraction of recycled municipal wastewater in the recharge water being monitored is less than the average fraction of recycled municipal wastewater in the recharge water applied over the quarter, the reported value shall be adjusted to exclude the effects of dilution. If a result exceeds a NL, within 72 hours of notification of the result a project sponsor shall collect another sample and have it analyzed for the contaminant as confirmation. If the average of the initial and confirmation sample exceeds the contaminant's NL, or a confirmation sample is not collected and analyzed pursuant to this subsection, the GRRP shall initiate weekly monitoring for the contaminant until the running four-week average no longer exceeds the NL.

(1) If the running four-week average exceeds the contaminant's NL, a project sponsor shall describe the reason(s) for the exceedance and provide a schedule for completion of corrective actions in a report submitted to the Regional Board no later than 45 days following the quarter in which the exceedance occurred, with a copy concurrently provided to the Department.

(2) If the running four-week average exceeds the contaminant's NL for sixteen consecutive weeks, a project sponsor shall notify the Department and Regional Board within 48 hours of knowledge of the exceedance.

(c) A project sponsor may reduce monitoring for the chemicals in this section to once each year following Department approval based on the Department's review of the most recent two years of results of the monitoring performed pursuant to this section.

(d) Annually, a project sponsor shall monitor the recycled municipal wastewater for indicator compounds specified by the Department and Regional Board based on the following:

(1) a review of the GRRP's engineering report;

(2) the inventory developed pursuant to section 60320.106(b)(4);

(3) the affected groundwater basin(s);

(4) an indicator compound's ability to characterize the presence of pharmaceuticals, endocrine disrupting chemicals, personal care products, and other indicators of the presence of municipal wastewater; and

(5) the availability of a test method for a chemical.

(e) A chemical or contaminant detected as a result of monitoring conducted pursuant to this section shall be reported to the Department and Regional Board no later than the quarter following the quarter in which the results are received by the GRRP's project sponsor.

§60320.122. Operation Optimization and Plan.

(a) Prior to operation of a GRRP, a project sponsor shall submit an Operation Optimization Plan to the Department and Regional Board for review and approval. At a minimum, the Operation Optimization Plan shall identify and describe the operations, maintenance, analytical methods, monitoring necessary for the GRRP to meet the requirements of this Article, and the reporting of monitoring results to the Department and Regional Board. A project sponsor shall be responsible for ensuring that the Operation Optimization Plan is, at all times, representative of the current operations, maintenance, and monitoring of the GRRP. A GRRP's project sponsor shall make the Operation Optimization Plan available to the Department or Regional Board for review upon request.

(b) During the first year of operation of a GRRP and at all times thereafter, all treatment processes shall be operated in a manner providing optimal reduction of all chemicals and contaminants including:

(1) microbial contaminants;

(2) regulated contaminants identified in section 60320.112 and the nitrogen compounds required pursuant to section 60320.110; and

(3) chemicals and contaminants required pursuant to section 60320.120.

(c) Within six months of optimizing treatment processes pursuant to subsection (b) and anytime thereafter operations are optimized that result in a change in operation, a project sponsor shall update the GRRP's Operation Optimization Plan to include such changes in operational procedures and submit the operations plan to the Department for review.

§60320.124. Response Retention Time.

(a) The recycled municipal wastewater applied by a GRRP shall be retained underground for a period of time necessary to allow a project sponsor sufficient response time to identify

treatment failures and implement actions, including those required pursuant to section 60320.100(b), necessary for the protection of public health.

(b) The response retention time required in subsection (a) must be approved by the Department, based on information provided in the engineering report required pursuant to section 60323. The response retention time shall be no less than two months.

(c) To demonstrate the retention time underground is no less than the response retention time approved pursuant to subsection (b), a tracer study utilizing an added tracer shall be implemented under hydraulic conditions representative of normal GRRP operations. With Department approval, an intrinsic tracer may be used in lieu of an added tracer. For each month of retention time estimated utilizing the approved intrinsic tracer, a project sponsor shall receive no more than 0.67 months credit. The retention time shall be the time representing the difference from when the water with the tracer is applied at the GRRP to when either; two percent (2%) of the initially introduced tracer concentration has reached the downgradient monitoring point, or ten percent (10%) of the peak tracer unit value observed at the downgradient monitoring point reaches the monitoring point. A project sponsor for a GRRP shall initiate the tracer study prior to the end of the third month of operation. A project sponsor for a GRRP permitted on or before June 18, 2014, that has not performed a tracer study shall complete a tracer study demonstrating the retention time underground.

(d) For the purpose of siting a GRRP location during project planning and until a GRRP's project sponsor has met the requirements of subsection (c), for each month of retention time estimated using the method in column 1, the recycled municipal wastewater or recharge water may be credited with no more than the corresponding response time in column 2 of Table 60320.124.

Table 60320.124

Column 1	Column 2
Method used to estimate the retention time	**Response Time Credit per Month**
Tracer study utilizing an added tracer.[1]	1.0 month
Tracer study utilizing an intrinsic tracer.[1]	0.67 month
Numerical modeling consisting of calibrated finite element or finite difference models using validated and verified computer codes used for simulating groundwater flow.	0.50 month
Analytical modeling using existing academically-accepted equations such as Darcy's Law to estimate groundwater flow conditions based on simplifying aquifer assumptions.	0.25 month

[1] The retention time shall be the time representing the difference from when the water with the tracer is applied at the GRRP to when either; two percent (2%) of the initially introduced tracer concentration has reached the downgradient monitoring point, or ten percent (10%) of the peak tracer unit value observed at the downgradient monitoring point reaches the monitoring point.

(e) A project sponsor shall obtain Department approval for the protocol(s) to be used to establish the retention times in subsections (c) and (d).

(f) Upon request from the Department, a project sponsor shall demonstrate that the underground retention times required in this section are being met based on changes in hydrogeological or climatic conditions since the most recent demonstration.

§60320.126. Monitoring Well Requirements.

(a) Prior to operating a GRRP, a project sponsor shall site and construct at least two monitoring wells downgradient of the GRRP such that:

(1) at least one monitoring well is located;

(A) no less than two weeks but no more than six months of travel through the saturated zone affected by the GRRP, and

(B) at least 30 days upgradient of the nearest drinking water well;

(2) in addition to the well(s) in paragraph (1) and after consultation with the Department, at least one monitoring well is located between the GRRP and the nearest downgradient drinking water well; and

(3) samples from the monitoring wells in paragraphs (1) and (2) can be;

(A) obtained independently from each aquifer, initially receiving the water used as a source of drinking water supply, that will receive the GRRP's recharge water, and

(B) validated as receiving recharge water from the GRRP.

(b) In addition to the monitoring required pursuant to section 60320.120, from each monitoring well in subsection (a)(1), and each monitoring well in subsection (a)(2) that has recharge water located within one year travel time of the well(s), a project sponsor shall collect two samples prior to GRRP operation and at least one sample each quarter after operation begins. Each sample shall be analyzed for total nitrogen, nitrate, nitrite, the contaminants in Tables 64449-A and B of section 64449, and any contaminants and chemicals specified by the Department or Regional Board based on the results of the recycled municipal wastewater monitoring conducted pursuant to this Article.

(c) If a result from the monitoring conducted pursuant to subsection (b) exceeds 80 percent of a nitrate, nitrite, or nitrate plus nitrite MCL a project sponsor shall, within 48 hours of being notified of the result by the laboratory, collect another sample and have it analyzed for the contaminant. If the average of the result of the initial sample and the confirmation sample exceed the contaminant's MCL, a project sponsor shall:

(1) within 24 hours of being notified by the laboratory of the confirmation sample result, notify the Department and Regional Board; and

(2) discontinue surface application of recycled municipal wastewater until corrective actions have been taken or evidence is provided to the Department and Regional Board that the contamination was not a result of the GRRP.

(d) For Department-specified chemical analyses completed in a month, a project sponsor shall ensure the laboratory electronically submits results to the Department no later than 45 days after the end of the month in which monitoring occurred, in a manner such that data is readily uploaded into the Department's database. Utilization of the process described on the Department's Web site will satisfy this requirement.

(e) The GRRP's project sponsor may reduce monitoring for the chemicals and contaminants in subsection (b) to once each year following Department approval based on the Department's review of the most recent two years of monitoring results.

§60320.128. Reporting.

(a) No later than six months after the end of each calendar year, a project sponsor shall provide a report to the Department and Regional Board. Public water systems and drinking water well owners having downgradient sources potentially affected by the GRRP and within 10 years groundwater travel time from the GRRP shall be notified by direct mail and/or electronic mail of the availability of the report. The report shall be prepared by an engineer licensed in California and experienced in the fields of wastewater treatment and public water supply. The report shall include the following:

(1) A summary of the GRRP's compliance status with the monitoring requirements and criteria of this Article during the previous calendar year;

(2) For any violations of this Article during the previous calendar year;

(A) the date, duration, and nature of the violation,

(B) a summary of any corrective actions and/or suspensions of surface application of recycled municipal wastewater resulting from a violation, and

(C) if uncorrected, a schedule for and summary of all remedial actions;

(3) Any detections of monitored chemicals or contaminants, and any observed trends in the monitoring wells and diluent water supplies;

(4) Information pertaining to the vertical and horizontal migration of the recharge water plume;

(5) A description of any changes in the operation of any unit processes or facilities;

(6) A description of any anticipated changes, along with an evaluation of the expected impact of the changes on subsequent unit processes;

(7) The estimated quantity and quality of the recycled municipal wastewater and diluent water to be applied for the next calendar year;

(8) A summary of the measures taken to comply with section 60320.106 and 60320.100(j), and the effectiveness of the implementation of the measures; and

(9) Increases in RWC during the previous calendar year and RWC increases anticipated for the next calendar year.

(b) Every five years from the date of the initial approval of the engineering report required pursuant to section 60323, a project sponsor shall update the report to address any project changes and submit the report to the Department and Regional Board. The update shall include, but not be limited to:

(1) anticipated RWC increases, a description of how the RWC requirements in section 60320.116 will be met, and the expected impact the increase will have on the GRRP's ability to meet the requirements of this Article;

(2) evidence that the requirements associated with retention time in section 60320.108, if applicable, and section 60320.124 have been met; and

(3) a description of any inconsistencies between previous groundwater model predictions and the observed and/or measured values, as well as a description of how subsequent predictions will be accurately determined.

§60320.130. Alternatives.

(a) A project sponsor may use an alternative to a requirement in this Article if the GRRP's project sponsor:

(1) demonstrates to the Department that the proposed alternative assures at least the same level of protection to public health;

(2) receives written approval from the Department prior to implementation of the alternative; and

(3) if required by the Department or Regional Board, conducts a public hearing on the proposed alternative, disseminates information to the public, and receives public comments, pursuant to sections 60320.102(b) and (c).

(b) Unless specified otherwise by the Department, the demonstration in subsection (a)(1) shall include the results of a review of the proposed alternative by an independent scientific advisory panel that includes a toxicologist, a registered engineering geologist or hydrogeologist, an engineer licensed in California with at least three years of experience in wastewater treatment and public drinking water supply, a microbiologist, and a chemist.

(c) The TOC limit specified in section 60320.118(c) may be increased if:

(1) The increased TOC limit is approved by the Department and Regional Board;

(2) The GRRP has been in operation for the most recent ten consecutive years;

(3) A project sponsor submits a proposal to the Department prepared and signed by an engineer licensed in California with at least three years of experience in the fields of wastewater treatment and public water supply. The proposal shall include the following, based on the most recent ten consecutive years of operation;

(A) GRRP operations, monitoring, and compliance data,

(B) Evidence that the GRRP has a history of compliance with the requirements of their Regional Board permit,

(C) Evidence that the water collected at all downgradient drinking water wells and monitoring wells impacted by the GRRP has met the primary drinking water standards,

(D) Analytical or treatment studies requested by the Department to make the determination in subparagraph (C),

(E) Validation of appropriate construction and siting of monitoring wells pursuant to section 60320.126(a), and

(F) A study defining the water quality changes, including organic carbon characterization, as a result of the impact of the GRRP; and

(4) A project sponsor performs a health effects evaluation that assesses the health risks to consumers of water impacted by the GRRP, including any anticipated water quality changes resulting from the proposed increased TOC limit. The evaluation shall include the following;

(A) An exposure assessment that characterizes the quality of the water consumed and the quantity of contaminants and chemicals consumed,

(B) All available human epidemiologic studies of the population that has consumed water impacted by the GRRP,

(C) The results of laboratory animal studies and health risk assessments available in peer-reviewed literature pertaining to water impacted by the GRRP and anticipated water quality changes resulting from the proposed increased TOC, including studies or assessments where extrapolation of data may be relevant,

(D) A health risk assessment of the potential individual and cumulative effects of each of the regulated contaminants identified in section 62320.112, and the chemicals or contaminants monitored pursuant to sections 60320.120(a) and (c), that includes;

1. lifetime risks of cancer, and
2. risks of non-cancer effects, and

(E) A report detailing comments, questions, concerns, and conclusions of a review by an independent scientific peer review advisory panel that includes, as a minimum, a toxicologist, an epidemiologist, an engineering geologist or hydrogeologist registered in California, an engineer licensed in California with at least three years of experience in wastewater treatment and public water supply, a microbiologist, and a chemist.

Article 5.2. Indirect Potable Reuse: Groundwater Replenishment – Subsurface Application.

§60320.200. General Requirements.

(a) The requirements of this Article apply to Groundwater Replenishment Reuse Projects (GRRPs) utilizing subsurface application, which receive initial permits from the Regional Board after June 18, 2014. Within 12 months after June 18, 2014, a project sponsor for a GRRP

permitted on or before June 18, 2014, shall submit a report to the Department and appropriate Regional Board assessing its compliance with the requirements of this Article. For each requirement considered noncompliant and applicable by the Department or Regional Board, a project sponsor shall submit a schedule to the Department and Regional Board, for demonstrating and/or achieving compliance with the applicable requirements of this Article. Unless directed otherwise by the Department, a project sponsor's report for a GRRP permitted on or before June 18, 2014, need not assess compliance with requirements of this Article that are required to be met prior to operation of a GRRP, except subsection (b) of this section. The report is subject to review and approval by the Department and Regional Board. A project sponsor shall ensure the GRRP continuously treats, with full advanced treatment meeting the criteria in section 60320.201, the entire recycled municipal wastewater stream prior to application.

(b) Prior to operation of a GRRP, the GRRP's project sponsor shall obtain Department approval of a plan describing the steps a project sponsor will take to provide an alternative source of drinking water supply to all users of a producing drinking water well, or a Department-approved treatment mechanism a project sponsor will provide to all owners of a producing drinking water well, that as a result of the GRRP's operation, as determined by the Department:

(1) violates a California or federal drinking water standard;

(2) has been degraded to the degree that it is no longer a safe source of drinking water; or

(3) receives water that fails to meet section 60320.208.

(c) Prior to operating a GRRP, a project sponsor shall collect at least four samples, at least one sample each quarter, from each potentially affected aquifer. The samples shall be representative of water in each aquifer, taking into consideration seasonal variations, and be analyzed for the chemicals, contaminants, and characteristics pursuant to sections 60320.210, 60320.212, 60320.218, and 60320.220.

(d) A GRRP's recycled municipal wastewater shall be retained underground for a period of time no less than the retention time required pursuant to sections 60320.208 and 60320.224. The GRRP shall be designed and operated in a manner that ensures water treated pursuant to this Article, beyond the boundary described in subsection (e)(2), meets the recycled municipal wastewater contributions (RWC) requirements in section 60320.216.

(e) Based on hydrogeologic flowpaths, a GRRP's project sponsor shall provide the Department, Regional Board, and local well-permitting authorities a map of the GRRP site at a scale of 1:24,000 or larger (1 inch equals 2,000 feet or 1 inch equals less than 2,000 feet) or, if necessary, a site sketch at a scale providing more detail, that clearly indicates the criteria in paragraphs (1) – (4) below. A revised map shall be prepared and provided when conditions change such that the previous map no longer accurately reflects current conditions.

(1) the location and boundaries of the GRRP;

(2) a boundary representing a zone of controlled drinking water well construction, the greatest of the horizontal and vertical distances reflecting the retention times required pursuant to sections 60320.208 and 60320.224;

(3) a secondary boundary representing a zone of potential controlled drinking water well construction, depicting the zone within which a well would extend the boundary in paragraph (2) to include existing or potential future drinking water wells, thereby requiring further study and potential mitigating activities prior to drinking water well construction; and

(4) the location of all monitoring wells established pursuant to section 60320.226, and drinking water wells within two years travel time of the GRRP based on groundwater flow directions and velocities expected under GRRP operating conditions.

(f) Prior to operating a GRRP, a project sponsor shall demonstrate to the Department and Regional Board that a project sponsor possesses adequate managerial and technical capability to assure compliance with this Article.

(g) Prior to replenishing a groundwater basin or an aquifer with recycled municipal wastewater, a GRRP's project sponsor shall demonstrate that all treatment processes have been installed and can be operated by a project sponsor to achieve their intended function. A protocol describing the actions to be taken to meet this subsection shall be included in the engineering report submitted pursuant section 60323.

(h) In the engineering report required pursuant to section 60323, a project sponsor for a GRRP shall include a hydrogeological assessment of the proposed GRRP's setting. The assessment shall include the following:

(1) the qualifications of the individual(s) preparing the assessment;

(2) a general description of geologic and hydrogeological setting of the groundwater basin(s) potentially directly impacted by the GRRP;

(3) a detailed description of the stratigraphy beneath the GRRP, including the composition, extent, and physical properties of the affected aquifers; and

(4) based on at least four rounds of consecutive quarterly monitoring to capture seasonal impacts;

(A) the existing hydrogeology and the hydrogeology anticipated as a result of the operation of the GRRP, and

(B) maps showing quarterly groundwater elevation contours, along with vector flow directions and calculated hydraulic gradients.

(i) If a project sponsor fails to complete compliance monitoring required pursuant to this Article, the Regional Board may determine water quality-related compliance based on available data.

(j) A project sponsor shall ensure that the recycled municipal wastewater used for a GRRP shall be from a wastewater management agency that is not in violation of the effluent limits pertaining to groundwater replenishment pursuant to this Article, as established in the wastewater management agency's Regional Board permit.

(k) If a project sponsor has been directed by the Department or Regional Board to suspend subsurface application pursuant to this Article, subsurface application shall not resume until the project sponsor has obtained Department and Regional Board approval.

§60320.201. Advanced Treatment Criteria.

Full advanced treatment is the treatment of an oxidized wastewater, as defined in section 60301.650, using a reverse osmosis and an oxidation treatment process that, at a minimum, meets the criteria of this section.

(a) A project sponsor shall select for use a reverse osmosis membrane such that:

(1) each membrane element used in the project has achieved a minimum rejection of sodium chloride of no less than 99.0 percent (99.0%) and an average (nominal) rejection of

sodium chloride of no less than 99.2 percent (99.2%), as demonstrated through Method A of ASTM International's method D4194-03 (2008) using the following substitute test conditions:

(A) tests are operated at a recovery of no less than 15 percent (15%);

(B) sodium chloride rejection is based on three or more successive measurements, after flushing and following at least 30 minutes of operation having demonstrated that rejection has stabilized;

(C) an influent pH no less than 6.5 and no greater than 8.0; and

(D) an influent sodium chloride concentration of no greater than 2,000 mg/L, to be verified prior to the start of testing; and

(2) during the first twenty weeks of full-scale operation the membrane produces a permeate with no more than five percent (5%) of the sample results having TOC concentrations greater than 0.25 mg/L, as verified through monitoring no less frequent than weekly.

(b) For the reverse osmosis treatment process, a project sponsor shall propose, for Department review and approval, on-going performance monitoring (e.g., conductivity or TOC) that indicates when the integrity of the process has been compromised. The proposal shall include at least one form of continuous monitoring, as well as the associated surrogate and/or operational parameter limits and alarm settings that indicate when the integrity has been compromised.

(c) To demonstrate a sufficient oxidation process has been designed for implementation, a project sponsor shall:

(1) Perform an occurrence study on the project's municipal wastewater to identify indicator compounds and select a total of at least nine indicator compounds, with at least one from each of the functional groups in subparagraphs (A) through (I) below. A project sponsor shall submit an occurrence study protocol, as well as the subsequent results and chosen indicator compounds, to the Department for review and approval.

(A) Hydroxy Aromatic

(B) Amino/Acylamino Aromatic

(C) Nonaromatic with carbon double bonds

(D) Deprotonated Amine

(E) Alkoxy Polyaromatic

(F) Alkoxy Aromatic

(G) Alkyl Aromatic

(H) Saturated Aliphatic

(I) Nitro Aromatic

(2) Utilize an oxidation process that achieves optimal removal of the indicator compounds selected in paragraph (1) such that removal is no less than;

(A) 0.5-log (69 percent) for each indicator compound representing the functional groups in paragraphs (1)(A) through (1)(G), and

(B) 0.3-log (50 percent) for each indicator compound representing the functional groups in paragraphs (1)(H) and (1)(I).

(3) Establish at least one surrogate or operational parameter that reflects the removal of at least five of the nine indicator compounds selected pursuant to paragraph (1) such that;

(A) at least one of the five indicator compounds represents at least one functional group in paragraphs (1)(A) through (1)(G),

(B) at least one of the five indicator compounds represents at least one functional group in paragraphs (1)(H) or (1)(I),

(C) at least one surrogate or operational parameter is capable of being monitored continuously, recorded, and have associated alarms, and

(D) a surrogate or operational parameter, including the parameter in subparagraph (C), is identified that indicates when the process may no longer meet the criteria established in paragraph (2).

(4) Conduct testing that includes confirmation of the findings of the occurrence study in paragraph (1) and provides evidence that the requirements of paragraphs (2) and (3) can be met with a full-scale oxidation process. The testing shall include challenge or spiking tests conducted to determine the removal differential under normal operating conditions utilizing, at minimum, the nine indicator compounds identified in paragraph (1). A project sponsor shall submit a testing protocol, as well as the subsequent results, to the Department for review and approval.

(d) In lieu of demonstrating that a sufficient oxidation process has been designed for implementation pursuant to subsection (c), a project sponsor may conduct testing demonstrating that the oxidation process will provide no less than 0.5-log (69 percent) reduction of 1,4-dioxane.

(1) A project sponsor shall submit a testing protocol, as well as the subsequent results, to the Department for review and approval. The testing shall include challenge or spiking tests, using 1,4-dioxane, to demonstrate the proposed oxidation process will achieve the minimum 0.5-log reduction under the proposed oxidation process's normal full-scale operating conditions.

(2) A project sponsor shall establish surrogate and/or operational parameters that reflect whether the minimum 0.5-log 1,4-dioxane reduction design criteria is being met. At least one surrogate or operational parameter shall be capable of being monitored continuously, recorded, and have associated alarms that indicate when the process is not operating as designed.

(e) During the full-scale operation of the oxidation process designed pursuant to subsection (c) or (d), a project sponsor shall continuously monitor the surrogate and/or operational parameters established pursuant to subsection (c)(3)(C) or (d)(2), as applicable. A project sponsor shall implement, in full-scale operation, the oxidation process as designed pursuant to subsection (c) or (d).

(f) Within 60 days after completing the initial 12-months of monitoring pursuant to subsection (e), a project sponsor shall submit a report to the Department and Regional Board that includes:

(1) the results of the monitoring performed in subsection (e);

(2) the removal differential of the indicator compounds;

(3) a description of the efficacy of the surrogate and/or operational parameters to reflect the removal differential of the indicator compounds; and

(4) a description of actions taken, or to be taken, if the indicator compound removal did not meet the associated design criteria in subsection (c) or (d), the continuous surrogate and/or operational parameter monitoring in subsection (c)(3)(C) or (d)(2) fails to correspond to the differential indicator compound removal, or the surrogate and/or operational parameter established in subsection (c)(3)(D) or (d)(2) is not met.

(g) Within 60 days after completing the initial 12 months of operation of the reverse osmosis process, a project sponsor shall submit a report to the Department and Regional Board describing the effectiveness of the treatment, process failures, and actions taken in the event the on-going monitoring in subsection (b) indicated that process integrity was compromised.

(h) Each quarter, a project sponsor shall calculate what percent of results of the quarter's monitoring, conducted pursuant to subsections (b) and (e), did not meet the surrogate and/or operational parameter limits established to assure proper on-going performance of the reverse

osmosis and oxidation processes. If the percent is greater than ten, within 45 days after the end of the quarter a project sponsor shall:

(1) submit a report to the Department and Regional Board describing the corrective actions planned or taken to reduce the percent to ten percent (10%) or less; and

(2) consult with the Department and, if required, comply with an alternative monitoring plan approved by the Department.

(i) Each month a project sponsor shall collect samples (grab or composite) representative of the effluent of the advanced treatment process and have the samples analyzed for contaminants having MCLs and notification levels (NLs). After 12 consecutive months with no results exceeding an MCL or NL, a project sponsor may apply for a reduced monitoring frequency. The reduced monitoring frequency shall be no less than quarterly. Monitoring conducted pursuant to this subsection may be used in lieu of the monitoring (for the same contaminants) required pursuant to sections 60320.212 and 60320.220. The effluent of the advanced treatment process shall not exceed an MCL.

§60320.202. Public Hearing.

(a) A public hearing for a GRRP shall be held by a project sponsor prior to the Department's submittal of its recommendations to the Regional Board for the GRRP's initial permit and any time an increase in maximum RWC has been proposed but not addressed in a prior public hearing. Prior to a public hearing conducted pursuant to this section, a project sponsor shall provide the Department, for its review and approval, the information a project sponsor intends to present at the hearing. Following the Department's approval of the information, a project sponsor shall place the information on a project sponsor's Web site and in a repository that provides at least 30 days of public access to the information prior to the public hearing.

(b) Prior to placing the information required pursuant to subsection (a) in a repository, a project sponsor shall:

(1) Notify the public of the following;

(A) the location and hours of operation of the repository,

(B) the Internet address where the information may be viewed,

(C) the purpose of the repository and public hearing,

(D) the manner in which the public can provide comments, and

(E) the date, time, and location of the public hearing; and

(2) At a minimum, notify the first downgradient drinking water well owner and well owners whose drinking water well is within 10 years from the GRRP based on groundwater flow directions and velocities.

(c) Unless directed otherwise by the Department, the public notification made pursuant to subsection (b)(2) shall be by direct mail and the notification made pursuant to subsection (b)(1) shall be delivered in a manner to reach persons whose source of drinking water may be impacted by the GRRP, using one or more of the following methods:

(1) local newspaper(s) publication of general circulation;

(2) mailed or direct delivery of a newsletter;

(3) conspicuously placed statement in water bills; and/or

(4) television and/or radio.

§60320.204. Lab Analyses.

(a) Analyses for contaminants having primary or secondary MCLs shall be performed by laboratories approved to perform such analyses by the Department utilizing Department-approved drinking water methods.

(b) Analyses for chemicals other than those having primary or secondary MCLs shall be described in the GRRP's Operation Optimization Plan prepared pursuant to section 60320.222.

§60320.206. Wastewater Source Control.

A project sponsor shall ensure that the recycled municipal wastewater used for a GRRP shall be from a wastewater management agency that:

(a) administers an industrial pretreatment and pollutant source control program; and

(b) implements and maintains a source control program that includes, at a minimum;

(1) an assessment of the fate of Department-specified and Regional Board-specified chemicals and contaminants through the wastewater and recycled municipal wastewater treatment systems,

(2) chemical and contaminant source investigations and monitoring that focuses on Department-specified and Regional Board-specified chemicals and contaminants,

(3) an outreach program to industrial, commercial, and residential communities within the portions of the sewage collection agency's service area that flows into the water reclamation plant subsequently supplying the GRRP, for the purpose of managing and minimizing the discharge of chemicals and contaminants at the source, and

(4) a current inventory of chemicals and contaminants identified pursuant to this section, including new chemicals and contaminants resulting from new sources or changes to existing sources, that may be discharged into the wastewater collection system.

§60320.208. Pathogenic Microorganism Control.

(a) A project sponsor shall design and operate a GRRP such that the recycled municipal wastewater used as recharge water for a GRRP receives treatment that achieves at least 12-log enteric virus reduction, 10-log Giardia cyst reduction, and 10-log Cryptosporidium oocyst reduction. The treatment train shall consist of at least three separate treatment processes. For each pathogen (i.e., virus, Giardia cyst, or Cryptosporidium oocyst), a separate treatment process may be credited with no more than 6-log reduction, with at least three processes each being credited with no less than 1.0-log reduction.

(b) For each month retained underground as demonstrated in subsection (e), the recycled municipal wastewater or recharge water will be credited with 1-log virus reduction.

(c) With the exception of log reduction credited pursuant to subsection (b), a project sponsor shall validate each of the treatment processes used to meet the requirements in subsection (a) for their log reduction by submitting a report for the Department's review and approval, or by using a challenge test approved by the Department, that provides evidence of the treatment process's ability to reliably and consistently achieve the log reduction. The report and/or challenge test shall be prepared by an engineer licensed in California with at least five years of experience, as a licensed engineer, in wastewater treatment and public water supply, including the evaluation of treatment processes for pathogen control. With the exception of retention time underground, a project sponsor shall propose and include in its Operation Optimization Plan prepared pursuant to section 60320.222, on-going monitoring using the pathogenic

microorganism of concern or a microbial, chemical, or physical surrogate parameter(s) that verifies the performance of each treatment process's ability to achieve its credited log reduction.

(d) To demonstrate the retention time underground in subsection (b) a tracer study utilizing an added tracer shall be implemented under hydraulic conditions representative of normal GRRP operations. The retention time shall be the time representing the difference from when the water with the tracer is applied at the GRRP to when either; two percent (2%) of the initially introduced tracer concentration has reached the downgradient monitoring point, or ten percent (10%) of the peak tracer unit value observed at the downgradient monitoring point reached the monitoring point. A project sponsor for a GRRP shall initiate the tracer study prior to the end of the third month of operation. A project sponsor for a GRRP permitted on or before June 18, 2014, that has not already performed such a tracer study shall complete a tracer study demonstrating the retention time underground. With Department approval, an intrinsic tracer may be used in lieu of an added tracer, with no more credit provided than the corresponding virus log reduction in column 2 of Table 60320.208.

(e) For the purpose of siting a GRRP location during project planning and until a GRRP's project sponsor has met the requirements of subsection (d), for each month of retention time estimated using the method in column 1, the recycled municipal wastewater or recharge water shall be credited with no more than the corresponding virus log reduction in column 2 of Table 60320.208.

Table 60320.208

Column 1	Column 2
Method used to estimate the retention time to the nearest downgradient drinking water well	**Virus Log Reduction Credit per Month**
Tracer study utilizing an added tracer.[1]	1.0 log
Tracer study utilizing an intrinsic tracer.[1]	0.67 log
Numerical modeling consisting of calibrated finite element or finite difference models using validated and verified computer codes used for simulating groundwater flow.	0.50 log
Analytical modeling using existing academically-accepted equations such as Darcy's Law to estimate groundwater flow conditions based on simplifying aquifer assumptions.	0.25 log

[1] The retention time shall be the time representing the difference from when the water with the tracer is applied at the GRRP to when either; two percent (2%) of the initially introduced tracer concentration has reached the downgradient monitoring point, or ten percent (10%) of the peak tracer unit value observed at the downgradient monitoring point reached the monitoring point.

(f) A project sponsor shall obtain Department approval for the protocol(s) to be used to establish the retention times in subsections (d) and (e).

(g) Based on changes in hydrogeological or climatic conditions since the most recent demonstration, the Department may require a GRRP's project sponsor to demonstrate that the underground retention times required in this section are being met.

(h) If a pathogen reduction in subsection (a) is not met based on the on-going monitoring required pursuant to subsection (c), within 24 hours of being aware a project sponsor shall immediately investigate the cause and initiate corrective actions. The project sponsor shall immediately notify the Department and Regional Board if the GRRP fails to meet the pathogen reduction criteria longer than 4 consecutive hours, or more than a total of 8 hours during any 7-

day period. Failures of shorter duration shall be reported to the Regional Board by a project sponsor no later than 10 days after the month in which the failure occurred.

(i) If the effectiveness of a treatment train's ability to reduce enteric virus is less than 10-logs, or Giardia cyst or Cryptosporidium oocyst reduction is less than 8-logs, a project sponsor shall immediately notify the Department and Regional Board, and discontinue application of recycled municipal wastewater at the GRRP, unless directed otherwise by the Department or Regional Board.

§60320.210. Nitrogen Compounds Control.

(a) To demonstrate control of the nitrogen compounds, a project sponsor shall:

(1) Each week, at least three days apart as specified in the GRRP's Operation Optimization Plan, collect at least two total nitrogen samples (grab or 24-hour composite) representative of the recycled municipal wastewater or recharge water applied. Samples may be collected before or after subsurface application;

(2) Have the samples collected pursuant to paragraph (1) analyzed for total nitrogen, with the laboratory being required by a project sponsor to complete each analysis within 72 hours and have the result reported to a project sponsor within the same 72 hours if the result of any single sample exceeds 10 mg/L;

(3) If the average of the results of two consecutive samples collected pursuant to paragraph (1) exceeds 10 mg/L total nitrogen;

(A) take a confirmation sample and notify the Department and the Regional Board within 48 hours of being notified of the results by the laboratory,

(B) investigate the cause for the exceedances and take actions to reduce the total nitrogen concentrations to ensure continued or future exceedances do not occur, and

(C) initiate additional monitoring for nitrogen compounds as described in the GRRP's Operation Optimization Plan, including locations in the groundwater basin, to identify elevated concentrations and determine whether such elevated concentrations exceed or may lead to an exceedance of a nitrogen-based MCL; and

(4) If the average of the results of four consecutive samples collected pursuant to paragraph (1) exceeds 10 mg/L total nitrogen, suspend the subsurface application of recycled municipal wastewater. Subsurface application shall not resume until corrective actions have been taken and at least two consecutive total nitrogen sampling results are less than 10 mg/L.

(b) Following Department and Regional Board approval, a project sponsor may initiate reduced monitoring frequencies for total nitrogen. A project sponsor may apply to the Department and Regional Board for reduced monitoring frequencies for total nitrogen if, for the most recent 12 months:

(1) the average of all results did not exceed 5 mg/L total nitrogen; and

(2) the average of a result and its confirmation sample (taken within 24 hours of receipt of the initial result) did not exceed 10 mg/L total nitrogen.

(c) If the results of reduced monitoring conducted as approved pursuant to subsection (b) exceed the total nitrogen concentration criteria in subsection (b), a project sponsor shall revert to the monitoring frequencies for total nitrogen prior to implementation of the reduced frequencies. Reduced frequency monitoring shall not resume unless the requirements of subsection (b) are met.

§60320.212. Regulated Contaminants and Physical Characteristics Control.

(a) Each quarter, as specified in the GRRP's Operation Optimization Plan, a project sponsor shall collect samples (grab or 24-hour composite) representative of the applied recycled municipal wastewater and have the samples analyzed for:

(1) the inorganic chemicals in Table 64431-A, except for nitrogen compounds;
(2) the radionuclide chemicals in Tables 64442 and 64443;
(3) the organic chemicals in Table 64444-A;
(4) the disinfection byproducts in Table 64533-A; and
(5) lead and copper.

(b) Recharge water may be monitored in lieu of recycled municipal wastewater to satisfy the monitoring requirements in subsection (a)(4) if the fraction of recycled municipal wastewater in the recharge water is equal to or greater than the average fraction of recycled municipal wastewater in the recharge water applied over the quarter. If the fraction of recycled municipal wastewater in the recharge water being monitored is less than the average fraction of recycled municipal wastewater in the recharge water applied over the quarter, the reported value shall be adjusted to exclude the effects of dilution.

(c) Each year, the GRRP's project sponsor shall collect at least one representative sample (grab or 24-hour composite) of the recycled municipal wastewater and have the sample(s) analyzed for the secondary drinking water contaminants in Tables 64449-A and 64449-B.

(d) If a result of the monitoring performed pursuant to subsection (a) exceeds a contaminant's MCL or action level (for lead and copper), a project sponsor shall collect another sample within 72 hours of notification of the result and then have it analyzed for the contaminant as confirmation.

(1) For a contaminant whose compliance with its MCL or action level is not based on a running annual average, if the average of the initial and confirmation sample exceeds the contaminant's MCL or action level, or the confirmation sample is not collected and analyzed pursuant to this subsection, the GRRP's project sponsor shall notify the Department and Regional Board within 24 hours and initiate weekly monitoring until four consecutive weekly results are below the contaminant's MCL or action level. If the running four-week average exceeds the contaminant's MCL or action level, the GRRP's project sponsor shall notify the Department and Regional Board within 24 hours and, if directed by the Department or Regional Board, suspend application of the recycled municipal wastewater.

(2) For a contaminant whose compliance with its MCL is based on a running annual average, if the average of the initial and confirmation sample exceeds the contaminant's MCL, or a confirmation sample is not collected and analyzed pursuant to this subsection, the GRRP shall initiate weekly monitoring for the contaminant until the running four-week average no longer exceeds the contaminant's MCL.

(A) If the running four-week average exceeds the contaminant's MCL, a project sponsor shall describe the reason(s) for the exceedance and provide a schedule for completion of corrective actions in a report submitted to the Department and Regional Board no later than 45 days following the quarter in which the exceedance occurred.

(B) If the running four-week average exceeds the contaminant's MCL for sixteen consecutive weeks, a project sponsor shall notify the Department and Regional Board within 48 hours of knowledge of the exceedance and, if directed by the Department or Regional Board, suspend application of the recycled municipal wastewater.

(e) If the annual average of the results of the monitoring performed pursuant to subsection (c) exceeds a contaminant's secondary MCL in Table 64449-A or the upper limit in Table 64449-B, a project sponsor shall initiate quarterly monitoring of the recycled municipal

wastewater for the contaminant and, if the running annual average of quarterly-averaged results exceeds a contaminant's secondary MCL or upper limit, describe the reason(s) for the exceedance and any corrective actions taken a report submitted to the Regional Board no later than 45 days following the quarter in which the exceedance occurred, with a copy concurrently provided to the Department. The annual monitoring in subsection (c) may resume if the running annual average of quarterly results does not exceed a contaminant's secondary MCL or upper limit.

(f) If four consecutive quarterly results for asbestos are below the detection limit in Table 64432-A for asbestos, monitoring for asbestos may be reduced to one sample every three years. Quarterly monitoring shall resume if asbestos is detected.

§60320.214. Diluent Water Requirements.

To be credited with diluent water used in calculating an RWC pursuant to section 60320.216, the GRRP shall comply with the requirements of this section and receive Department approval. For diluent water that is a Department-approved drinking water source, the GRRP's project sponsor is exempt from subsections (a) and (b). The GRRP's project sponsor shall:

(a) Monitor the diluent water quarterly for nitrate and nitrite and, within 72 hours of being informed by the laboratory of a nitrate, nitrite, or nitrate plus nitrite result exceeding a maximum contaminant level (MCL), collect a confirmation sample. If the average of the two samples is greater than an MCL;

(1) notify the Department and the Regional Board within 48 hours of receiving the confirmation sample result,

(2) investigate the cause(s) and implement corrective actions, and

(3) each week, collect and analyze two grab samples at least three days apart as specified in the GRRP's Operation Optimization Plan. If the average of the results for a two-week period exceeds the MCL, subsurface application of the diluent water shall not be used in the calculation of RWC until corrective actions are made. Quarterly monitoring may resume if four consecutive results are below the MCL.

(b) Conduct a source water evaluation per the California-Nevada Section of American Water Works Association's Watershed Sanitary Survey Guidance Manual (1993), as it may be amended, or other Department-approved evaluation, of the diluent water for Department review and approval that includes, but is not limited to:

(1) a description of the source of the diluent water;

(2) delineation of the origin and extent of the diluent water;

(3) the susceptibility of the diluent water to contamination;

(4) the identification of known or potential contaminants; and

(5) an inventory of the potential sources of diluent water contamination.

(c) Ensure diluent water does not exceed a primary MCL, a secondary MCL upper limit, or a notification level (NL), and implement a Department-approved water quality monitoring plan for Department-specified contaminants to demonstrate compliance with the primary MCLs, secondary MCLs, and NLs. The plan shall also include:

(1) except for Department-approved drinking water sources used as a diluent water, monitoring of any chemicals or contaminants required pursuant to section 60320.220, based on the source water evaluation performed in subsection (b); and

(2) actions to be taken in the event of non-compliance with a primary MCL, secondary MCL, or exceedance of a NL.

(d) Develop a method for determining the volume of diluent water to be credited and demonstrate that the diluent water will be introduced in a manner such that the diluent water volume will not result in the GRRP's 120-month running monthly average RWC exceeding its maximum RWC at or beyond the boundary established pursuant to section 60320.200(e)(2). The method shall be submitted to the Department for review and approval, and be conducted at a frequency specified in the engineering report prepared pursuant to section 60323. The method shall address all conditions that influence how and when the recycled municipal wastewater and diluent water arrive at all points along the boundary. The conditions must include, but are not limited to, temporal variability in the diluent water supply and regional groundwater gradients, the difference in the distribution of the recycled municipal wastewater and diluent water between individual aquifers where more than one aquifer is replenished, and the difference in travel-time when recycled municipal wastewater and diluent water are introduced at different locations and/or times.

(e) For credit prior to the operation of the GRRP, but not to exceed 120 months:
(1) demonstrate that the diluent water met the nitrate, nitrite, and nitrate plus nitrite MCLs, NLs, and the water quality requirements in section 60320.212;
(2) provide evidence that the quantity of diluent water has been accurately determined and was distributed such that the proposed or permitted maximum RWC would not have been exceeded; and
(3) conduct a source water evaluation of the diluent water pursuant to subsection (b).

(f) In the Operation Optimization Plan prepared pursuant to section 60320.222, include a description of:
(1) how the diluent water will be distributed in a manner that ensures that the maximum RWC will not be exceeded during normal operations; and
(2) the actions to be taken in the event the diluent water is curtailed or is no longer available.

(g) If approved by the Department, recharge water may be monitored in lieu of a diluent water source if the diluent water source cannot be monitored directly in a manner that provides samples representative of the diluent water being applied.

§60320.216. Recycled Municipal Wastewater Contribution (RWC) Requirements.

(a) Each month, for each subsurface application GRRP used for replenishing a groundwater basin, the GRRP's project sponsor shall calculate the running monthly average (RMA) RWC based on the total volume of the recycled municipal wastewater and credited diluent water for the preceding 120 months. For GRRPs in operation less than 120 months, calculation of the RMA RWC shall commence after 30 months of recycled municipal wastewater application, based on the total volume of the recycled municipal wastewater and credited diluent water introduced during the preceding months.

(b) The GRRP's RMA RWC, as determined in subsection (a), shall not exceed the maximum RWC specified for the GRRP by the Department.

(c) The initial maximum RWC, which may be up to 1.0, will be based on, but not limited to, the Department's review of the engineering report, information obtained as a result of the public

hearing(s), and a project sponsor's demonstration that the treatment processes will reliably achieve TOC concentrations no greater than 0.5 mg/L.

(d) A GRRP may increase its maximum RWC, provided:
(1) the increase has been approved by the Department and Regional Board;
(2) for the previous 52 weeks the TOC 20-week running average, as monitored pursuant to section 62320.218, has not exceeded 0.5 mg/L; and
(3) the GRRP has received a permit from the Regional Board that allows operation of the GRRP at the increased maximum RWC.

(e) If the RMA RWC exceeds its maximum RWC, the GRRP's project sponsor shall:
(1) notify the Department and Regional Board in writing within seven days of knowledge of the exceedance; and
(2) within 60 days of knowledge of the exceedance, implement corrective action(s) and additional actions that may be required by the Department or Regional Board, and submit a report to the Department and Regional Board describing the reason(s) for the exceedance and the corrective action(s) taken to avoid future exceedances.

§60320.218. Total Organic Carbon Requirements.

(a) For each subsurface application GRRP used for replenishing a groundwater basin, the GRRP's project sponsor shall monitor the applied recycled municipal wastewater for TOC as follows:
(1) Prior to replenishment, at least one 24-hour composite sample each week.
(2) Grab samples may be used in lieu of the 24-hour composite samples required in paragraph (1) if the GRRP demonstrates that a grab sample is representative of the water quality throughout a 24-hour period.

(b) Analytical results of the TOC monitoring performed pursuant to subsection (a) shall not exceed 0.5 mg/L based on:
(1) the 20-week running average of all TOC results; and
(2) the average of the last four TOC results.

(c) If the GRRP exceeds the limit in subsection (b)(1) based on a 20-week running average, a project sponsor shall take the following actions upon being notified of the results:
(1) immediately suspend the addition of recycled municipal wastewater until at least two consecutive results, three days apart, are less than the limit;
(2) notify the Department and Regional Board within seven days of suspension; and
(3) within 60 days, submit a report to the Department and Regional Board describing the reasons for the exceedance and the corrective actions to avoid future exceedances. At a minimum, the corrective actions shall include a reduction of RWC sufficient to comply with the limit.

(d) If the GRRP exceeds the limit in subsection (b)(2) based on the average of the last four results, a project sponsor shall, within 60 days of being notified of the results, submit a report to the Department and Regional Board describing the reasons for the exceedance and the corrective actions taken to avoid future exceedances.

(e) To use one or more wastewater chemicals in lieu of TOC, a project sponsor shall obtain approval from the Department. At a minimum, the chemical(s) used in lieu of TOC shall:

(1) be quantifiable in the wastewater, recycled municipal wastewater, groundwater, and throughout the treatment processes; and

(2) have identifiable treatment performance standards as protective of public health as the TOC standards in this Article.

§60320.220. Additional Chemical and Contaminant Monitoring.

(a) Each quarter, the GRRP's project sponsor shall sample and analyze the recycled municipal wastewater and the groundwater (from the downgradient monitoring wells established pursuant to section 60320.226) for the following:

(1) Priority Toxic Pollutants (chemicals listed in 40 CFR section 131.38, "Establishment of numeric criteria for priority toxic pollutants for the State of California", as the foregoing may be amended) specified by the Department, based on the Department's review of the GRRP's engineering report; and

(2) Chemicals that the Department has specified, based on a review of the GRRP's engineering report, the affected groundwater basin(s), and the results of the assessment performed pursuant to section 60320.206(b)(1).

(b) Each quarter, the GRRP's project sponsor shall sample and analyze the recycled municipal wastewater for Department-specified chemicals having notification levels (NLs). Recharge water may be monitored in lieu of recycled municipal wastewater if the fraction of recycled municipal wastewater in the recharge water is equal to or greater than the average fraction of recycled municipal wastewater in the recharge water applied over the quarter. If the fraction of recycled municipal wastewater in the recharge water being monitored is less than the average fraction of recycled municipal wastewater in the recharge water applied over the quarter, the reported value shall be adjusted to exclude the effects of dilution. If a result exceeds a NL, within 72 hours of notification of the result a project sponsor shall collect another sample and have it analyzed for the contaminant as confirmation. If the average of the initial and confirmation sample exceeds the contaminant's NL, or a confirmation sample is not collected and analyzed pursuant to this subsection, the GRRP shall initiate weekly monitoring for the contaminant until the running four-week average no longer exceeds the NL.

(1) If the running four-week average exceeds the contaminant's NL, a project sponsor shall describe the reason(s) for the exceedance and provide a schedule for completion of corrective actions in a report submitted to the Regional Board no later than 45 days following the quarter in which the exceedance occurred, with a copy concurrently provided to the Department.

(2) If the running four-week average exceeds the contaminant's NL for sixteen consecutive weeks, a project sponsor shall notify the Department and Regional Board within 48 hours of knowledge of the exceedance.

(c) A project sponsor may reduce monitoring for the chemicals in this section to once each year following Department approval based on the Department's review of the most recent two years of results of the monitoring performed pursuant to this section.

(d) Annually, a project sponsor shall monitor the recycled municipal wastewater for indicator compounds specified by the Department and Regional Board based on the following:

(1) a review of the GRRP's engineering report;

(2) the inventory developed pursuant to section 60320.206(b)(4);

(3) the affected groundwater basin(s);

(4) an indicator compound's ability to characterize the presence of pharmaceuticals, endocrine disrupting chemicals, personal care products, and other indicators of the presence of municipal wastewater; and

(5) the availability of a test method for a chemical.

(e) A chemical or contaminant detected as a result of monitoring conducted pursuant to this section shall be reported to the Department and Regional Board no later than the quarter following the quarter in which the results are received by the GRRP's project sponsor.

§60320.222. Operation Optimization and Plan.

(a) Prior to operation of a GRRP, a project sponsor shall submit an Operation Optimization Plan to the Department and Regional Board for review and approval. At a minimum, the Operation Optimization Plan shall identify and describe the operations, maintenance, analytical methods, monitoring necessary for the GRRP to meet the requirements of this Article, and the reporting of monitoring results to the Department and Regional Board. A project sponsor shall be responsible for ensuring that the Operation Optimization Plan is, at all times, representative of the current operations, maintenance, and monitoring of the GRRP. A GRRP's project sponsor shall make the Operation Optimization Plan available to the Department or Regional Board for review upon request.

(b) During the first year of operation of a GRRP and at all times thereafter, all treatment processes shall be operated in a manner providing optimal reduction of all chemicals and contaminants including:

(1) microbial contaminants;

(2) regulated contaminants identified in section 60320.212 and the nitrogen compounds required pursuant to section 60320.210; and

(3) chemicals and contaminants required pursuant to section 60320.220.

(c) Within six months of optimizing treatment processes pursuant to subsection (b) and anytime thereafter operations are optimized that result in a change in operation, a project sponsor shall update the GRRP's Operation Optimization Plan to include such changes in operational procedures and submit the operations plan to the Department for review.

§60320.224. Response Retention Time.

(a) The recycled municipal wastewater applied by a GRRP shall be retained underground for a period of time necessary to allow a project sponsor sufficient response time to identify treatment failures and implement actions, including those required pursuant to section 60320.200(b), necessary for the protection of public health.

(b) The response retention time required in subsection (a) must be approved by the Department, based on information provided in the engineering report required pursuant to section 60323. The response retention time shall be no less than two months.

(c) To demonstrate the retention time underground is no less than the response retention time approved pursuant to subsection (b), a tracer study utilizing an added tracer shall be implemented under hydraulic conditions representative of normal GRRP operations. With Department approval, an intrinsic tracer may be used in lieu of an added tracer. For each month of retention time estimated utilizing the approved intrinsic tracer, a project sponsor shall receive no more than 0.67 months credit. The retention time shall be the time representing the

difference from when the water with the tracer is applied at the GRRP to when either; two percent (2%) of the initially introduced tracer concentration has reached the downgradient monitoring point, or ten percent (10%) of the peak tracer unit value observed at the downgradient monitoring point reaches the monitoring point. A project sponsor for a GRRP shall initiate the tracer study prior to the end of the third month of operation. A project sponsor for a GRRP permitted on or before June 18, 2014, that has not performed a tracer study shall complete a tracer study demonstrating the retention time underground.

(d) For the purpose of siting a GRRP location during project planning and until a GRRP's project sponsor has met the requirements of subsection (c), for each month of retention time estimated using the method in column 1, the recycled municipal wastewater or recharge water may be credited with no more than the corresponding response time in column 2 of Table 60320.224.

Table 60320.224

Column 1	Column 2
Method used to estimate the retention time	**Response Time Credit per Month**
Tracer study utilizing an added tracer.[1]	1.0 month
Tracer study utilizing an intrinsic tracer.[1]	0.67 month
Numerical modeling consisting of calibrated finite element or finite difference models using validated and verified computer codes used for simulating groundwater flow.	0.50 month
Analytical modeling using existing academically-accepted equations such as Darcy's Law to estimate groundwater flow conditions based on simplifying aquifer assumptions.	0.25 month

[1] The retention time shall be the time representing the difference from when the water with the tracer is applied at the GRRP to when either; two percent (2%) of the initially introduced tracer concentration has reached the downgradient monitoring point, or ten percent (10%) of the peak tracer unit value observed at the downgradient monitoring point reaches the monitoring point.

(e) A project sponsor shall obtain Department approval for the protocol(s) to be used to establish the retention times in subsections (c) and (d).

(f) Upon request from the Department, a project sponsor shall demonstrate that the underground retention times required in this section are being met based on changes in hydrogeological or climatic conditions since the most recent demonstration.

§60320.226. Monitoring Well Requirements.

(a) Prior to operating a GRRP, a project sponsor shall site and construct at least two monitoring wells downgradient of the GRRP such that:

(1) at least one monitoring well is located;

(A) no less than two weeks but no more than six months of travel time from the GRRP, and

(B) at least 30 days upgradient of the nearest drinking water well;

(2) in addition to the well(s) in paragraph (1) and after consultation with the Department, at least one monitoring well is located between the GRRP and the nearest downgradient drinking water well; and

(3) samples from the monitoring wells in paragraphs (1) and (2) can be;

(A) obtained independently from each aquifer initially receiving the water used as a source of drinking water supply that will receive the GRRP's recharge water, and

(B) validated as receiving recharge water from the GRRP.

(b) In addition to the monitoring required pursuant to section 60320.220, from each monitoring well in subsection (a)(1), and each monitoring well in subsection (a)(2) that has recharge water located within one year travel time of the well(s), a project sponsor shall collect two samples prior to GRRP operation and at least one sample each quarter after operation begins. Each sample shall be analyzed for total nitrogen, nitrate, nitrite, the contaminants in Tables 64449-A and B of section 64449, and any contaminants and chemicals specified by the Department or Regional Board based on the results of the recycled municipal wastewater monitoring conducted pursuant to this Article.

(c) If a result from the monitoring conducted pursuant to subsection (b) exceeds 80 percent of a nitrate, nitrite, or nitrate plus nitrite MCL a project sponsor shall, within 48 hours of being notified of the result by the laboratory, collect another sample and have it analyzed for the contaminant. If the average of the result of the initial sample and the confirmation sample exceed the contaminant's MCL, a project sponsor shall:

(1) within 24 hours of being notified by the laboratory of the confirmation sample result, notify the Department and Regional Board; and

(2) discontinue subsurface application of recycled municipal wastewater until corrective actions have been taken or evidence is provided to the Department and Regional Board that the contamination was not a result of the GRRP.

(d) For Department-specified chemical analyses completed in a month, a project sponsor shall ensure the laboratory electronically submits results to the Department no later than 45 days after the end of the month in which monitoring occurred, in a manner such that data is readily uploaded into the Department's database. Utilization of the process described on the Department's Web site will satisfy this requirement.

(e) The GRRP's project sponsor may discontinue monitoring for the chemicals and contaminants in subsection (b) following Department approval based on the Department's review of the most recent two years of monitoring results.

§60320.228. Reporting.

(a) No later than six months after the end of each calendar year, a project sponsor shall provide a report to the Department and Regional Board. Public water systems and drinking water well owners having downgradient sources potentially affected by the GRRP and within 10 years groundwater travel time from the GRRP shall be notified by direct mail and/or electronic mail of the availability of the report. The report shall be prepared by an engineer licensed in California and experienced in the fields of wastewater treatment and public water supply. The report shall include the following:

(1) A summary of the GRRP's compliance status with the monitoring requirements and criteria of this Article during the previous calendar year;

(2) For any violations of this Article during the previous calendar year;

(A) the date, duration, and nature of the violation,

(B) a summary of any corrective actions and/or suspensions of subsurface application of recycled municipal wastewater resulting from a violation, and

(C) if uncorrected, a schedule for and summary of all remedial actions;

(3) Any detections of monitored chemicals or contaminants, and any observed trends in the monitoring wells and diluent water supplies;

(4) Information pertaining to the vertical and horizontal migration of the recharge water plume;

(5) A description of any changes in the operation of any unit processes or facilities;

(6) A description of any anticipated changes, along with an evaluation of the expected impact of the changes on subsequent unit processes;

(7) The estimated quantity and quality of the recycled municipal wastewater and diluent water to be applied for the next calendar year;

(8) A summary of the measures taken to comply with section 60320.206 and 60320.200(j), and the effectiveness of the implementation of the measures; and

(9) Increases in RWC during the previous calendar year and RWC increases anticipated for the next calendar year.

(b) Every five years from the date of the initial approval of the engineering report required pursuant to section 60323, a project sponsor shall update the report to address any project changes and submit the report to the Department and Regional Board. The update shall include, but not be limited to:

(1) anticipated RWC increases, a description of how the RWC requirements in section 60320.216 will be met, and the expected impact the increase will have on the GRRP's ability to meet the requirements of this Article;

(2) evidence that the requirements associated with retention time in section 60320.208, if applicable, and section 60320.224 have been met; and

(3) a description of any inconsistencies between previous groundwater model predictions and the observed and/or measured values, as well as a description of how subsequent predictions will be accurately determined.

§60320.230. Alternatives.

(a) A project sponsor may use an alternative to a requirement in this Article if the GRRP's project sponsor:

(1) demonstrates to the Department that the proposed alternative assures at least the same level of protection to public health;

(2) receives written approval from the Department prior to implementation of the alternative; and

(3) if required by the Department or Regional Board, conducts a public hearing on the proposed alternative, disseminates information to the public, and receives public comments, pursuant to sections 60320.202(b) and (c).

(b) Unless specified otherwise by the Department, the demonstration in subsection (a)(1) shall include the results of a review of the proposed alternative by an independent scientific advisory panel that includes a toxicologist, a registered engineering geologist or hydrogeologist, an engineer licensed in California with at least three years of experience in wastewater treatment and public drinking water supply, a microbiologist, and a chemist.

Article 5.5. Other Methods of Treatment.

§60320.5. Other methods of treatment.

Methods of treatment other than those included in this chapter and their reliability features may be accepted if the applicant demonstrates to the satisfaction of the State Department of Health that the methods of treatment and reliability features will assure an equal degree of treatment and reliability.

Article 6. Sampling and Analysis.

§60321. Sampling and analysis.

(a) Disinfected secondary-23, disinfected secondary-2.2, and disinfected tertiary recycled water shall be sampled at least once daily for total coliform bacteria. The samples shall be taken from the disinfected effluent and shall be analyzed by an approved laboratory.

(b) Disinfected tertiary recycled water shall be continuously sampled for turbidity using a continuous turbidity meter and recorder following filtration. Compliance with the daily average operating filter effluent turbidity shall be determined by averaging the levels of recorded turbidity taken at four-hour intervals over a 24-hour period. Compliance with turbidity pursuant to section 60301.320 (a)(2)(B) and (b)(1) shall be determined using the levels of recorded turbidity taken at intervals of no more than 1.2-hours over a 24- hour period. Should the continuous turbidity meter and recorder fail, grab sampling at a minimum frequency of 1.2-hours may be substituted for a period of up to 24-hours. The results of the daily average turbidity determinations shall be reported quarterly to the regulatory agency.

(c) The producer or supplier of the recycled water shall conduct the sampling required in subsections (a) and (b).

Article 7. Engineering Report and Operational Requirements.

§60323. Engineering report.

(a) No person shall produce or supply recycled water for reuse from a water reclamation plant without a Department-approved engineering report.

(b) The report shall be prepared by a qualified engineer licensed in California and experienced in the field of wastewater treatment, and shall contain a description of the design of the proposed reclamation system. The report shall clearly indicate the means for compliance with these regulations and any other features specified by the regulatory agency.

(c) The report shall contain a contingency plan which will assure that no untreated or inadequately treated wastewater will be delivered to the use area.

§60325. Personnel.

(a) Each reclamation plant shall be provided with a sufficient number of qualified personnel to operate the facility effectively so as to achieve the required level of treatment at all times.

(b) Qualified personnel shall be those meeting requirements established pursuant to Chapter 9 (commencing with Section 13625) of the Water Code.

§60327. Maintenance.

A preventive maintenance program shall be provided at each reclamation plant to ensure that all equipment is kept in a reliable operating condition.

§60329. Operating records and reports.

(a) Operating records shall be maintained at the reclamation plant or a central depository within the operating agency. These shall include: all analyses specified in the reclamation criteria; records of operational problems, plant and equipment breakdowns, and diversions to emergency storage or disposal; all corrective or preventive action taken.

(b) Process or equipment failures triggering an alarm shall be recorded and maintained as a separate record file. The recorded information shall include the time and cause of failure and corrective action taken.

(c) A monthly summary of operating records as specified under (a) of this section shall be filed monthly with the regulatory agency.

(d) Any discharge of untreated or partially treated wastewater to the use area, and the cessation of same, shall be reported immediately by telephone to the regulatory agency, the State Department of Health, and the local health officer.

§60331. Bypass.

There shall be no bypassing of untreated or partially treated wastewater from the reclamation plant or any intermediate unit processes to the point of use.

Article 8. General Requirements of Design.

§60333. Flexibility of design.
The design of process piping, equipment arrangement, and unit structures in the reclamation plant must allow for efficiency and convenience in operation and maintenance and provide flexibility of operation to permit the highest possible degree of treatment to be obtained under varying circumstances.

§60335. Alarms.
(a) Alarm devices required for various unit processes as specified in other sections of these regulations shall be installed to provide warning of:
(1) Loss of power from the normal power supply.
(2) Failure of a biological treatment process.
(3) Failure of a disinfection process.
(4) Failure of a coagulation process.
(5) Failure of a filtration process.
(6) Any other specific process failure for which warning is required by the regulatory agency.

(b) All required alarm devices shall be independent of the normal power supply of the reclamation plant.

(c) The person to be warned shall be the plant operator, superintendent, or any other responsible person designated by the management of the reclamation plant and capable of taking prompt corrective action.

(d) Individual alarm devices may be connected to a master alarm to sound at a location where it can be conveniently observed by the attendant. In case the reclamation plant is not attended full time, the alarm(s) shall be connected to sound at a police station, fire station or other full time service unit with which arrangements have been made to alert the person in charge at times that the reclamation plant is unattended.

§60337. Power supply.
The power supply shall be provided with one of the following reliability features:
(a) Alarm and standby power source.

(b) Alarm and automatically actuated short-term retention or disposal provisions as specified in Section 60341.

(c) Automatically actuated long-term storage or disposal provisions as specified in Section 60341.

1.1 Article 9. Reliability Requirements for Primary Effluent.

§60339. Primary treatment.
Reclamation plants producing reclaimed water exclusively for uses for which primary effluent is permitted shall be provided with one of the following reliability features:

(a) Multiple primary treatment units capable of producing primary effluent with one unit not in operation.

(b) Long-term storage or disposal provisions as specified in Section 60341.

Article 10. Reliability Requirements for Full Treatment.

§60341. Emergency storage or disposal.

(a) Where short-term retention or disposal provisions are used as a reliability feature, these shall consist of facilities reserved for the purpose of storing or disposing of untreated or partially treated wastewater for at least a 24-hour period. The facilities shall include all the necessary diversion devices, provisions for odor control, conduits, and pumping and pump back equipment. All of the equipment other than the pump back equipment shall be either independent of the normal power supply or provided with a standby power source.

(b) Where long-term storage or disposal provisions are used as a reliability feature, these shall consist of ponds, reservoirs, percolation areas, downstream sewers leading to other treatment or disposal facilities or any other facilities reserved for the purpose of emergency storage or disposal of untreated or partially treated wastewater. These facilities shall be of sufficient capacity to provide disposal or storage of wastewater for at least 20 days, and shall include all the necessary diversion works, provisions for odor and nuisance control, conduits, and pumping and pump back equipment. All of the equipment other than the pump back equipment shall be either independent of the normal power supply or provided with a standby power source.

(c) Diversion to a less demanding reuse is an acceptable alternative to emergency disposal of partially treated wastewater provided that the quality of the partially treated wastewater is suitable for the less demanding reuse.

(d) Subject to prior approval by the regulatory agency, diversion to a discharge point which requires lesser quality of wastewater is an acceptable alternative to emergency disposal of partially treated wastewater.

(e) Automatically actuated short-term retention or disposal provisions and automatically actuated long-term storage or disposal provisions shall include, in addition to provisions of (a), (b), (c), or (d) of this section, all the necessary sensors, instruments, valves and other devices to enable fully automatic diversion of untreated or partially treated wastewater to approved emergency storage or disposal in the event of failure of a treatment process and a manual reset to prevent automatic restart until the failure is corrected.

§60343. Primary treatment.

All primary treatment unit processes shall be provided with one of the following reliability features:

(a) Multiple primary treatment units capable of producing primary effluent with one unit not in operation.

(b) Standby primary treatment unit process.

(c) Long-term storage or disposal provisions.

§60345. Biological treatment.
All biological treatment unit processes shall be provided with one of the following reliability features:

(a) Alarm and multiple biological treatment units capable of producing oxidized wastewater with one unit not in operation.

(b) Alarm, short-term retention or disposal provisions, and standby replacement equipment.

(c) Alarm and long-term storage or disposal provisions.

(d) Automatically actuated long-term storage or disposal provisions.

§60347. Secondary sedimentation.
All secondary sedimentation unit processes shall be provided with one of the following reliability features:

(a) Multiple sedimentation units capable of treating the entire flow with one unit not in operation.

(b) Standby sedimentation unit process.

(c) Long-term storage or disposal provisions.

§60349. Coagulation.

(a) All coagulation unit processes shall be provided with the following mandatory features for uninterrupted coagulant feed:

(1) Standby feeders,
(2) Adequate chemical stowage and conveyance facilities,
(3) Adequate reserve chemical supply, and
(4) Automatic dosage control.

(b) All coagulation unit processes shall be provided with one of the following reliability features:

(1) Alarm and multiple coagulation units capable of treating the entire flow with one unit not in operation;
(2) Alarm, short-term retention or disposal provisions, and standby replacement equipment;
(3) Alarm and long-term storage or disposal provisions;
(4) Automatically actuated long-term storage or disposal provisions, or
(5) Alarm and standby coagulation process.

§60351. Filtration.
All filtration unit processes shall be provided with one of the following reliability features:

(a) Alarm and multiple filter units capable of treating the entire flow with one unit not in operation.

(b) Alarm, short-term retention or disposal provisions and standby replacement

equipment.

(c) Alarm and long-term storage or disposal provisions.

(d) Automatically actuated long-term storage or disposal provisions.

(e) Alarm and standby filtration unit process.

§60353. Disinfection.

(a) All disinfection unit processes where chlorine is used as the disinfectant shall be provided with the following features for uninterrupted chlorine feed:

(1) Standby chlorine supply,

(2) Manifold systems to connect chlorine cylinders,

(3) Chlorine scales, and

(4) Automatic devices for switching to full chlorine cylinders. Automatic residual control of chlorine dosage, automatic measuring and recording of chlorine residual, and hydraulic performance studies may also be required.

(b) All disinfection unit processes where chlorine is used as the disinfectant shall be provided with one of the following reliability features:

(1) Alarm and standby chlorinator;

(2) Alarm, short-term retention or disposal provisions, and standby replacement equipment;

(3) Alarm and long-term storage or disposal provisions;

(4) Automatically actuated long-term storage or disposal provisions; or

(5) Alarm and multiple point chlorination, each with independent power source, separate chlorinator, and separate chlorine supply.

§60355. Other alternatives to reliability requirements

Other alternatives to reliability requirements set forth in Articles 8 to 10 may be accepted if the applicant demonstrates to the satisfaction of the State Department of Health that the proposed alternative will assure an equal degree of reliability.

* * * * *

CUSTOMER SURVEY QUESTIONS

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Santa Clara Valley Water District and South County Regional Wastewater Authority

South County Recycled Water Master Plan Update

Recycled Water Questionnaire

1. Would you be interested in using recycled water, a drought-proof water supply, for your non-potable water needs?
2. What are your primary non-potable water uses (landscape irrigation/agricultural irrigation/ industrial/commercial/other)?
    a. NOTE: If more than one type of use, the questions should be answered for each.
3. If your primary water use is irrigation, how many acres do you irrigate and what is your method of application?
4. What is your estimated demand/how much water do you use on average (in AFY)?
5. What is your estimate of the highest daily water use rate you see in a year, and when does that occur (in gpm)?
6. Do you have any plans to change your water use/demand in the future? If yes, please explain.
7. Is your water usage constant throughout the day, or is there a daily pattern of water usage (day/night/other)?
8. Are there any seasonal changes in water use? If yes, please explain.
9. What is your present source(s) of water/current water supply?
10. Is your irrigation/industrial water distribution system separate from your potable system or is it combined?
11. Do you have any specific water quality requirements for your application?
12. Do you have any concerns with using recycled water?
13. Do you have any other questions about recycled water or any other input you would like to provide the District regarding recycled water?

December 2015

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POTENTIAL CUSTOMER DATABASE

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List of New/Potential Recycled Water Users in South County (updated September 2015)

Site #	Site Name	Contact Name	Location/ Address	APNs	Interested in Recycled water? (Y/N)	Water Use Type (Ag, M&I, Other?)	Acres/Square Feet	Est. Demand	Estimated Peak Flow	Idea of Est. Future Demand?	Time of Usage (day, night?)	Time of Year Usage	Current water supply?	Separate Irrigation/Industrial water system separate from potable? (Y/N)	Types of Water use/Specific Water Quality Requirements?	Any Concerns with Using rec. water?	Comments
1	**Gilroy Gardens**	Walter Dunckel (Director of Park Operations)	3050 Hecker Pass Hwy Gilroy, CA 95020	810-19-014	Yes	Irrigation of large trees	36	150 (blending 30 to 40% recycled water)	NK	Anticipated that demand will remain steady.	Currently day usage, but looking into systems that could water at night	Greater usage in the summer	Small reservoir for summer, groundwater in the summer. Restroom water, etc. purchased from the city	Yes	Salt	Salt content.	Alternative Contact: Barbara-Lea Granter barb.granter@gilroygardens.org (408) 840-7135
2	**Sundance Landscaping, Inc.**	Steve Trout	Based in Oakland, but have two sites in Gilroy. First site is 23 miles east of Gilroy Outlets. Second site is about 4 miles west of 152 on Solis road.	N/A	Yes	Drip Irrigation for ornamental landscape (consultant to Verizon).	Two sites (approximately ~1500 sf and ~750 sf each)	500 to 1500 gal tanks every two months. First Site: 500 gal every 6 weeks; Second site: 2-300 gal every 2 months	Irrigate from tanks every 3 to 14 days	Dependent on Verizon. Second site may be planting new plants in the next few months. Typically the first year of their plants have high usage and then decreases annually.	Irrigate at 5 am using tanks.	Higher rates in the summer based on the evapotranspiration cycle	Using EBMUD water and transporting to Gilroy.	N/A	No high salts or mineral contamination.	Used before and have experience. No concerns. Would like a training session if implemented.	Demand is based on ten seasonal batch fills of 500 gal tank(s) - fill up every two months
3	**TBD by airandenergyresearch.com**	Kim Waggoner	Looking at options in CA and AZ	NK	Yes	Ag	NK	2.5 mgd	NK	NK	NK	NK	N/A	NK	NK	Need at least secondary treated water	Not sure where they will be expanding yet. Don't have a good idea of usage at this point. May know in a month or so.
4	**Flannagan (Kapa Seeds)**	Kevin Flanagan	Sheldon Rd S of Bloomfield Rd	TBD	Yes	Ag	11	10-60 afy	NK	Not foreseen to increase	Morning	Heavy in July/August	Well water	Yes	Food-grade specifications	That it is food grade and no heavy metals.	NA
5	**Kapa Seeds**	Same as Flannagan (See Site #4)															
6	**Bonfante Nurseries**	Jeff Terry or Bill Miller	Bloomfield Rd W of Sheldon Rd	841-30-008	No	Ag - Ornamental crops.	48	200 afy	NK	NK	NK	NK	NK	NK	NK	Determined that it is cost prohibitive to convert to recycled water and would no longer like to do it. Also, don't think that their staff would be able to handle recycled water correctly.	NA
7	**Western Tree Nursery I**	Jim Blocker	3873 Hecker Pass Road Gilroy, CA 95020	783-07-032	Generally interested	Ag - Ornamental crops	NK	Up to 900,000 gpd	900,000 gpd	Steady	24 hours a day during the summer (try drip irrigation during day and sprinklers at night)	Running at very high rates in the summer.	Well	Yes	No edible crops. Need minerals within certain tolerances.	Quality control, availability, and cost.	They have an on-site pond for potential blending or storage of recycled water.
8	**Western Tree Nursery II**	Jim Blocker	3280 Hecker Pass Road Gilroy, CA 95020 (across the street from above)	810-17-005	See above	See Above	See above	Up to 700,000 gpd	700,000 gpd	See above	See above	See above	See above	See above	See above	See above	See above.
9	**Bloomfield Ranch**	Jim Blocker	Same as Bonfante Nurseries (See site #6)														
10	**Syngenta**	Andreas Albring	2280 Hecker Pass Hwy	810-20-005	Yes	Ag	40	10,000 to 150,000 gpd	150,000 gpd	NK	Currently used during the day, but can be flexible.	Heavy in the summer	Well	Yes	No chlorine. Interested in recycled water only as emergency backup.	Water quality concerns because Syngenta is a research facility.	Flower breeding research station. Wells have been running dry during drought years. Currently running on only one well.
11	**Gilroy Self Storage**	Tom Smith	6500 Cameron Blvd., Gilroy, CA	532-02-015	Yes	NK	NK	TBD	NK	NK	NK	NK	NK	NK	NK	NK	NA
12	**Gilroy Cogen and Energy Center**	Lance Null Plant Engineer	1400 Pacheco Pass Hwy, Gilroy, CA	841-17-089	Yes	M&I	NK	20 afy	NK	NK	NK	NK	NK	NK	TDS	NK	Possible Water Quality Sensitive Use (TDS); at this time, Calpine does not believe they will need additional capacity - this will be confirmed with a site inspection at Calpine on 1/14/2015.
13	**Obata Farms (north of Gilroy WPCP)**	Thomas Obata	Miller Slough, APN 84117084	841-17-084	Yes	Ag	69	300 afy	NK	NK	NK	NK	NK	NK	NK	NK	Under construction
14	**Cintas Corp**	James Wagoner	904 Holloway Road Gilroy, CA	841-70-015	Yes	M&I	NA	80-105 afy	NK	105 afy estimate includes installation of future additional washer	24 hours a day	consistent	Municipal water supply	Yes	NK	No	NA
15	**United Natural Food - UNFI Warehouse and Distribution Facility**	Royce Railey	At end of Cameron Blvd adjacent to the reclaimed distribution main that runs along the SCVWD Princevale Channel.	TBD	Yes	M&I	NK	20 afy	NK	NK	NK	NK	None	Exterior use of recycled water only	NK	NK	landscape irrigation; truck washing
17	**Temporary Construction Demand**	Saeid Vaziry	TBD	TBD	TBD	NK	NK	0	NK	NK	NK	NK	NK	NK	NK	NK	NA
18	**Temple-Inland**	Mike Thompson	6400 Jamieson Way, Gilroy, CA 95020	NK	No	M&I	NA	NA	NA	NA	NA	NA	Recycling their own water on-site.	NA	NA	They are recycling water on-site already, which they use to manufacture starch for their products. He said that he currently doesn't see a need for additional recycled water at the moment or in the near future.	NA
19	**C&E Farms**	Steve Malatesta	South end of Sheldon rd	841-38-009	Yes	Ag	92.00	150 afy	NK	NK	8am-5pm preference	Seasonal	Well	NK	NK	NK	NK
20	**Fiorio Farms**	Dan Fiorio	1663 Hecker Pass Hwy	810-20-011	Yes	Ag	13.00	40 afy (150-200 gpm)	NK	NK	8am-5pm preference	Seasonal	NK	NK	NK	NK	NK
21	**Fiorio Farms/Sportspark Complex**	Dan Fiorio	6065 Monterey Frontage (in front of gilroy sports park)		Yes	Ag	10.00	30 afy (140-160 gpm)	NK	NK	8am-5pm preference	Seasonal	NK	NK	NK	NK	NK
22	**Meritage Homes Hecker Pass**	Jim Schul - RJA Inc(Development Engineer)	SF Home Development. Hecker Pass & Santa Teressa Blvd.	NK	Yes	Development/ City Park Irrigation	NK	6,678,695 gal/year	NK	NK	NK	NK	Recycled water is currenlty only source being set up for irrigation.	NK	NK	NK	NK
23	**Glen Loma Ranch**	Jim Schul - RJA Inc(Development Engineer)	SF Home Development. Extension to Luchessa Ave.	NK	Yes	Development/ City Park Irrigation	NK	TBD	NK	NK	NK	NK	NK	NK	NK	NK	NK
24	**Santa Teressa & Third Park (City of Gilory)**	Rick Smelser	Park Irrigation	TBD	TBD	NK	3.70	12 afy	NK	NK	NK	NK	NK	NK	NK	NK	NK

Notes:
TBD = To Be Determined
NA = Not Applicable
NK = Not Known at this time

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MORGAN HILL RECYCLED WATER EVALUATION

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MORGAN HILL
California

March
2016

Recycled Water Feasibility Evaluation

AKEL ENGINEERING GROUP, INC.

Final

MWH

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CITY OF MORGAN HILL

CITY OF MORGAN HILL

RECYCLED WATER FEASIBILITY EVALUATION

Final

March 2016

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MWH

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Smart Planning Our Water Resources

March 30, 2016

City of Morgan Hill
17575 Peak Ave
Morgan Hill, CA 95037

Attention: Karl Bjarke P.E.
Public Works Director / City Engineer

Subject: Recycled Water Feasibility Evaluation – Final Report

Dear Karl:

We are pleased to submit the final report for the City of Morgan Hill Recycled Water Feasibility Evaluation. This standalone report was prepared by Akel Engineering Group, Inc. and MWH Americas, Inc. in coordination with the 2015 Santa Clara Valley Water District Master Plan Update. This report documents the feasibility of bringing recycled water to the City of Morgan Hill and includes the following recycled water alternative evaluations:

- Transport recycled water from existing SCRWA WWTP.
- New satellite treatment plant to produce recycled water.
- Recharge aquifers using recycled water to augment groundwater supply.
- Promote "gray water" reuse systems.
- Explore the possibility of transporting recycled water from Regional Wastewater Facility

We extend our thanks to you, Karl Bjarke, Public Works Director / City Engineer; Dan Repp, Deputy Director for Utility Services; and other City staff whose courtesy and cooperation were valuable components in completing this study.

Sincerely,

AKEL ENGINEERING GROUP, INC.

Tony Akel, P.E.
Principal

Enclosure: Report

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CITY OF MORGAN HILL

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Steve Tate, Mayor

Rich Constantine, Mayor Pro Tem

Gordon Siebert, Council Member

Marilyn Librers, Council Member

Larry Carr, Council Member

Management Personnel

Karl Bjarke P.E., Public Works Director / City Engineer

Dan Repp P.E., Deputy Director for Utility Services

Other City Engineering, Planning, and Operations Staff

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Morgan Hill Recycled Water Feasibility Evaluation

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1 INTRODUCTION AND BACKGROUND

1.1 INTRODUCTION

The City of Morgan Hill (Morgan Hill) is exploring options for expanding the use of recycled water, from the Gilroy Wastewater Treatment Plant to Morgan Hill, in order to offset demand for potable water and meet the City's long-term water supply needs. Recycled water is highly treated wastewater treatment plant effluent that can be used in various applications. Recycled water can serve as a reliable water source for non-potable applications and a source of water for groundwater recharge. Increasing the utilization of recycled water improves the resilience of the City's water supply by reducing dependence on groundwater aquifers and imported supplies.

Four project alternatives to increase the utilization of recycled water in Morgan Hill have been identified. Potential recycled water customers were identified and prioritized to develop potential recycled water distribution systems for each alternative. The purpose of this report is to evaluate the feasibility of each alternative recycled water project. This evaluation is being prepared in coordination with the 2015 Santa Clara Valley Water District Master Plan Update and the results will also be reported there.

1.2 STUDY AREA

This report evaluated recycled water alternatives for Morgan Hill. The wastewater treatment plant serving Morgan Hill is the South County Regional Wastewater Authority (SCRWA) wastewater treatment plant (WWTP) located South of Morgan Hill, in the City of Gilroy. In a partnership agreement between SCWRA and the Santa Clara Valley Water District (SCVWD, the District), effluent from the SCRWA WWTP is treated to meet California recycled water standards and distributed to 14 existing customers. Due to the location of the WWTP, the existing recycled water system is located within the City of Gilroy and serves customers in areas surrounding the WWTP. Figure 1 shows the location of the WWTP, the City of Gilroy, and the City of Morgan Hill.

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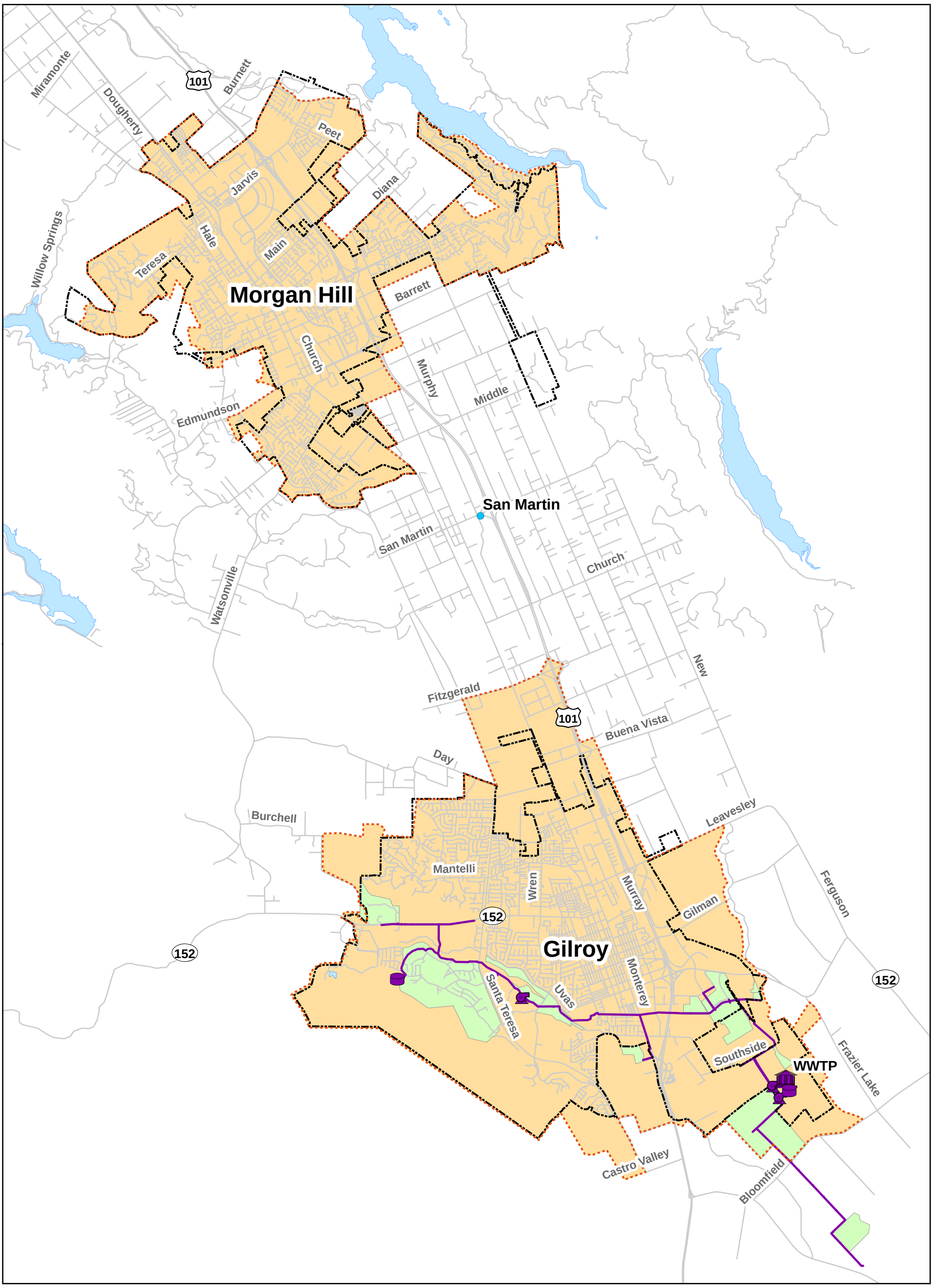

Legend

Existing System

- WWTP
- Storage Tanks
- Booster Stations
- Recycled Water Pipelines
- Existing Users
- Cities
- City Limits
- Urban Growth Boundary
- Roads
- Lakes

N W GIS E S

0 0.5 1 2 Miles

Updated: April 25, 2016

AKEL ENGINEERING GROUP, INC.

File Name & Location: P:\xGIS\GIS_Projects\SCVWD\MWH\2016\MP_Report\Appx-D\MH_Fig1_ProjLoc_042516.mxd

Figure 1
Project Location Area

City of Morgan Hill
Recycled Water Study

CITY OF MORGAN HILL

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1.3 MARKET ASSESSMENT

The market assessment identified potential recycled water customers in Morgan Hill. These potential customers are documented in Table 1 and shown in Figure 2. Using the same criteria as the 2015 SCVWD Master Plan Update each potential user was ranked based on the following criteria:

- Year Round/seasonal Use and High/Low Demand
- Flexibility of Water Usage/On-Site Storage
- Proximity to the Baseline System
- Level of Interest /Water Quality
- Capital, Construction, and O&M Annual Costs

The evaluation categories are described on Table 2. The results of the prioritization are documented on Table 3. This table includes two rankings; one that includes the costs of constructing a new recycled water transmission main to Morgan Hill and the other that excludes the Morgan Hill transmission main cost. The total scores range from 15 to 9 with the Morgan Hill transmission main cost and from 16 to 9 without. In comparison to the Gilroy customer rankings that range from 25 to 10 as documented in the 2015 SCVWD Master Plan Update.

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Table 1 Potential Recycled Water Customers

Recycled Water Feasibility Evaluation
City of Morgan Hill

Site No.	Site Name	Usage Type	Hours of Operation		Peaking Factors		Usage Estimates		Recycled Water Demand Estimates		
					Maximum Month Demand	Maximum Day Demand			Maximum Month	Maximum Day	Peak Hour
			(period)	(hrs)			(AFY)	(gpm)	(gpm)	(gpm)	(gpm)
M-1	Ann Sobrato High School	Irrigation	10PM-7AM	9	2.0	2.7	84	52	104	141	375
M-2	Morgan Hill Growers	Irrigation	24HR	24	2.5	3.5	39	24	61	86	86
M-3	Park	Irrigation	10PM-7AM	9	2.0	2.7	2	1	2	3	9
M-4	Morgan Hill Orthopedics & Sports Medicine	Irrigation	10PM-7AM	9	2.0	2.7	78	49	97	131	350
M-5	Park	Irrigation	10PM-7AM	9	2.0	2.7	12	7	14	20	52
M-6	Park	Irrigation	10PM-7AM	9	2.0	2.7	5	3	7	9	24
M-7	California Color Growers LLC	Irrigation	24HR	24	2.5	3.5	141	87	218	306	306
M-8	El Toro Elementary School	Irrigation	10PM-7AM	9	2.0	2.7	21	13	26	35	94
M-9	PA Walsh Elementary School	Irrigation	10PM-7AM	9	2.0	2.7	17	11	21	29	77
M-10	Central High School	Irrigation	10PM-7AM	9	2.0	2.7	6	4	7	10	27
M-11	Park	Irrigation	10PM-7AM	9	2.0	2.7	7	5	9	13	33
M-12	Park	Irrigation	10PM-7AM	9	2.0	2.7	10	6	13	17	46
M-13	Park	Irrigation	10PM-7AM	9	2.0	2.7	8	5	10	13	36
M-14	Park	Irrigation	10PM-7AM	9	2.0	2.7	3	2	3	4	11
M-15	Jackson Elementary School	Irrigation	10PM-7AM	9	2.0	2.7	13	8	16	22	58
M-16	Park	Irrigation	10PM-7AM	9	2.0	2.7	10	6	12	16	44
M-17	Nordstrom Elementary School	Irrigation	10PM-7AM	9	2.0	2.7	17	10	21	28	75
M-18	St Catherine's School	Irrigation	10PM-7AM	9	2.0	2.7	14	9	17	24	63
M-19	Morgan Hill Community and Cultural Center	Irrigation	10PM-7AM	9	2.0	2.7	22	14	27	37	99
M-20	Morgan Hill Community Park	Irrigation	10PM-7AM	9	2.0	2.7	70	44	87	118	314
M-21	Nursery	Irrigation	24HR	24	2.5	3.5	40	25	63	88	88
M-22	Coyote Valley Nursery	Irrigation	24HR	24	2.5	3.5	53	33	83	116	116
M-23	Valley Orchids Inc	Irrigation	24HR	24	2.5	3.5	67	42	104	145	145
M-24	Hoo Gee Nursery	Irrigation	24HR	24	2.5	3.5	65	40	101	141	141
M-25	Hung's Nursery	Irrigation	24HR	24	2.5	3.5	37	23	57	79	79
M-26	Kajiko Nursery	Irrigation	24HR	24	2.5	3.5	149	93	231	324	324
M-27	Institute Golf Course	Irrigation	9PM-7AM	10	2.0	2.7	494	307	624	842	2,021
M-28	Gabilan Growers	Irrigation	24HR	24	2.5	3.5	13	8	20	28	28
M-29	Farmer's Market	Irrigation	7AM-1PM	6	2.0	2.7	4	2	5	6	26
M-30	Greenfield Nursery	Irrigation	24HR	24	2.5	3.5	70	43	108	151	151
M-31	Lakeside Nursery	Irrigation	24HR	24	2.5	3.5	19	12	29	41	41
M-32	Paradise Park	Irrigation	10PM-7AM	9	2.0	2.7	16	10	20	27	72
M-33	Morgan Hill Outdoor Sports Center	Irrigation	10PM-7AM	9	1.9	2.5	54	33	62	84	225
M-34	Britton Field (Park)	Irrigation	10PM-7AM	9	2.0	2.7	59	37	73	99	264
M-35	Burnett Elementary School	Irrigation	10PM-7AM	9	2.0	2.7	19	12	23	32	85
M-36	Holiday Lake Meadow (Park)	Irrigation	10PM-7AM	9	2.0	2.7	17	10	21	28	75
M-37	Park	Irrigation	10PM-7AM	9	2.0	2.7	3	2	4	5	14
M-38	Nursery	Irrigation	24HR	24	2.5	3.5	52	32	81	113	113
M-39	Barrett Elementary School	Irrigation	10PM-7AM	9	2.0	2.7	16	10	20	27	71
M-40	Park	Irrigation	10PM-7AM	9	2.0	2.7	6	4	8	11	28
M-41	Del Monte Townhomes	Irrigation	10PM-7AM	9	2.0	2.7	17	11	22	29	77
M-42	Park	Irrigation	10PM-7AM	9	2.0	2.7	2	1	2	3	7
M-43	Park	Irrigation	10PM-7AM	9	2.0	2.7	5	3	7	9	24
M-44	Live Oak High School	Irrigation	10PM-7AM	9	2.0	2.7	81	50	101	136	363
M-45	Park	Irrigation	10PM-7AM	9	2.0	2.7	7	5	9	12	32
M-46	Park	Irrigation	10PM-7AM	9	2.0	2.7	6	4	8	10	27
M-47	Park	Irrigation	10PM-7AM	9	2.0	2.7	2	1	3	4	10
M-48	Park (Coyote Estates)	Irrigation	10PM-7AM	9	2.0	2.7	1	1	1	2	5
M-49	Park	Irrigation	10PM-7AM	9	2.0	2.7	7	4	8	11	30
M-50	Park	Irrigation	10PM-7AM	9	2.0	2.7	9	6	11	15	41
M-51	TenCate Advanced Composites	Irrigation	10PM-7AM	9	2.0	2.7	19	12	24	32	85
M-52	Morgan Hill Library	Irrigation	10PM-7AM	7	2.0	2.7	7	4	9	12	40
M-53	Oak Creek Park	Irrigation	10PM-7AM	9	2.0	2.7	9	6	12	16	42
M-54	Oakwood School	Irrigation	10PM-7AM	9	2.0	2.7	44	28	55	74	198
M-55	Howard Wiechert Park	Irrigation	10PM-7AM	9	2.0	2.7	3	2	4	5	14
M-56	Coyote Valley Sporting Clays	Irrigation	7AM-11PM	4	2.1	2.8	1	0	1	1	7
M-57	Wing Mok Nursery	Irrigation	24HR	24	2.5	3.5	49	31	77	107	107
M-58	Nursery	Irrigation	24HR	24	2.5	3.5	66	41	102	143	143
M-59	Farm	Agricultural	8AM-5PM	9	2.5	3.5	36	22	55	78	207
M-60	Park	Irrigation	10PM-7AM	9	2.0	2.7	3	2	4	5	13
M-61	Stratford School	Irrigation	10PM-7AM	9	2.0	2.7	4	2	5	6	17
M-62	Morgan Hill Bible Church	Irrigation	10PM-7AM	9	2.0	2.7	7	4	8	11	30
M-63	Kawahara Nursery Inc	Irrigation	24HR	24	2.5	3.5	353	219	548	767	767
M-64	Madrone Plaza	Irrigation	10PM-7AM	9	2.0	2.7	4	2	5	7	18
M-65	Diana Park	Irrigation	10PM-7AM	9	2.0	2.7	10	6	12	16	43
M-66	Park	Irrigation	10PM-7AM	9	2.0	2.7	3	2	3	5	12
M-67	Park	Irrigation	10PM-7AM	9	2.0	2.7	2	1	2	3	7
M-68	Park	Irrigation	10PM-7AM	9	2.0	2.7	5	3	6	8	20
M-69	Park	Irrigation	10PM-7AM	9	2.0	2.7	2	1	2	3	9
M-70	Park	Irrigation	10PM-7AM	9	2.0	2.7	2	1	2	3	7
M-71	Park	Irrigation	10PM-7AM	9	2.0	2.7	8	5	10	13	34
M-72	Jackson Park	Irrigation	10PM-7AM	9	2.0	2.7	4	3	5	7	18
M-73	William F. James Boys Ranch	Irrigation	10PM-7AM	9	2.0	2.7	185	115	230	310	827
M-74	Galvan Park	Irrigation	10PM-7AM	9	2.0	2.7	23	14	29	39	103
M-75	Nordstrom Park	Irrigation	10PM-7AM	9	2.0	2.7	14	9	17	23	62
M-76	Park	Irrigation	10PM-7AM	9	2.0	2.7	3	2	4	6	15
M-77	Park	Irrigation	10PM-7AM	9	2.0	2.7	11	7	14	19	51
M-78	Park	Irrigation	10PM-7AM	9	2.0	2.7	9	6	11	15	40
M-79	Paradise Valley Elementary School	Irrigation	10PM-7AM	9	2.0	2.7	24	15	30	40	107
						Total	2,877	1,787	3,967	5,453	

Notes:
1. Demand estimate calculated based on acreages of similar use

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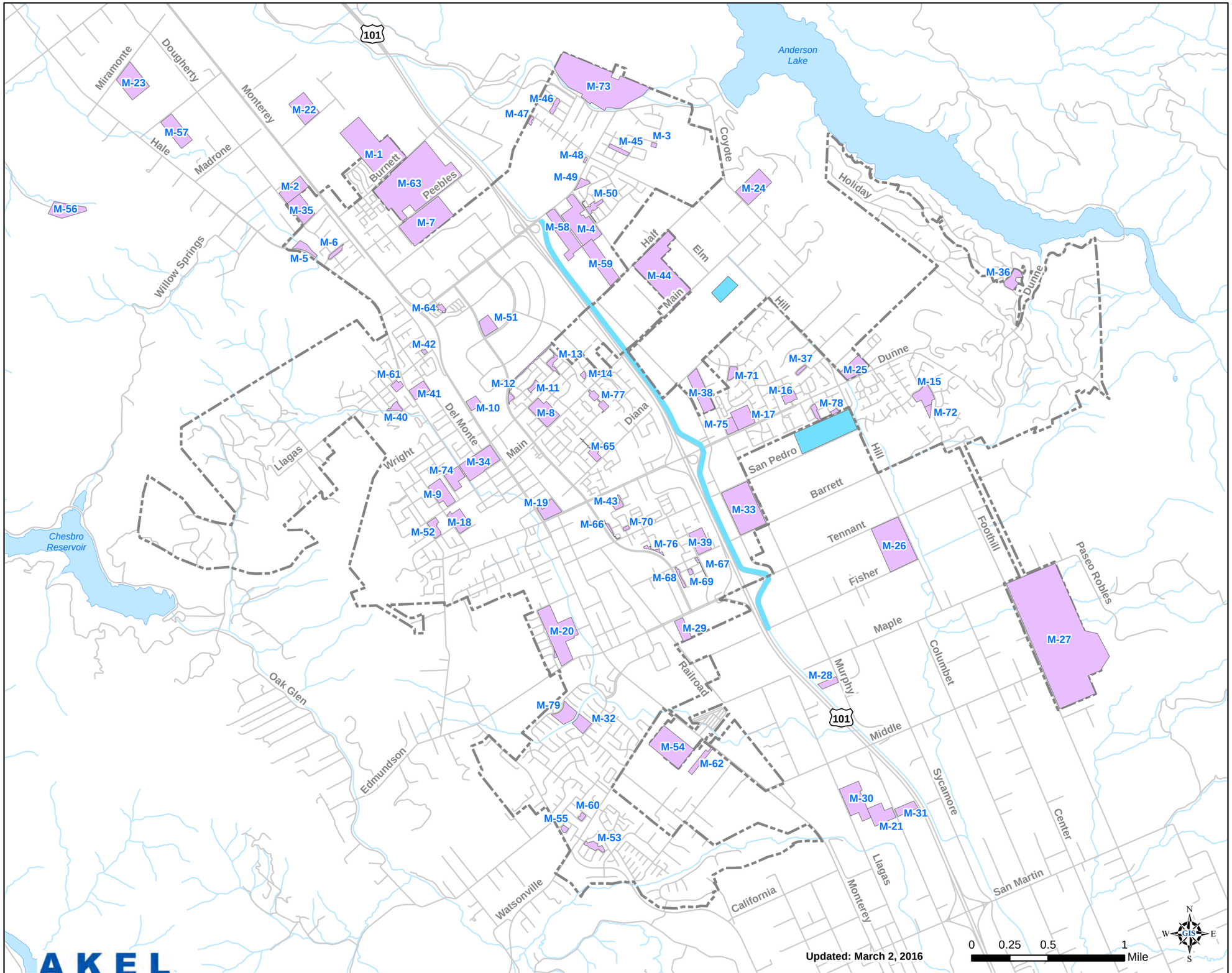

Legend

- Potential Users
- Potential Recharge
- City Limits
- Roads
- Creeks
- Lakes

Figure 2
Recycled Water System
Potential Users

City of Morgan Hill
Recycled Water Study

CITY OF MORGAN HILL

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Table 2 Evaluation Criteria - Categories and Scores

Recycled Water Feasibility Evaluation
City of Morgan Hill

Category 1 - Year Round/Seasonal Use and High/Low Demand

The scores in this category range from 1 to 5:

1. Highly Seasonal with High Demands (Irrigation)
2. Seasonal with High Variable Demand (Irrigation)
3. Seasonal with Low Variable Demand (M&I)
4. Mildly Seasonal with Low Consistent Demand (M&I)
5. Year Round Usage with Consistent High Demand (M&I)

Category 2 - Flexibility of Water Usage/On-site Storage

The scores in this category range from 1 to 5:

1. Strict usage times
2. Flexible usage times with potable water supply back-up required
3. Flexible usage times with ground water supply well back up required
4. Flexible usage times with no back up supply required
5. On-Site Storage (allows off-peak storage filling)

Category 3 - Proximity to Baseline System

The scores in this category range from 1 to 5:

1. System extension greater than 1/4 mile
2. System extension between 500 feet and 1/4 mile
3. System extension less than 500 feet
4. New turnout required
5. Existing turnout available

Category 4 - Level of Interest/Water Quality

The scores in this category range from 1 to 5:

1. No Interest
2. Interested but require high quality water and/or significant on-site infrastructure improvements
3. Interested and willing to meet higher quality requirements at their own expense and/or moderate on-site infrastructure improvements
4. Moderate Interest and not concerned about water quality and/or low on-site infrastructure improvements
5. High Interest and not concerned about quality and/or low on-site infrastructure improvements

Category 5 - Capital, Construction, and O&M Annual Costs

The scores in this category range from 1 to 5:

1. > $2,500 per acre foot
2. $1,500 - $2,500 per acre foot
3. $1,000 - $1,500 per acre foot
4. $500 - $1,000 per acre foot
5. < $500 per acre foot

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Table 3 Results of Recycled Water Customer Prioritization

Recycled Water Feasibility Evaluation
City of Morgan Hill

Site No.	Site Name	Recycled Water Demand Estimates		Evaluation Criteria						Evaluation Criteria (Not Including the Recharge Pipeline Project Costs)					
		Annual Average	Maximum Day Demand	Category 1 Seasonal Usage	Category 2 Flexibility of Use	Category 3 Proximity	Category 4 Level of Interest	Category 5 Capital/ O&M Costs	Total Score	Category 1 Seasonal Usage	Category 2 Flexibility of Use	Category 3 Proximity	Category 4 Level of Interest	Category 5 Capital/ O&M Costs	Total Score
		(afy)	(MGD)	(1-5)	(1-5)	(1-5)	(1-5)	(1-5)		(1-5)	(1-5)	(1-5)	(1-5)	(1-5)	
MH-30	Greenfield Nursery	70	0.22	5	3	1	3	3	15	5	3	1	3	4	16
MH-7	California Color Growers LLC	141	0.44	5	3	1	3	2	14	5	3	1	3	3	15
MH-21	Nursery	40	0.13	5	3	1	3	2	14	5	3	1	3	3	15
MH-26	Kajiko Nursery	149	0.47	5	3	1	3	2	14	5	3	1	3	3	15
MH-38	Nursery	52	0.16	5	3	1	3	2	14	5	3	1	3	3	15
MH-58	Nursery	66	0.21	5	3	1	3	2	14	5	3	1	3	4	16
MH-63	Kawahara Nursery Inc	353	1.10	5	3	1	3	2	14	5	3	1	3	2	14
MH-2	Morgan Hill Growers	39	0.12	5	3	1	3	1	13	5	3	1	3	2	14
MH-22	Coyote Valley Nursery	53	0.17	5	3	1	3	1	13	5	3	1	3	2	14
MH-23	Valley Orchids Inc	67	0.21	5	3	1	3	1	13	5	3	1	3	1	13
MH-24	Hoo Gee Nursery	65	0.20	5	3	1	3	1	13	5	3	1	3	2	14
MH-25	Hung's Nursery	37	0.11	5	3	1	3	1	13	5	3	1	3	2	14
MH-28	Gabilan Growers	13	0.04	5	3	1	3	1	13	5	3	1	3	2	14
MH-31	Lakeside Nursery	19	0.06	5	3	1	3	1	13	5	3	1	3	2	14
MH-57	Wing Mok Nursery	49	0.15	5	3	1	3	1	13	5	3	1	3	1	13
MH-1	Ann Sobrato High School	84	0.20	3	1	1	5	2	12	3	1	1	5	2	12
MH-8	El Toro Elementary School	21	0.05	3	1	1	5	2	12	3	1	1	5	2	12
MH-11	Park	7	0.02	3	1	1	5	2	12	3	1	1	5	2	12
MH-12	Park	10	0.02	3	1	1	5	2	12	3	1	1	5	3	13
MH-17	Nordstrom Elementary School	17	0.04	3	1	1	5	2	12	3	1	1	5	4	14
MH-27	Institute Golf Course	494	1.21	5	1	1	3	2	12	5	1	1	3	3	13
MH-44	Live Oak High School	81	0.20	3	1	1	5	2	12	3	1	1	5	4	14
MH-66	Park	3	0.01	3	1	1	5	2	12	3	1	1	5	3	13
MH-68	Park	5	0.01	3	1	1	5	2	12	3	1	1	5	3	13
MH-75	Nordstrom Park	14	0.03	3	1	1	5	2	12	3	1	1	5	4	14
MH-76	Park	3	0.01	3	1	1	5	2	12	3	1	1	5	3	13
MH-3	Park	2	0.00	3	1	1	5	1	11	3	1	1	5	1	11
MH-5	Park	12	0.03	3	1	1	5	1	11	3	1	1	5	1	11
MH-6	Park	5	0.01	3	1	1	5	1	11	3	1	1	5	2	12
MH-9	PA Walsh Elementary School	17	0.04	3	1	1	5	1	11	3	1	1	5	2	12
MH-10	Central High School	6	0.01	3	1	1	5	1	11	3	1	1	5	1	11
MH-13	Park	8	0.02	3	1	1	5	1	11	3	1	1	5	2	12
MH-14	Park	3	0.01	3	1	1	5	1	11	3	1	1	5	1	11
MH-15	Jackson Elementary School	13	0.03	3	1	1	5	1	11	3	1	1	5	1	11
MH-16	Park	10	0.02	3	1	1	5	1	11	3	1	1	5	3	13
MH-18	St Catherine's School	14	0.03	3	1	1	5	1	11	3	1	1	5	1	11
MH-20	Morgan Hill Community Park	70	0.17	3	1	1	5	1	11	3	1	1	5	2	12
MH-32	Paradise Park	16	0.04	3	1	1	5	1	11	3	1	1	5	1	11
MH-34	Britton Field (Park)	59	0.14	3	1	1	5	1	11	3	1	1	5	2	12
MH-35	Burnett Elementary School	19	0.05	3	1	1	5	1	11	3	1	1	5	2	12
MH-36	Holiday Lake Meadow (Park)	17	0.04	3	1	1	5	1	11	3	1	1	5	1	11
MH-37	Park	3	0.01	3	1	1	5	1	11	3	1	1	5	1	11
MH-39	Barrett Elementary School	16	0.04	3	1	1	5	1	11	3	1	1	5	2	12
MH-40	Park	6	0.02	3	1	1	5	1	11	3	1	1	5	1	11
MH-42	Park	2	0.00	3	1	1	5	1	11	3	1	1	5	1	11
MH-43	Park	5	0.01	3	1	1	5	1	11	3	1	1	5	1	11
MH-45	Park	7	0.02	3	1	1	5	1	11	3	1	1	5	1	11
MH-46	Park	6	0.01	3	1	1	5	1	11	3	1	1	5	1	11
MH-47	Park	2	0.01	3	1	1	5	1	11	3	1	1	5	1	11
MH-48	Park (Coyote Estates)	1	0.00	3	1	1	5	1	11	3	1	1	5	2	12
MH-49	Park	7	0.02	3	1	1	5	1	11	3	1	1	5	3	13
MH-50	Park	9	0.02	3	1	1	5	1	11	3	1	1	5	2	12
MH-53	Oak Creek Park	9	0.02	3	1	1	5	1	11	3	1	1	5	1	11
MH-54	Oakwood School	44	0.11	3	1	1	5	1	11	3	1	1	5	2	12
MH-55	Howard Wiechert Park	3	0.01	3	1	1	5	1	11	3	1	1	5	1	11
MH-60	Park	3	0.01	3	1	1	5	1	11	3	1	1	5	1	11
MH-61	Stratford School	4	0.01	3	1	1	5	1	11	3	1	1	5	1	11
MH-65	Diana Park	10	0.02	3	1	1	5	1	11	3	1	1	5	1	11
MH-67	Park	2	0.00	3	1	1	5	1	11	3	1	1	5	2	12
MH-69	Park	2	0.00	3	1	1	5	1	11	3	1	1	5	1	11
MH-70	Park	2	0.00	3	1	1	5	1	11	3	1	1	5	1	11
MH-71	Park	8	0.02	3	1	1	5	1	11	3	1	1	5	1	11
MH-72	Jackson Park	4	0.01	3	1	1	5	1	11	3	1	1	5	1	11
MH-74	Galvan Park	23	0.06	3	1	1	5	1	11	3	1	1	5	2	12
MH-77	Park	11	0.03	3	1	1	5	1	11	3	1	1	5	1	11
MH-78	Park	9	0.02	3	1	1	5	1	11	3	1	1	5	2	12
MH-79	Paradise Valley Elementary School	24	0.06	3	1	1	5	1	11	3	1	1	5	1	11
MH-29	Farmer's Market	4	0.01	3	1	1	3	2	10	3	1	1	3	3	11
MH-33	Morgan Hill Outdoor Sports Center	54	0.12	3	1	1	3	2	10	3	1	1	3	4	12
MH-51	TenCate Advanced Composites	19	0.05	3	1	1	3	2	10	3	1	1	3	3	11
MH-59	Farm	36	0.11	1	3	1	3	2	10	1	3	1	3	4	12
MH-4	Morgan Hill Orthopaedics & Sports Medicine	78	0.19	3	1	1	3	1	9	3	1	1	3	4	12
MH-19	Morgan Hill Community and Cultural Center	22	0.05	3	1	1	3	1	9	3	1	1	3	2	10
MH-41	Del Monte Townhomes	17	0.04	3	1	1	3	1	9	3	1	1	3	1	9
MH-52	Morgan Hill Library	7	0.02	3	1	1	3	1	9	3	1	1	3	1	9
MH-56	Coyote Valley Sporting Clays	1	0.00	3	1	1	3	1	9	3	1	1	3	1	9
MH-62	Morgan Hill Bible Church	7	0.02	3	1	1	3	1	9	3	1	1	3	1	9
MH-64	Madrone Plaza	4	0.01	3	1	1	3	1	9	3	1	1	3	2	10
MH-73	William F. James Boys Ranch	185	0.45	3	1	1	3	1	9	3	1	1	3	2	10
	Total	2,877	7.85												

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1.4 ALTERNATIVES EVALUATED

The following recycled water alternatives were evaluated in this report

1) Transport recycled water from existing SCRWA WWTP to users in Morgan Hill

2) Recharge aquifers using recycled water to augment groundwater supply

3) Utilize a satellite treatment plant to produce recycled water in Morgan Hill

4) Promote “gray water” reuse systems in Morgan Hill

These recycled water alternatives are shown on Figure 3, excluding the gray water reuse system which would not require any new piping. A conceptual system buildout is shown in Figure 4. Since this buildout system would demand more recycled water than what is available, potential recycled water distribution systems options were developed for a 1.0 mgd and a 2.25 mgd buildout scenario. These potential distribution system options were developed to distribute recycled water to different users and areas of Morgan Hill and are labeled MH-1 through MH-6. Table 4 presents the users and flows identified for each distribution system option. Class 5 cost estimates for each alternative are shown in Table 5. Distribution system piping alignments are shown for each alternative in the following sections.

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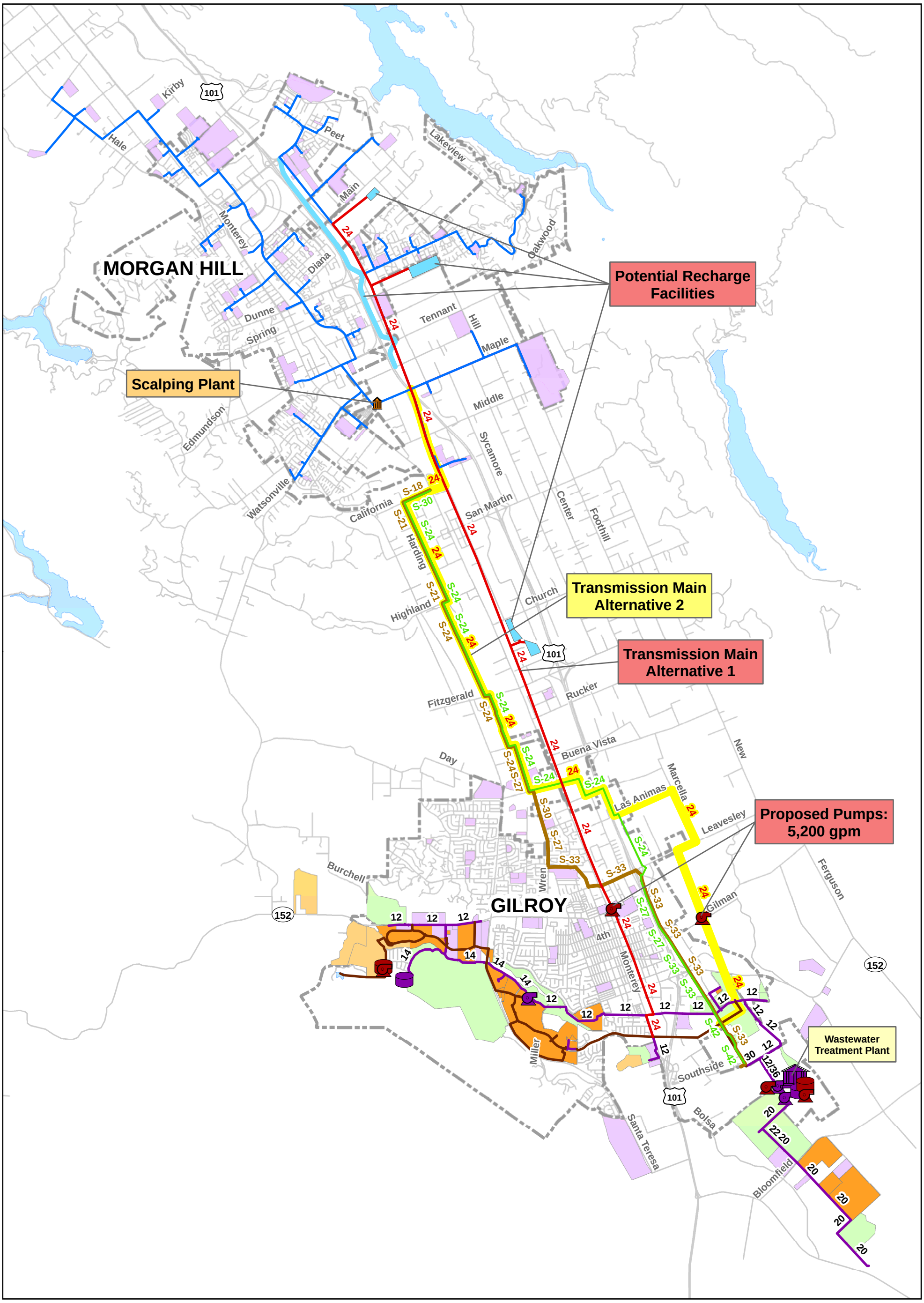

Figure 3
Morgan Hill Recycled Water Alternatives

City of Morgan Hill
Recycled Water Study

CITY OF MORGAN HILL

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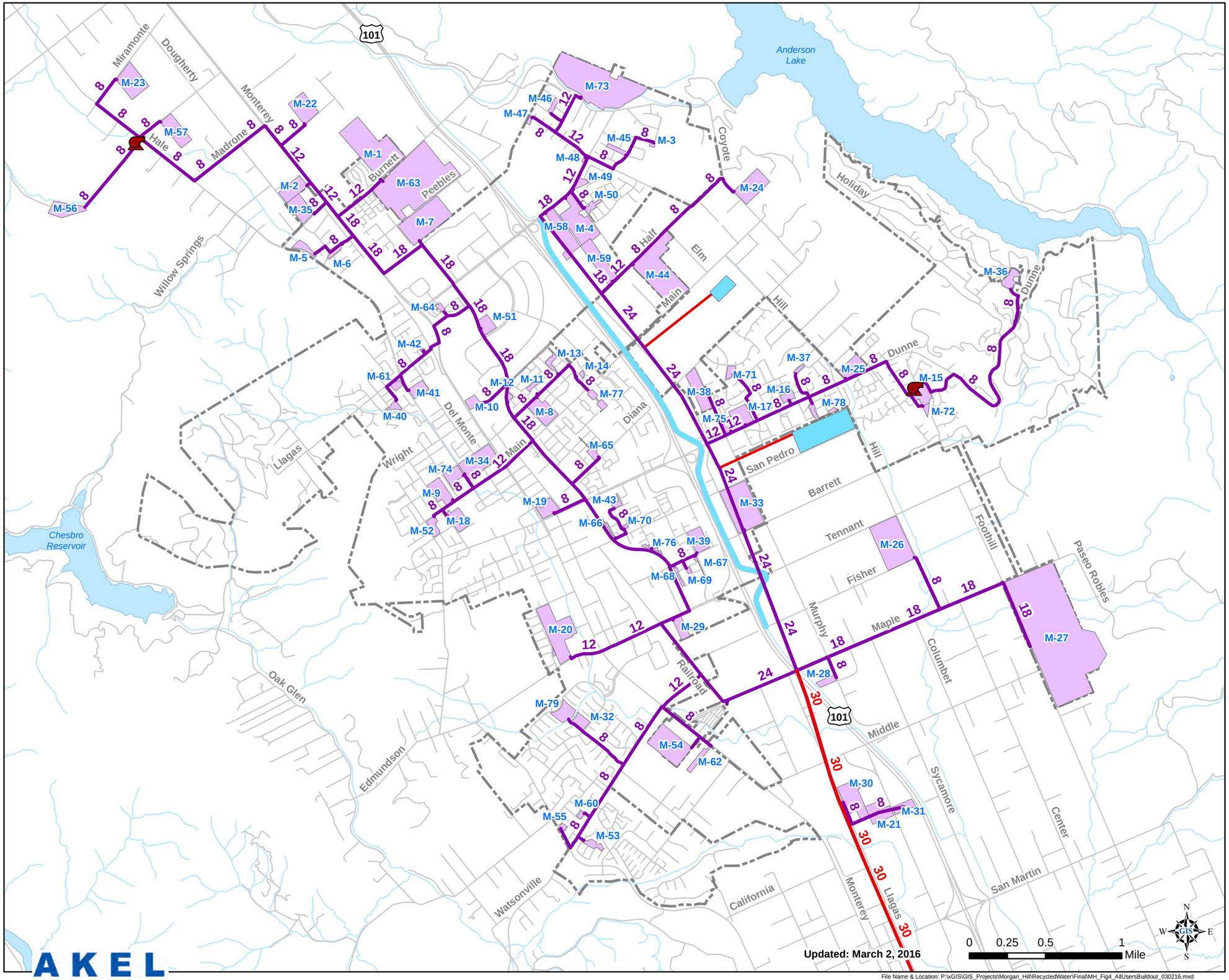

Legend

Proposed

- Booster Stations
- Recharge Pipeline Project
- Recycled Water System
- Potential Users

Existing

- Recharge Ponds
- City Limits
- Roads
- Creeks
- Lakes

Updated: March 2, 2016

File Name & Location: P:\xGIS\GIS_Projects\Morgan_Hill\RecycledWater\Final\MH_Fig4_AllUsersBuildout_030216.mxd

Figure 4
Recycled Water System Conceptual Buildout (Morgan Hill)

City of Morgan Hill
Recycled Water Study

CITY OF MORGAN HILL

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Table 4 Alternative Users and Demands

Recycled Water Feasibility Evaluation
City of Morgan Hill

Site No.	Site Name		Annual Average (MGD)	Maximum Day Demand (MGD)	Peak Hour Demand (MGD)
Option MH-1[1,2]					
M-27	Institute Golf Course				
		Total	**0.4**	**1.21**	**2.91**
Option MH-2[1]					
M-21	Nursery		M-30	Greenfield Nursery	
M-26	Kajiko Nursery		M-31	Lakeside Nursery	
M-28	Gabilan Growers		M-33	Morgan Hill Outdoor Sports Center	
		Total	**0.3**	**1.03**	**1.23**
Option MH-3[1]					
M-27	Institute Golf Course		M-30	Greenfield Nursery	
M-26	Kajiko Nursery		M-31	Lakeside Nursery	
M-21	Nursery		M-33	Morgan Hill Outdoor Sports Center	
M-28	Gabilan Growers				
		Total	**0.7**	**2.24**	**4.14**
Option MH-4[1]					
M-21	Nursery		M-58	Nursery	
M-26	Kajiko Nursery		M-59	Farm	
M-28	Gabilan Growers		M-15	Jackson Elementary School	
M-30	Greenfield Nursery		M-16	Park	
M-31	Lakeside Nursery		M-17	Nordstrom Elementary School	
M-33	Morgan Hill Outdoor Sports Center		M-25	Hung's Nursery	
M-4	Morgan Hill Orthopedics & Sports Medicine		M-37	Park	
M-44	Live Oak High School		M-38	Nursery	
M-45	Park		M-71	Park	
M-48	Park (Coyote Estates)		M-72	Jackson Park	
M-49	Park		M-75	Nordstrom Park	
M-50	Park		M-78	Park	
		Total	**0.7**	**2.26**	**3.40**
Option MH-5[2]					
M-11	Park		M-54	Oakwood School	
M-18	St Catherine's School		M-62	Morgan Hill Bible Church	
M-19	Morgan Hill Community and Cultural Center		M-67	Park	
M-21	Nursery		M-68	Park	
M-30	Greenfield Nursery		M-69	Park	
M-31	Lakeside Nursery		M-74	Galvan Park	
M-34	Britton Field (Park)		M-76	Park	
M-39	Barrett Elementary School		M-8	El Toro Elementary School	
M-52	Morgan Hill Library		M-9	PA Walsh Elementary School	
		Total	**0.3**	**1.00**	**2.02**
Option MH-6[2]					
M-11	Park		M-62	Morgan Hill Bible Church	
M-18	St Catherine's School		M-67	Park	
M-19	Morgan Hill Community and Cultural Center		M-68	Park	
M-21	Nursery		M-69	Park	
M-30	Greenfield Nursery		M-74	Galvan Park	
M-31	Lakeside Nursery		M-76	Park	
M-34	Britton Field (Park)		M-8	El Toro Elementary School	
M-39	Barrett Elementary School		M-9	PA Walsh Elementary School	
M-52	Morgan Hill Library		M-1	Ann Sobrato High School	
M-54	Oakwood School		M-63	Kawahara Nursery Inc	
		Total	**0.7**	**2.31**	**3.66**
Option MH-7[2]					
M-27	Institute Golf Course		M-33	Morgan Hill Outdoor Sports Center	
M-17	Nordstrom Elementary School		M-37	Park	
M-25	Hung's Nursery		M-38	Nursery	
M-26	Kajiko Nursery		M-71	Park	
M-16	Park		M-75	Nordstrom Park	
M-28	Gabilan Growers		M-78	Park	
		Total	**0.8**	**2.26**	**4.41**
Conceptual Buildout - Morgan Hill					
All Users					
		Total	**2.57**	**7.90**	**14.20**

Notes:

1. Recycled Water Supplied via Recharge Pipe Line Project
2. Recycled Water Supplied via Scalping Plant

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Table 5 Alternative Cost Summary

Recycled Water Feasibility Evaluation

City of Morgan Hill

	Pipes (millions)	Pump Stations (millions)	Tanks (millions)	Land/Easement Acquisition (millions)	Scalping Plant (millions)	Planned SCRWA Improvements (millions)	Total[1,2] (millions)
Gilroy Baseline Alternative							
Immediate - Term	$14.7	-	-	-	-	$5.3	**$20.0**
Near/Short - Term	$9.4	-	-	-	-	$8.4	**$17.8**
Long - Term	$2.8	$2.1	$6.0	$0.6	-	$50.0	**$61.5**
Total	$26.9	$2.1	$6.0	$0.6	$0.0	$63.7	**$99.3**
Expansion to Morgan Hill Alternatives							
Morgan Hill Transmission Main	$23.2 - $30.8	$3.9	-	$7.9 - $7.1	-	-	**$35.0 - $41.8**
Option MH-1/ MH-2 (1.0 MGD)	$4.1 - $5.2	$1.9 - $1.0	-	-	-	-	**$6.0 - $6.2**
Option MH-3/ MH-4 (2.25 MGD)	$3.9 - $11.3	$2.5 - $2.2	-	-	-	-	**$6.4 - $13.5**
Morgan Hill Scalping Plant Alternatives							
Option MH-1/ MH-5 (1.0 MGD)	$5.2 - $10.8	$1.9 - $1.5	-	-	$18.0	-	**$25.1 - $30.3**
Option MH-6/ MH-7 (2.25 MGD)	$6.4- $4.5	$2.3 - $2.6	-	-	n/a	-	**$8.7 - $7.1**

Notes:

1. Costs include contingencies of 20% for estimating, 20% for construction, and 30% for administration
2. Costs listed under each heading are incremental

11/17/2015

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1.5 RECYCLED WATER STANDARDS, ORDINANCES AND REGULATIONS

Production, discharge, distribution and use of recycled water within the City are subject to several Federal, State, and local regulations for recycled water programs, the primary objectives of which are to protect public health. Should the City decide to implement a recycled water project, a thorough review of all applicable regulations should be done in the earliest stages of planning and re-evaluated during pre-design, then confirmed during the design effort in order to provide the most effective and up to date recycled water program. A summary of existing regulatory requirements is provided in this section.

1.5.1 FEDERAL REQUIREMENTS

Two federal acts regulate the discharge and use of recycled water or wastewater: The Clean Water Act and the Safe Drinking Water Act.

1.5.1.1 Clean Water Act

Federal requirements relevant to the discharge of recycled water or wastewater, and any other liquid waste to "navigable waters," are contained in the 1972 amendments to the Federal Water Pollution Control Act of 1956, commonly known as the federal Clean Water Act (CWA) (public Law 92-500). The CWA created the U.S. Environmental Protection Agency (USEPA) and established the National Pollutant Discharge Elimination System (NPDES), a permit system for discharge of contaminants to navigable waters. NPDES requires that all municipal and industrial discharges of liquid wastes apply for and obtain a permit prior to initiating discharge.

The USEPA has also developed recommended recycled water guidelines in the *2004 Guidelines for Water Reuse* that can be found on the USEPA's website at: http://www.epa.gov/region09/water/recycling/index.html#regs

The guidelines examine opportunities for substituting recycled water for potable water supplies where potable water quality is not required. The recommended recycled water guidelines, along with supporting information, are provided as guidance for the benefit of the water and wastewater utilities and regulatory agencies.

1.5.1.2 Safe Drinking Water Act

Federal requirements relevant to the use of recycled water for groundwater recharge are contained in the 1986 amendments to the Safe Drinking Water Act (SDWA) of 1974 (Public Law 93-523). The SDWA focuses on regulation of drinking water and control of public health risks by establishing and enforcing maximum contaminant levels (MCLs) for various compounds in drinking water. The 1986 amendments also establish requirements for protection of groundwater supplies through wellhead protection programs and regulations of underground injection of wastes.

1.5.1.3 Administration

In the State of California, the administration and enforcement of the NPDES and SDWA programs have been delegated to the state.

1.5.2 STATE REQUIREMENTS

State requirements for production, discharge, distribution and use of recycled water are contained in the following regulations:

1. California Water Code, Division 7-Water Quality, Sections 1300 through 1399.16 (Water Code);
2. California Administrative Code, Title 22-Social Security, Division 4-Environmental health, Chapter 3-Reclamation Criteria, Sections 60301 through 60475 (Title 22); and
3. California Administrative Code, Title 17-Public Health, Chapter 5, Subchapter 1, Group 4-Drinking Water Supplies, Sections 7583 through 7630 (Title 17).

In addition, guidelines for production, distribution and use of recycled water have been prepared or endorsed by state agencies administering the recycled water regulations.

1.5.2.1 Water Code

The Water Code contains requirements for the production, discharge and use of recycled water. The Porter-Cologne Water Quality Control Act (Division 7 of the California Water Code), which was promulgated in 1969, established the State Water Resources Control Board (SWRCB) as the state agency with primary responsibility for the coordination and control of water quality, water pollution, and water rights (Division 7, Chapter 1).

Nine Regional Water Quality Control Boards (RWQCB) were established to represent the SWRCB regionally and carry out the enforcement of water quality and pollution control measures (Division 7, Chapter 4). In addition, each RWQCB was required to formulate and adopt water quality control plans and establish requirements for waste discharge to waters of the state. In 1972, Chapter 5.5 was added to Division 7 to provide the RWQCBs with the authority to carry out the provisions of the federal CWA. The Central Coast RWQCB has jurisdiction over the City.

Division 7, Chapter 7-Water Reclamation, was included in the Porter-Cologne Water Quality Control Act in 1969. Subsequent amendments required SWRCB to establish water reclamation criteria, gave the RWQCB the responsibility of prescribing specific water reclamation requirements for water which is used or proposed to be used as recycled water, provided for the regulation of injection of waste into the ground, and required the use of recycled water, if available, rather than potable water for irrigation of greenbelt areas.

In addition to Division 7, Chapter 7, Sections 1210 through 1212 of the Water Code, added in 1980, focus on ownership of treated wastewater and require that the owner of a wastewater treatment plant obtain approval from SWRCB prior to making any change in the point of discharge, place of use or purpose of use of treated wastewater.

1.5.2.2 Title 22

In 1975, Title 22 was prepared by the CDPH in accordance with the requirements of Division 7, Chapter 7 of the Water Code. In 1978, Title 22 was revised to conform with the 1977 amendment to the federal CWA. The requirements of Title 22, as revised in 1978, 1990, 2001, 2008, and 2014 regulate production and use of recycled water in California. In 2014, the duties

of updating and enforcing these regulations was transferred from the CDPH to the SWRCB Division or Drinking Water (DDW).

Chapter 3, Water Recycling Criteria, of the Title 22 regulations contains recycled water quality criteria and treatment requirements based on the type and area of use, e.g., irrigation of food crops, recreational impoundments, and groundwater recharge. Title 22 requirements are summarized in Table 6.

Title 22 establishes the quality and/or treatment processes required for an effluent to be used for a specific non-potable application. The following categories of recycled water are identified:

- Disinfected tertiary recycled water
- Disinfected secondary-2.2 recycled water[1]
- Disinfected secondary-23 recycled water[2]
- Undisinfected secondary recycled water
- Disinfected tertiary recycled water with conventional treatment
- Disinfected tertiary recycled water without conventional treatment.

In addition to recycled water uses and treatment requirements, Title 22 addresses sampling and analysis requirements at the treatment plant, preparation of an engineering report prior to production or use of recycled water, general treatment design requirements, reliability requirements, and alternative methods of treatment.

The 2014 revision of the Title 22 regulation includes updated requirements for groundwater replenishment projects. These requirements are described in Section 3.2.

[1] The 2.2 refers to the coliform count requirement for the water – 2.2 MPN/100 mL

[2] The 23 refers to the coliform count requirement for the water – 23 MPN/100 mL

Table 6 Title 22 Requirements

Recycled Water Feasibility Evaluation
City of Morgan Hill

Recycled Water Use	Minimum Treatment Requirements	Use Distance Requirement from Water Supply Well[2]
Landscape Irrigation		
Food crops where recycled water comes in contact with the edible portion of the crop, including all root crops Parks and playgrounds School yards Residential landscaping Unrestricted-access golf course Any other irrigation not listed in this table and not prohibited by the California Code of Regulations	disinfected tertiary[3]	50 ft[4,5]
Surface irrigation of food crops where edible portion is above ground and not contacted by recycled water	disinfected secondary-2.2	100 ft[5]
Cemeteries Freeway landscaping Restricted access golf courses Ornamental nursery stock and sod farms with unrestricted public access Pasture for milk animals for human consumption Non-edible vegetation with access control to prevent use as a park, playground or school yard	disinfected secondary-23	100 ft[5]
Orchards with no contact between edible portion and recycled water Vineyards with no contact between edible portion and recycled water Non food-bearing trees, including Christmas tree farms not irrigated less than 14 days before harvesting Fodder and fiber crops and pasture for animals not producing milk for human consumption Seed crops not eaten by humans Food crops undergoing commercial pathogen-destroying processing before being consumed by humans Ornamental nursery stock and sod farms not irrigated less than 14 days before harvesting	undisinfected secondary	150 ft[5]
Impoundments		
Unrestricted recreational impoundments	disinfected tertiary subject to conventional treatment[6,7]	100 ft
Restricted recreational impoundments and publicly accessible fish hatcheries	disinfected secondary-2.2	100 ft
Landscape impoundments without decorative fountains	disinfected secondary-23	100 ft
Cooling		
Industrial or commercial cooling involving a cooling tower, evaporative condenser, or spraying that creates a mist	disinfected tertiary[8]	n/a
Industrial or commercial cooling that does not involves not involving a cooling tower, evaporative condenser, or spraying that creates a mist	disinfected secondary-23	n/a
Other Uses		
Flushing toilets and urinals Priming drain traps Industrial process water that may contact workers Structural fire fighting Decorative fountains Commercial laundries Consolidation of backfill around potable water pipelines Artificial snow making for commercial outdoor use Commercial car washes, including hand washes with heated water where the public is excluded from washing process	disinfected tertiary[3]	n/a
Industrial boiler feed Nonstructural fire fighting Backfill consolidation around non-potable piping Soil compaction Mixing concrete Dust control on roads and streets Cleaning roads, sidewalks and outdoor work areas Industrial process water that will not contact workers	disinfected secondary-23	n/a
Flushing sanitary sewers	undisinfected	n/a
Groundwater recharge	determined on an individual case basis by Title 22 Regulations[9]	

3/29/2016

1. Refer to the full text of Title 22: California Code of Regulations, Chapter 3 Water Recycling Criteria. This chart is only a summary of the criteria as of March 24, 2011. Full text can be downloaded from: http://www.cdph.ca.gov/HealthInfo/environhealth/water/Pages/Waterrecycling.aspx.
2. Applies to recycled water meeting minimum treatment requirements that apply to each use.
3. Filtration pursuant to Title 22 Section 60301.320(a) requirements for coagulation need not be used as part of the treatment process provided that the filter effluent turbidity does not exceed 2 NTU, the turbidity of the influent to the filters is continuously measured, the influent turbidity does not exceed 5 NTU for more than 15 minutes and never exceeds 10 NTU, and that there is the capability to automatically activate chemical addition or divert the wastewater should the filter influent turbidity exceed 5 NTU for more than 15 minutes.
4. Irrigation with disinfected tertiary water may take place within 50 feet of any domestic water supply well if the conditions of Title 22 Section 60310(a) have been met.
5. No spray irrigation of any recycled water, other than disinfected tertiary recycled water, shall take place within 100 feet of a residence or a place where public exposure could be similar to that of a park, playground, or school yard.
6. Disinfected tertiary recycled water that has not received conventional treatment may be used for unrestricted recreational impoundments if it is monitored for the presence of pathogenic organisms in accordance with Title 22 Section 60305(b)(1).
7. The total coliform bacterial concentrations in recycled water used for unrestricted recreational impoundments shall comply with criteria in Title 22 Section 60301.230 (b) when measured between disinfection and impoundment entry.
8. Cooling system must also use a drift eliminator when in operation, and chlorine or other biocide must be used to treat recirculated water.
9. Refer to the article 5.1 of the Title 22 Recycled Water Regulations.

1.5.2.3 Title 17

The focus of Title 17 is protection of drinking (potable) water supplies through control of cross-connections with potential contaminants, including non-potable water supplies such as recycled water. The cross-connection control program and backflow protection required by Title 17 for public water supply protection are discussed in Section 4: Connection Issues Driven by Water Code and City Ordinances.

Recycled water is specifically addressed within Title 17 as follows:

- An air-gap separation is required on "premises where the public water system is used to supplement the recycled water supply"
- A reduced pressure principle backflow prevention device (RPPD) is required on "premises where recycled is used… and there is no interconnection with the potable water system."
- A double-check valve assembly may be used for "residences using recycled water for landscape irrigation as part of an approved dual plumbed use area established pursuant to sections 60313 through 60316 unless the recycled water supplier obtains approval for the local public water supplier, or the DDW if the water supplier is also the supplier of the recycled water, to utilize an alternative backflow prevention plan that includes an annual inspection and annual shutdown test of the recycled water and potable water systems pursuant to subsection 60316(a).

1.5.2.4 Administration

In California, reclamation requirements are administrated by the SWRCB and the individual RWQCBs. The direct involvement of each agency in recycled water is summarized below:

1.5.2.5 State Water Resources Control Board

The SWRCB does not have water quality requirements for recycled water other than the Title 22 Recycled Water Regulations. It has adopted Resolution No. 77-1 "Policy with Respect to Water Reclamation in California" that encourages reclamation, reuse, and water conservation. On February 2009, the SWRCB adopted "A Policy for Water Quality Control for Recycled Water." The policy, which will take effect after approval by the Office of Administrative Law, states goals for use of recycled water, including the substitution of as much recycled water for potable water as possible by 2030.

SWRCB does have the requirement to issue loans (such as those from Proposition 1) in accordance with the Water Code as well as approval of petitions for the change in place and purpose of use of treated wastewater in accordance with the Water Code.

1.5.2.6 State Water Resources Control Board Division of Drinking Water

The DDW has the responsibility to:

1. Review and approve engineering reports as requested by RWQCB
2. Review and approve final plans for cross-connection control and pipeline separations in accordance with Title 17 and inspect the distribution system prior to operation.

3. In conjunction with local health agencies, review and approve final on-site (user) system plans for cross-connection control in accordance with Title 17 and inspect the system prior to operation.

The DDW has delegated a portion of its administrative duties in the past to local health agencies (such as the Long Beach Department of Public Health and the County of Los Angeles Department of Public Health) and becomes more involved at the request of the local health agencies.

1.5.3 ON-GOING DEVELOPMENT TO EXISTING WATER QUALITY REQUIREMENTS

The SWRCB DDW is currently developing regulations for IPR projects utilizing surface water augmentation and regulations for direct potable reuse projects (DPR). Direct potable reuse is the practice of supplying highly treated wastewater effluent to a potable distribution system with an engineered buffer instead of the environmental buffer required in IPR projects. There are currently no DPR projects in California because there are no regulations that allow them at this time.

An expert panel has been formed to advise the DDW on public health issues regarding the development of surface water augmentation and DPR regulations. The panel will also asses what additional research is needed for establishing regulations for DPR.

2 EVALUATE FEASIBILITY OF BRINGING RECYCLED WATER FROM THE SCRWA WWTP

2.1 INTRODUCTION

The SCRWA is a joint powers agency between the Cities of Morgan Hill and Gilroy that operates a WWTP located approximately 3 miles southeast of Gilroy and 10 miles southeast of Morgan Hill. The wastewater treatment plant collects influent from both the Cities of Gilroy and Morgan Hill with a permitted capacity to treat a maximum average dry weather flow (ADWF) of 8.5 mgd. The ADWF over the last three years is reported to be 6.2 MGD. The WWTP utilizes grit removal and two oxidation ditches to provide nutrient removal. Secondary effluent can then be sent to on-site percolation ponds or diverted to tertiary facilities for further treatment.

2.1.1 SCRWA TERTIARY TREATMENT FACILITIES

Oxidized wastewater can be diverted to a granular media filtration plant with four filter beds. The filtration rate is limited to 5 gallons per minute per square foot (gpm/sf) by California Title 22 regulations. Given this filtration rate, each of the four filters has the capacity to treat a maximum flow of 3 MGD. Filters are periodically backwashed - one at a time, so the firm filtration capacity of the SCRWA filter plant is approximately 9 MGD.

Disinfection is currently provided to the filter plant effluent by dosing chlorine and sending the effluent through a chlorine contact basin. Under California Title 22 regulations, disinfected tertiary recycled water must have a 450 mg/L-minute of concentration times modal contact time (CT). Additionally, disinfected tertiary recycled water must have a 90 minute modal contact time, based on peak dry weather flow prior to its reuse.

The on-site Reclaimed Water Reservoir can store 3 MG of tertiary disinfected effluent. The purpose of the Reservoir is to supplement the Reclamation System with tertiary disinfected effluent when demand exceeds Chlorine Contact Basin effluent flow rate. The Reservoir is filled when the Chlorine Contact Basin effluent exceeds reclaimed water demand and is drained when reclaimed water demand exceeds Chlorine Contact Basin effluent. This allows the SCRWA Reclamation System to meet peak demands in excess of the tertiary treatment capacity.

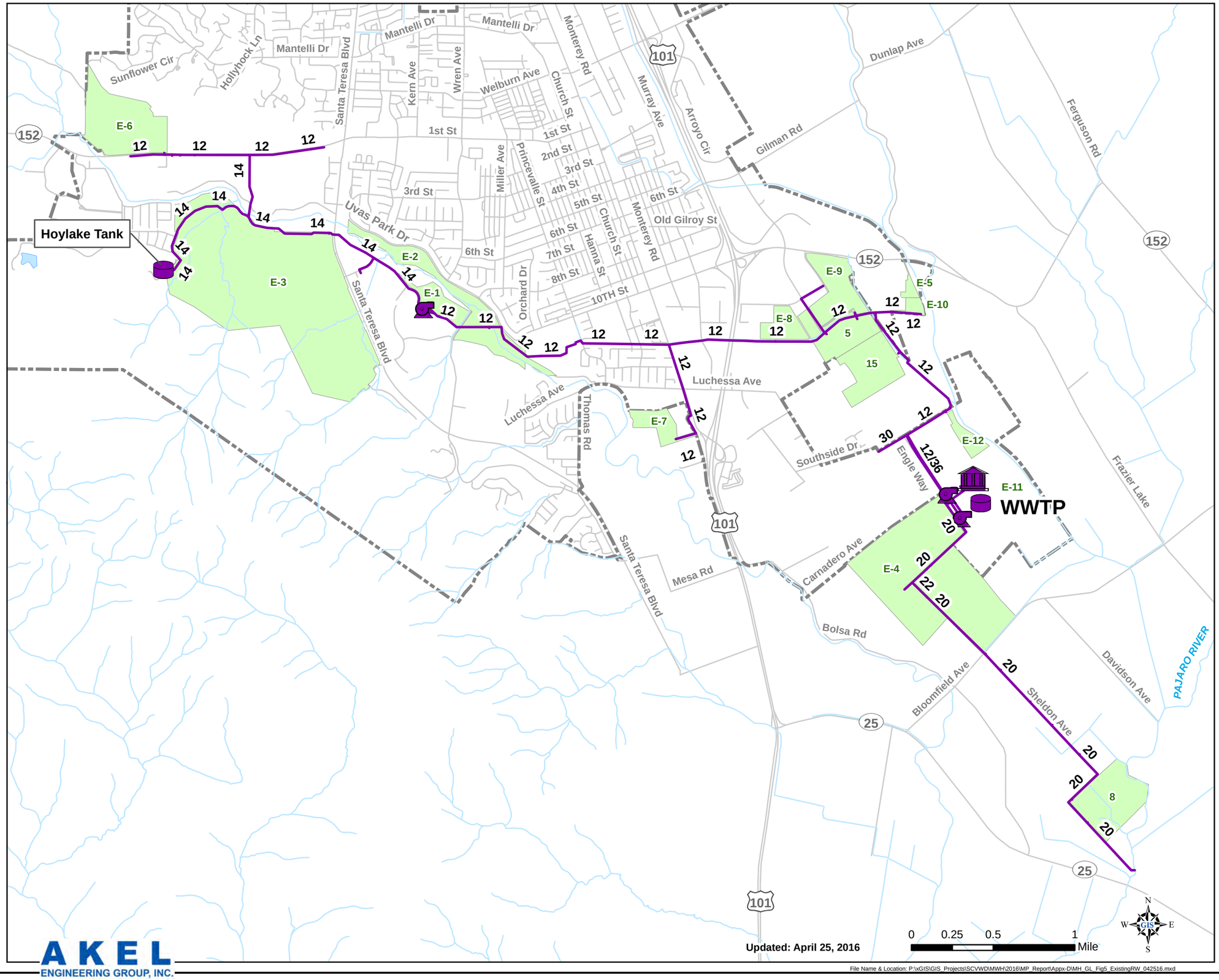
2.2 SCRWA RECLAIMED WATER QUALITY

The SCRWA WWTP provides reclaimed water that meets the California Title 22 regulations for tertiary disinfected wastewater. No further treatment of reclaimed water is required prior to any of the uses described in the California Title 22 Recycled Water Regulations for tertiary disinfected wastewater.

2.3 CURRENT SCRWA RECLAIMED WATER

The SCRWA WWTP currently supplies recycled water to users located in Gilroy and the surrounding area. The existing recycled water distribution system and users are shown in Figure 5. Recycled water users are allotted a specific volume of recycled water and specified hours of operation when they can use it. Table 7 lists the current SCRWA recycled water users, the

hours when they are permitted to use recycled water, estimated yearly recycled water demands, and year 2014 observed recycled water demand.



Legend

Existing

- WWTP
- Storage Tanks
- Booster Stations
- Recycled Water Pipelines
- Existing Users
- City Limits
- Roads
- Lake
- Creeks

Updated: April 25, 2016

Figure 5
Existing Recycled Water System

City of Morgan Hill
Recycled Water Study

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File Name & Location: P:\xGIS\GIS_Projects\SCVWD\MWH\2016\MP_Report\Appx-D\MH_GL_Fig5_ExistingRW_042516.mxd

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Table 7 Current Recycled Water Customers Hours of Usage

Recycled Water Feasibility Evaluation

City of Morgan Hill

Site No.	Site Name	Recycled Water System	Zone	Usage Type	On-Site Storage	Hours of Usage (period)	Hours of Usage (hrs)	Estimated Demands[1] (afy)	Actual Usage (2014)[2] (afy)
Existing Users									
E-1	Christmas Hill Park - Ranch	North	1	Irrigation		10pm - 7am	9	25	7
E-2	Christmas Hill Park - North	North	1	Irrigation		10pm - 7am	9		19
E-3	Eagle Ridge Golf Course	North	2	Irrigation	Pond	9pm - 6am	9	330	455
E-4	SCRWA Farms (Ag Lease) Turnout #1-#6	South	-	Agricultural		7 am-1pm; 7pm-1am	12	150	174
E-8	Obata Farms (North)	North	1	Agricultural		7 am-1pm; 7pm-1am	12		60
E-5	Calpine Power Plant - Peaker	North	1	M&I		24hr	24	260	6
E-10	Calpine Power Plant - Cogen	North	1	M&I		24hr	24		77
E-6	City of Gilroy - Golf Course	North	2	Irrigation		9pm - 7am	10	120	129
E-7	City of Gilroy - Sports Park	North	1	Irrigation		10pm - 7am	9	30	32
E-9	McCarthy Business Park	North	1	Irrigation		9pm - 6am	9	5	15
E-11	WWTP Utility Water	WWTP Utility	-	M&I		24hr	24	1,000	1020
E-12	City of Gilroy - Shooting Range	North	1	Irrigation		7am - 11pm	4	1	1
8	C & E Farms[3]	South	-	Agricultural		8am-5pm	9	150	-
15	Obata (new turnout)[3]	North	1	Agricultural		7 am-1pm; 7pm-1am	12	150	-
5	United Natural Food[3]	North	1	Irrigation		10pm - 7am	9	20	-
	Total							2,241	1,995

Notes:

9/14/2015

1. Estimated Demands for existing users obtained from 'Recycled Water Use Permits.'
2. Actual usage per 'SCRWA Reclaimed Water Usage Log' for Calendar 2014 listed (quarter usage received)
3. Not used in 2014 Analysis Scenario, customers will be on-line and receiving water in the near-term.

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2.4 SCRWA RECYCLED WATER AVAILABLE FOR USE IN MORGAN HILL

Recycled water availability could be limited by any component of the recycled water system: wastewater influent to the SCRWA WWTP, the SCRWA tertiary treatment system, or the recycled water distribution system pump station capacities. On-site reclaimed water storage facilities are used to meat peak demands when recycled water demand exceeds plant influent flows or tertiary treatment system capacities. The plant influent ADWF and tertiary treatment capacities are presented in section 2.1.

Figure 6 provides recycled water use data for existing users along the North Pipeline and South Pipeline and the current capacities of the recycled water distribution pump stations. While current recycled water users are restricted in when they can use recycled water, the capacity of the SCRWA recycled water system can be nearly exceeded during periods of peak demand. This could potentially limit recycled water use by new users in Morgan Hill.

The total volume of water available for use in Morgan Hill can be estimated by subtracting current recycled water use from the permitted plant capacity. This calculation is provided in section 3.5. It is important to note that without storage facilities, Morgan Hill recycled water customers would not be able to take advantage of this entire volume due to time of use demands from existing customers.

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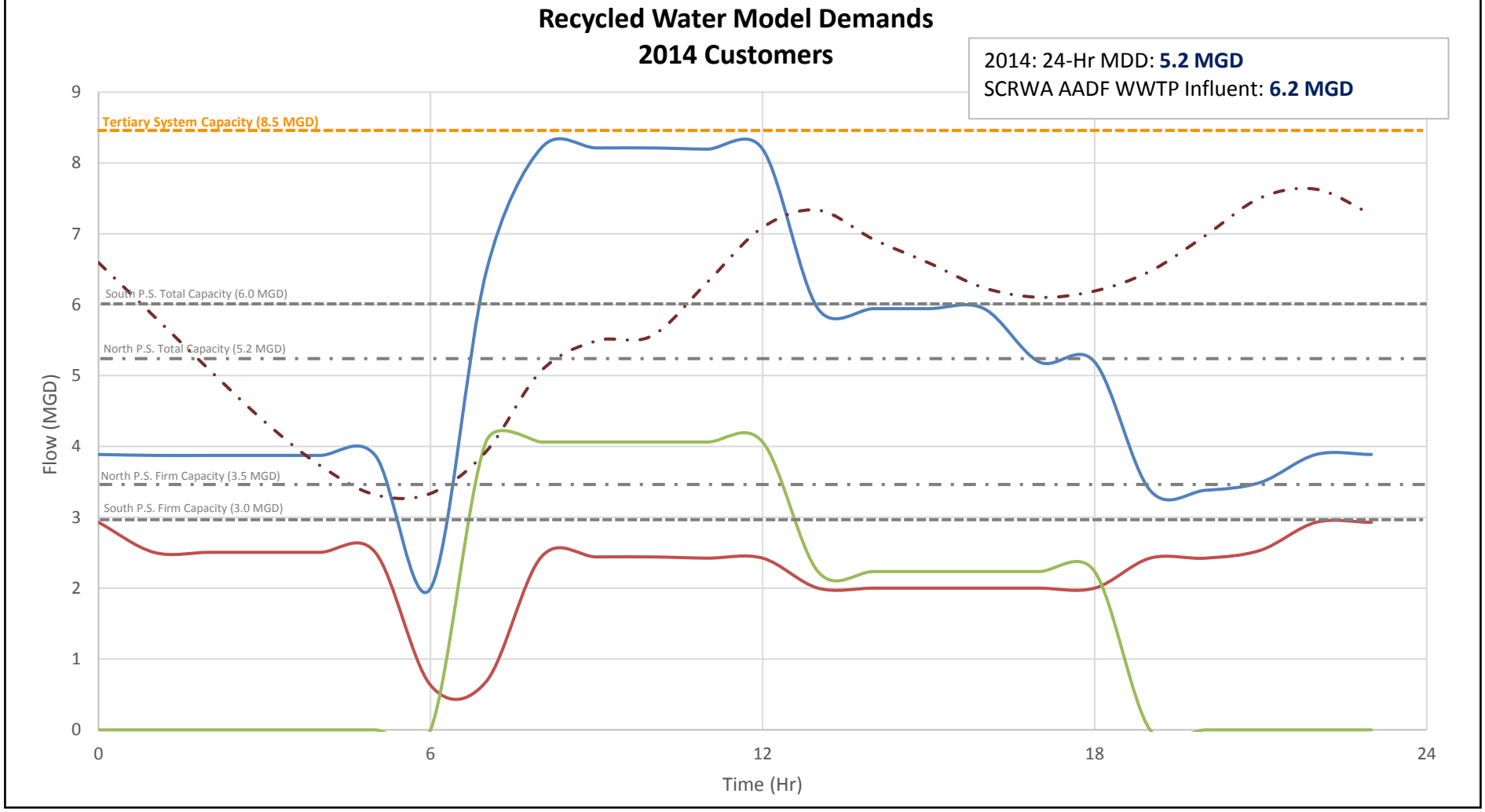

LEGEND

- 2014 Total Demand
- P.S. (North) Discharge
- P.S. (South) Discharge
- SCRWA AADF WWTP Inflow

Existing Pump Station Total Capacities:
North: **5.2 MGD**
South: **6.0 MGD**

November 18, 2015

Figure 6
Recycled Water Model Demands
2014 Existing System
City of Morgan Hill
Recycled Water Study

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CITY OF MORGAN HILL

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2.5 ALTERNATIVES FOR CONVEYING RECYCLED WATER FROM SCRWA TO MORGAN HILL

The two potential recycled water transmission main alignment alternatives for bringing recycled water from the SCRWA WWTP to Morgan Hill are shown in Figure 3. The two transmission main alignments are described as follows:

- **Alternative 1 - MH High Speed Rail Transmission Main:** This Morgan Hill alignment is to extend a Morgan Hill recycled water transmission main along the future High Speed Rail easement along Monterey Road to service potential customers and/or for potential recharge in Morgan Hill. This alternative was intended to take advantage of construction in conjunction with the High Speed Rail.

  A 24-inch transmission main begins at the intersection of W. Luchessa Ave. and Monterey Rd. From the intersection, the pipeline heads in the north-west direction and parallels the railroad tracks towards Morgan Hill to Maple Avenue. A 1,400 to 5,200 gpm pump station is required in the City of Gilroy and is generally proposed to be near First Street and Monterey Avenue.

- **Alternative 2 - Joint Trunk Transmission Main:** Similar to the MH High Speed Rail Alignment, this transmission main along the existing sewer joint trunk is intended to take advantage of the existing easements to Morgan Hill and the possibility of re-purposing the existing sewer trunk for recycled water purposes.

  A 24-inch transmission main begins at Luchessa Avenue connecting to the proposed 30-inch main and heading north in the future Cameron Boulevard road up to Leavesley Road. The alignment jogs north-east to Marcella Avenue and continues north to Las Animas Aveune. The alignment then turns west along Las Anaimas Avenue and meets the future sewer joint trunk alignment at San Ysidro Avenue. From San Ysidro Avenue the main follows the future joint trunk alignment north-west to Day Road between Santa Teresa Boulevard and Monterey Highway, from here the alignment heads north to Maple Avenue. A 1,400 to 5,200 gpm pump station is required in the City of Gilroy and is generally proposed to be near Gilman Road and the future Cameron Boulevard.

From the end of the transmission main the Morgan Hill recycled water distribution system will begin. For this analysis different system options are presented as customer preference, user interest, or connection viability is based on planning level assumptions. The total demands the hydraulic analysis will focus on are based on 1.0 MGD of recycled water for existing conditions and 2.25 MGD of recycled water for buildout conditions.

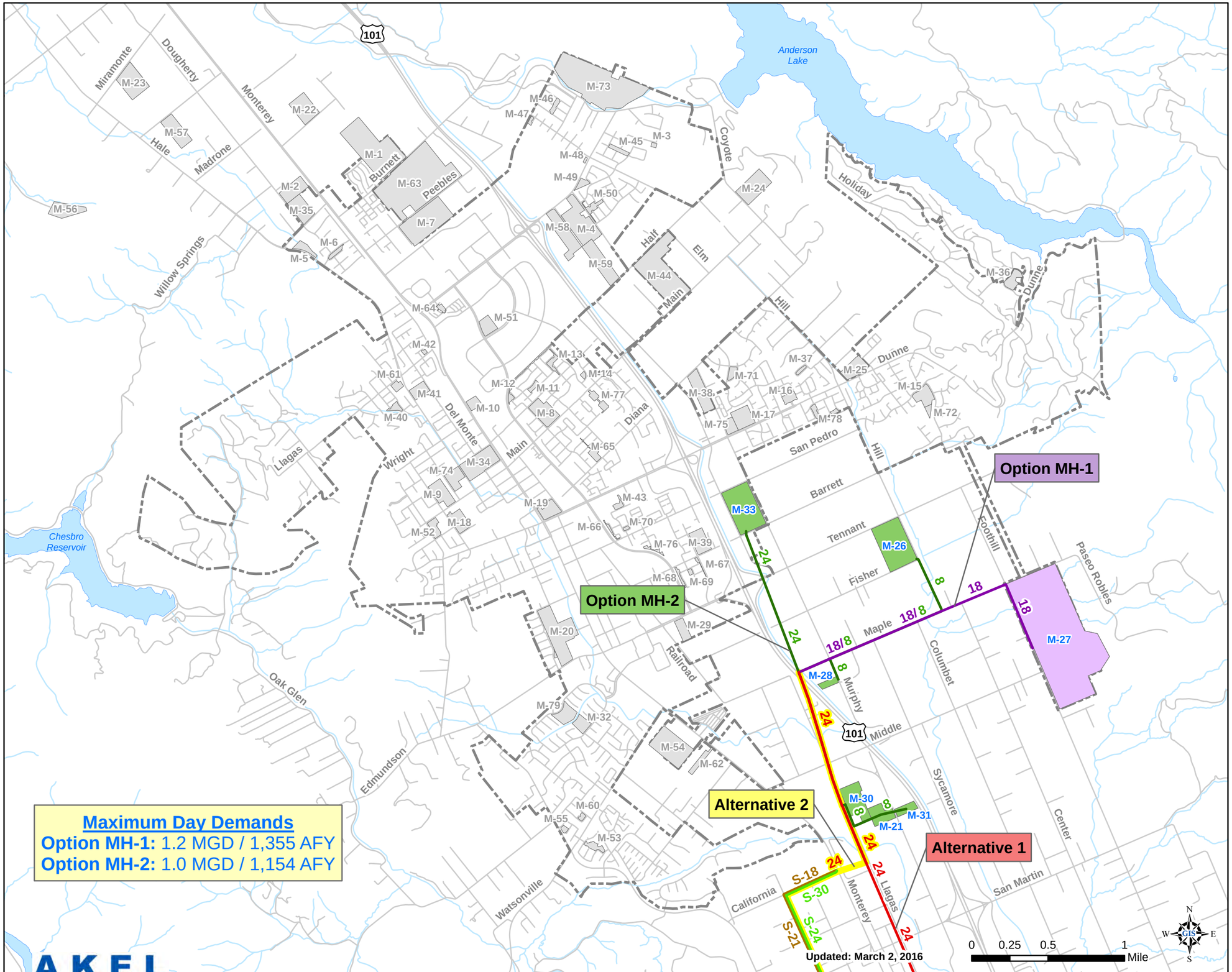
The recycled water distribution system options for the transmission main alternatives focus on the east side of Morgan Hill and expand from south to north. The recycled water system expansion options for the alternatives are as follows:

- **Option 1 (1 mgd) and 3 (2.25 mgd):** Option 1 begins with an 18-inch main heading east on Maple from the proposed 24-inch transmission main in Llagas and connects to the Institute Golf Course as shown in purple on Figure 7. Option 3 expands the recycled

water system from 1 mgd to 2.25 and includes additional customers along Condit Road as shown in purple on Figure 8.

- **Option 2 (1 mgd) and 4 (2.25 mgd)**: Option 2 begins with a 24-inch main extending from the proposed 24-inch transmission main in Llagas Avenue to connect customers up to Barrett Avenue as shown in green on Figure 7. Option 4 expands the recycled water system from 1 mgd to 2.25 mgd and includes additional customers north along Condit Road and Dunne Avenue up to Cochrane Road as shown in green on Figure 8.

The demands and users for each of the options are documented in Table 4 and costs for the transmission main and distribution system options are in Table 5.



Legend

Proposed

- Option MH-1 Alignment
- Option MH-2 Alignment
- Alternative 1
- Alternative 2
- Sewer Relief Trunk
- Sewer Joint Trunk
- Option MH-1 Users
- Option MH-2 Users
- Other Potential Users
- City Limits
- Roads
- Creeks
- Lakes

Figure 7
Options MH-1 and MH-2
1 MGD Use

City of Morgan Hill
Recycled Water Study

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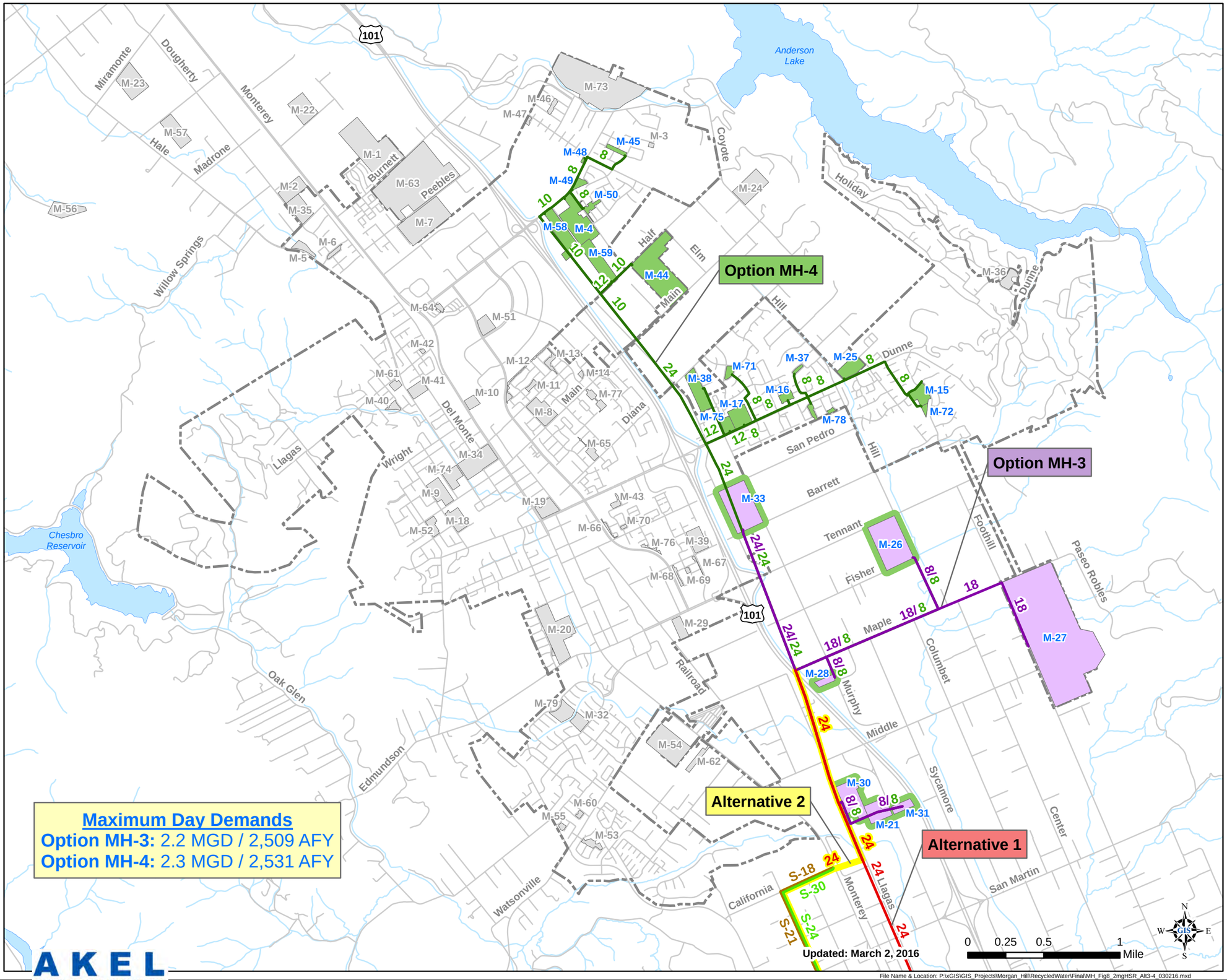

Legend

Proposed

- Option MH-3 Alignment
- Option MH-4 Alignment
- Alternative 1
- Alternative 2
- Sewer Relief Trunk
- Sewer Joint Trunk
- Option MH-3 Users
- Option MH-4 Users
- Opt MH-3 or MH-4 Users
- Other Potential Users
- City Limits
- Roads
- Creeks
- Lakes

Figure 8
Options MH-3 and MH-4
2.25 MGD Use

City of Morgan Hill
Recycled Water Study

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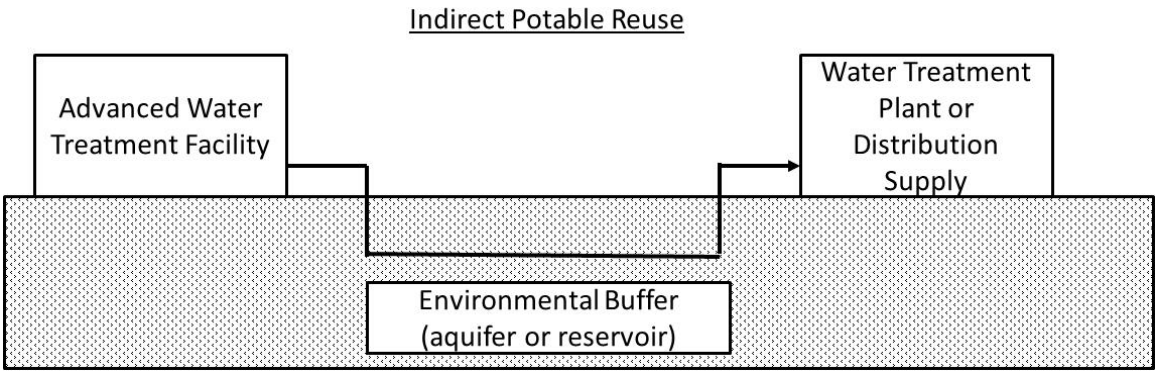
3 EVALUATE FEASIBILITY OF USING RECYCLED WATER FOR RECHARGE

3.1 INTRODUCTION

Recycled water can be supplied to underground aquifers to augment groundwater that is used as a drinking water source. This practice is categorized as indirect potable reuse (IPR), which is illustrated in Figure 9. The underlying aquifer serves as a natural storage reservoir in addition to providing treatment as the recycled water flows through the porous media. Storing recycled water in an aquifer would allow Morgan Hill to take advantage surplus recycled water capacity from the SCRWA WWTP at times when the demand for recycled water is low.

Figure 9 Schematic of major treatment components for indirect potable reuse (adapted from Tchobanoglous, 2014)

Recycled Water Feasibility Evaluation
City of Morgan Hill



Recycled water can be delivered to the aquifer in two ways. It can be spread across the land surface and allowed to percolate through the ground to the aquifer. This method, referred to as surface spreading, works only when the ground beneath the spreading pond is permeable enough to allow water to percolate through to the aquifer at a reasonable rate. Secondly, water can be injected into the groundwater using pressurized injection wells. This technique could be utilized in less permeable conditions.

3.2 TITLE 22 REGULATIONS REGARDING RECHARGING GROUNDWATER WITH RECYCLED WATER

Groundwater replenishment projects that apply treated wastewater to an aquifer that serves as a water supply are referred to as indirect potable reuse projects (IPR) and are regulated by the State Water Resources Control Board Division of Drinking Water (SWRCB DDW) Title 22 Recycled Water Regulations. These regulations were substantially updated in 2014 to include separate requirements for groundwater replenishment projects that use surface spreading and groundwater replenishment projects that use injection wells. The following analysis proposes utilizing surface spreading in existing facilities to apply treated wastewater to the aquifer.

Pathogenic microorganism control for surface application IPR projects requires an acceptable combination of engineered treatment processes and underground retention time to the nearest down gradient drinking water well. This retention time is estimated using tracer studies, numerical modelling, or analytical modelling. The pathogen reduction credited to each month of underground retention time will depend on the level of uncertainty associated with the method used for estimating the underground retention time. Pathogen reduction credits will be given to treatment processes based on validation tests or approved treatment trains specified in the regulations.

Effluent that meets the Title 22 definition for tertiary disinfected wastewater and demonstrates at least six months of underground retention time, as estimated with a tracer study, can be used in IPR surface spreading projects with no further treatment. If six months of underground retention time cannot be demonstrated, additional treatment will be required by California Title 22 regulations.

3.3 POTENTIAL SOURCES OF RECYCLED WATER FOR RECHARGE

3.3.1 SANTA CLARA VALLEY WATER DISTRICT

As part of this feasibility evaluation, Akel Engineering Group and MWH have explored the possibility of importing recycled water from north of Morgan Hill, i.e., from SCVWD's recycled water system.

The allocation of recycled water from the Regional Wastewater Facility (RWF) was most recently evaluated in the 2015 South Bay Water Recycling Strategic and Master Plan. The target of this plan is to expand recycled water production from its current county-wide value of 15,000 AFY up to 40,000 AFY by 2025 and 50,000 AFY by 2035. The plan identifies non-potable and potable pathways to achieve this target. This report does not include any provisions for supplying recycled water to users in Morgan Hill. Discussions with the SCVWD have indicated that a future, county-wide recycled water plan will evaluate the potential for including Morgan Hill recycled water users in their overall recycled water portfolio.

3.3.2 SOUTH COUNTY REGIONAL WASTEWATER AUTHORITY WASTEWATER TREATMENT PLANT

This evaluation identifies the SCRWA WWTP as the most viable source of recycled water. Existing treatment facilities at the SCRWA WWTP can produce tertiary disinfected water as described in Section 2.1.1**.** Additional treatment may be required to achieve compliance with Title 22 regulations or with the water quality objectives for the groundwater basin.

3.4 ADDITIONAL WATER QUALITY REQUIREMENTS FOR GROUNDWATER RECHARGE

In addition to complying with Title 22 Recycled Water Regulations, recycled water being used to recharge groundwater should be consistent with the goals of the 2014 Llagas Subbasin Salt and Nutrient Management Plan (SNMP). The Llagas Subbasin is located in Southern Santa Clara County and is the main drinking water source for the Cities of Gilroy and Morgan Hill. The (SNMP) establishes nitrate and total dissolved solids (TDS) as appropriate indicators for salts and nutrients in the groundwater.

In order to not degrade the quality of groundwater in the Llagas Subbasin, water used for recharge should meet the water quality objectives established by the Central Coast Regional water Quality Control Board for TDS and Nitrate. The median water quality baseline (MWQB) for the Llagas subbasin and the current SCRWA effluent values for TDS and nitrogen are shown in Table 8.

Table 8 Llagas Subbasin Groundwater Quality
Recycled Water Feasibility Evaluation
City of Morgan Hill

Parameter	MWQB	SCRWA Tertiary Effluent
TDS	300	665[1]
Nitrogen	5	2.36[2]

1. 2014 average secondary effluent value.
2. 2014 average tertiary effluent nitrate as N. Note: there will be additional nitrogen as ammonia, but this is a relatively small contribution.

Reducing the TDS of a water source is most often achieved by using a reverse osmosis (RO) membrane treatment process. This is an energy intensive treatment process that could add costs to a groundwater recharge project. Additionally, the reject stream from an RO process, referred to as RO concentrate, is a high salinity brine that requires special consideration for disposal.

Average yearly tertiary water quality is shown in Table 9. SCRWA is required to meet National Pollutant Discharge Elimination System (NPDES) for an emergency discharge to the local Pajaro River and a discharge limit is required for chlorodibromomethane.

Table 9 Average yearly tertiary effluent water quality at SCRWA
Recycled Water Feasibility Evaluation
City of Morgan Hill

	Units	2009	2010	2011	2012	2013	2014
Total flow	MGM	26.65	19.38	16.72	26.04	29.54	30.08
Average daily flow	MGD	0.87	0.64	0.55	0.85	0.97	0.99
pH	-	7.24	7.23	7.23	7.23	7.17	7.20
Biochemical oxygen demand (BOD)	mg/L	2.00	2.25	2.33	2.67	2.58	3
Total suspended solids (TSS)	mg/L	1.00	1.00	1.08	1.50	1.08	1.75
Turbidity	NTU	0.36	0.42	0.40	0.50	0.42	0.35
Coliform	MPN/100 mL	2.00	2.33	2.08	2.00	2.08	<2
Nitrate-N	mg/L	3.18	3.73	3.45	2.92	3.33	2.36
Dissolved oxygen	mg/L	4.08	4.48	3.98	3.93	3.61	3.33

3.5 RECYCLED WATER AVAILABLE FOR RECHARGE

The volume of recycled water that would be available for recharge is calculated by subtracting the baseline recycled water use from the 8.5 MGD permitted capacity of the SCRWA WWTP. Table 10 shows the amount of recycled water that is available for recharge each month versus the projected recycled water use in Gilroy. A majority of this supply is available during off-peak months, when demand for recycled water is low. It should be noted that the volume of recycled water available for recharge could be less if SCRWA plant influent flows do not meet the permitted capacity. Additionally, if RO treatment is required, additional water would be lost in the RO concentrate reject stream.

Table 10 Potential Recycled Water Recharge

Recycled Water Feasibility Evaluation

City of Morgan Hill

Off-Peak Months			Peak Months							Off-Peak Months		Maximum Day Demand	Annual Average
January	February	March	April	May	June	July Max Month	August	September	October	November	December Min Month		
Potential Recycled Water Avaliable for Recharge[2]													
8,107 afy	**7,852** afy	**7,822** afy	**6,652** afy	**4,842** afy	**2,957** afy	**1,622** afy	**1,952** afy	**5,040** afy	**6,491** afy	**8,301** afy	**8,417** afy	**0** afy	**5,838** afy
7.2 mgd	**7.0** mgd	**6.9** mgd	**5.9** mgd	**4.3** mgd	**2.6** mgd	**1.4** mgd	**1.7** mgd	**4.5** mgd	**5.8** mgd	**7.4** mgd	**7.5** mgd	**0** mgd	**5.2** mgd
Projected Recycled Water Usage in Gilroy Baseline Long Term Alternative[1]													
1,413 afy	**1,668** afy	**1,698** afy	**2,868** afy	**4,678** afy	**6,563** afy	**7,898** afy	**7,568** afy	**4,480** afy	**3,029** afy	**1,219** afy	**1,103** afy	**9520** afy	**3,682** afy
1.3 mgd	**1.5** mgd	**1.6** mgd	**2.6** mgd	**4.2** mgd	**5.9** mgd	**7.1** mgd	**6.8** mgd	**4.0** mgd	**2.7** mgd	**1.1** mgd	**1.0** mgd	**8.5** mgd	**3.3** mgd

Potential Recharge Facilities and Estimated Recharge Rates[3]

Recharge Facility	Average Annual Recharge Capacity (afy)
Main Ave Ponds	2,700
Madrone Channel	10,500
Church Avenue Ponds	7,300
San Pedro Ponds	4,700

Notes:

9/16/2015

1. Peaking Factors used for the monthly demands per SCRWA Water Reclamation Facility Order No. 98-052, 2014 Annual report, Table 1: 2014 Reclamation Facility-Monthly Averages.

2. Recharge amount assumes 8.5 MGD recycled water treatment and includes the Baseline System Customer Demands.

3. Recharge Facilities and Rates per Screening Level Assessment of IPR Reuse in the Llagas Subbasin, 2015 by Todd Groundwater.

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3.6 GROUNDWATER RECHARGE ALTERNATIVES

The transmission mains required for conveying recycled water from the SCRWA WWTP to Morgan Hill for recharge are similar to those as described in Chapter 2.5; Alternative 1 – High Speed Rail Alignment, and Alternative 2 - Joint Trunk Transmission Main Alignment. For the recharge alternative the transmission main will extend from Maple Avenue to the potential recharge facilities. The existing potential recharge sites identified by Todd Groundwater in the 2015 Screening Level Assessment of IPR Reuse in the Llagas Subbasin report (Todd Report) are the Main Avenue Ponds, the Madrone Channel, the Church Avenue Ponds, and the San Pedro Ponds. The Todd Report also identifies other new potential recharge areas near Morgan Hill, if the existing sites cannot be utilized. The existing recharge facilities and proposed transmission mains are shown on Figure 10.

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MORGAN HILL

GILROY

Main Ave Ponds

San Pedro Ponds

Church Ave Ponds

Madrone Channel

Recycled Water Recharge Pipeline

Transmission Main Alternative 2

Transmission Main Alternative 1

Proposed Pumps: 5,200 gpm

Wastewater Treatment Plant

Kirby
Hale
Monterey
Peet
Main
Diana
Spring
Edmundson
Watsonville
California
Harding
Highland
San Martin
Sycamore
Center
Foothill
Church
Rucker
Fitzgerald
Buena Vista
Day
Tennant
Hill
Oakwood
Maple
Middle
Las Animas
Marcella
New
Leavesley
Gilman
Ferguson
Burchell
Wren
Miller
Southside
Bolsa
Santa Teresa
Bloomfield
4th

101
152

24
S-18
S-21
S-24
S-27
S-30
S-33
S-42
12
14
20
30
12/36

Legend

Proposed

- Storage Tanks
- Booster Stations
- Baseline Improvements for all Alternatives
- Recycled Water Recharge Pipeline
- Recharge Pipeline Project Alternative 1
- Recharge Pipeline Project Alternative 2
- Sewer Relief Trunk
- Recycled Water Pipelines

Existing

- WWTP
- Storage Tanks
- Booster Stations
- Recharge Ponds
- Sewer Joint Trunk
- City Limits
- Lakes
- Roads

Updated: April 25, 2016

0 0.25 0.5 1 Mile

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Figure 10
Potential Recharge Opportunities

City of Morgan Hill
Recycled Water Study

CITY OF MORGAN HILL

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4 EVALUATE FEASIBILITY OF SCALPING PLANT

4.1 BACKGROUND

Decentralized wastewater treatment plants, also known as scalping plants, intercept and treat wastewater before it flows to the centralized treatment facility. Scalping plants are typically utilized to produce recycled water in close proximity to both the source of wastewater that feeds the plant and the demand for the treated effluent. This type of decentralized treatment becomes attractive when it is challenging to convey recycled water from the centralized treatment plant to potential users.

The SCRWA operates the South County Regional WWTP, located over nine miles south of the southern boundary for the Morgan Hill. The SCRWA WWTP is currently producing Title 22 recycled water, however, the distance between the plant and potential recycled water users in Morgan Hill warrants the consideration of a scalping plant.

4.2 TREATMENT TECHNOLOGY

The proposed scalping plant would consist of a pretreatment process, a biological treatment process, and a disinfection step. The main treatment process of a scalping plant typically utilizes membrane bioreactor (MBR) technology. Solids from the process are transported to the central wastewater treatment plant via existing sanitary sewers.

4.2.1 MEMBRANE BIOREACTOR

An MBR plant utilizes both a suspended growth biological process and a microfiltration or ultrafiltration process. MBR systems do not rely on a gravity separation reactor to remove solids and can therefore operate at a higher mixed liqueur suspended solids (MLSS) concentration. High MLSS concentration and the lack of clarifiers or solids handling processes allow MBR scalping plants to have a very small footprint relative to a traditional wastewater treatment plant.

MBR systems have additional capital and operational costs associated with purchasing membranes, cleaning membranes, and providing sufficient transmembrane pressure to induce flow across the membranes. Additionally, flows in scalping plants are typically smaller than in centralized treatment plants leading to a high unit cost of water.

4.3 ENVIRONMENTAL AND REGULATORY CONSIDERATIONS

The proposed scalping plant would have no solids handling facilities, instead, returning solids to the central wastewater treatment plant. While this would simplify the environmental and regulatory considerations of this project, there would still be two categories of regulations that would apply to this project.

4.3.1 RECYCLED WATER REGULATIONS

For the uses considered for Morgan Hill's recycled water system, irrigation and industrial, California State Water Resources Control Board, Title 22 regulations would require the effluent from the proposed scalping plant to receive tertiary treatment and disinfection. An MBR at a

satellite plant would meet the tertiary treatment requirement and chlorine disinfection was assumed as the disinfection method for this study.

4.3.2 CALIFORNIA ENVIRONMENTAL QUALITY ACT

The construction of a new MBR and associated facilities would be subject to the California Environmental Quality Act (CEQA). The first step in the CEQA process would be to prepare an initial study to evaluate potential impacts of the project, including but not limited to the following:

- Alternative locations for the project
- Footprint
- Mapping for sensitive resources
- Air emissions
- Geology
- Biological Resources
- Time to construct the facilities
- Estimate of costs
- Land use conflicts
- Permitting requirements

Based on the findings of this initial study, it would be determined if an Environmental Impact Review (EIR) or Mitigated Negative Declaration would be required for the project.

4.4 SCALPING PLANT COST ESTIMATE

Assessing the costs of implementing a MBR scalping plant requires considering capital costs and O&M costs for both the scalping plant and the recycled water distribution system. A 1 mgd scalping plant was assumed for this estimate. This capacity was selected based on the current dry weather minimum daily sewer flows from the Morgan Hill service area. It was further assumed that the scalping plant would be sited on a trunk line carrying half of the total Morgan Hill flows and that the process would have a 15% reject rate.

A treated water storage facility would also be required to allow recycled water users some flexibility in when to use recycled water. A 500,000 gallon storage facility (1 half day) is assumed for this estimate.

4.4.1 SCALPING PLANT CAPITAL COST ESTIMATE

A class 5 capital cost estimate was performed for the construction of a 1 mgd scalping plant with the following major components: pre-treatment process, MBR, a chlorine contact basin, and a treated water storage facility with one half day of capacity. The total capital cost for this scalping plant is estimated at $15.5 Million.

Table 11 provides a breakdown of the components of this capital cost.

Table 11 Estimate of Scalping Plant Capital Costs
Recycled Water Feasibility Evaluation
City of Morgan Hill

Process Cost Summary			Subtotal
Sitework		$	1,110,000
Structural		$	2,520,000
Mechanical		$	5,600,000
Electrical		$	509,000
I&C		$	255,000
Total Direct Costs		**$**	**9,994,000**
Contractor's Overhead &Profit (17%)	17%	$	1,699,000
Subtotal 1 (Direct Costs plus O&P)		**$**	**11,693,000**
Mobilization/Bonds/Insurance (3% of Subtotal 1)	3%	$	351,000
General Conditions (8% of Subtotal 1)	8%	$	935,000
Subtotal 2		**$**	**12,979,000**
Contingencies (20% of Subtotal 2)	20%	$	2,596,000
Subtotal 3		**$**	**15,575,000**
Administrative Costs (10% of Subtotal 3)	10%	$	1,557,500
Permitting Costs (5% of Subtotal 3)	5%	$	778,750
Real Estate (1 acre)	L.S	$	100,000
Total Capital Costs		**$**	**18,011,250**

4.4.2 O&M COST ESTIMATE

Table 12 provides a planning-level O&M cost estimate for the operation of a 1 mgd scalping plant consisting of a pre-treatment process, MBR, and a chlorine disinfection step. Electrical demands are due primarily to the power required to pump across the membranes and into the distribution system. Chemical costs include sodium hypochlorite for disinfection, membrane cleaning chemicals, and alum for coagulation.

Table 12 Scalping Plant O&M Cost Estimate
Recycled Water Feasibility Evaluation
City of Morgan Hill

Description	Total ($/year)	
Power Requirements	$	76,000
Chemical Costs	$	727,000
Equipment Replacement Cost	$	126,000
Staffing Costs	$	572,000
Total Annual Cost	***$***	***1,500,000***

4.5 SCALPING PLANT FOOTPRINT

Dimensions for the MBR scalping plant components are based on past project experience and are provided in Table 13.The potential site layout is also shown in Figure 11.

Table 13 Dimensions for 1 mgd MBR Scalping Plant
Recycled Water Feasibility Evaluation
City of Morgan Hill

Facility	SF
Intake & Screens	100
Pumps & Blowers	800
MBR Facility	1,200
Chemical Storage & Feed	1,600
Electrical/Control Room	600
Clearwell and Pumps	1500
Total Building Area Requirement	5,800
Total Area Required[1]	15,000
[1] Depends on Site Layout	

Figure 11 Potential Scalping Plant Layout
Recycled Water Feasibility Evaluation
City of Morgan Hill

4.6 PROJECT TIMELINE

Implementing a scalping plant would involve planning, permitting, design, construction, and commissioning phases. Completing these phases would require a minimum of three years.

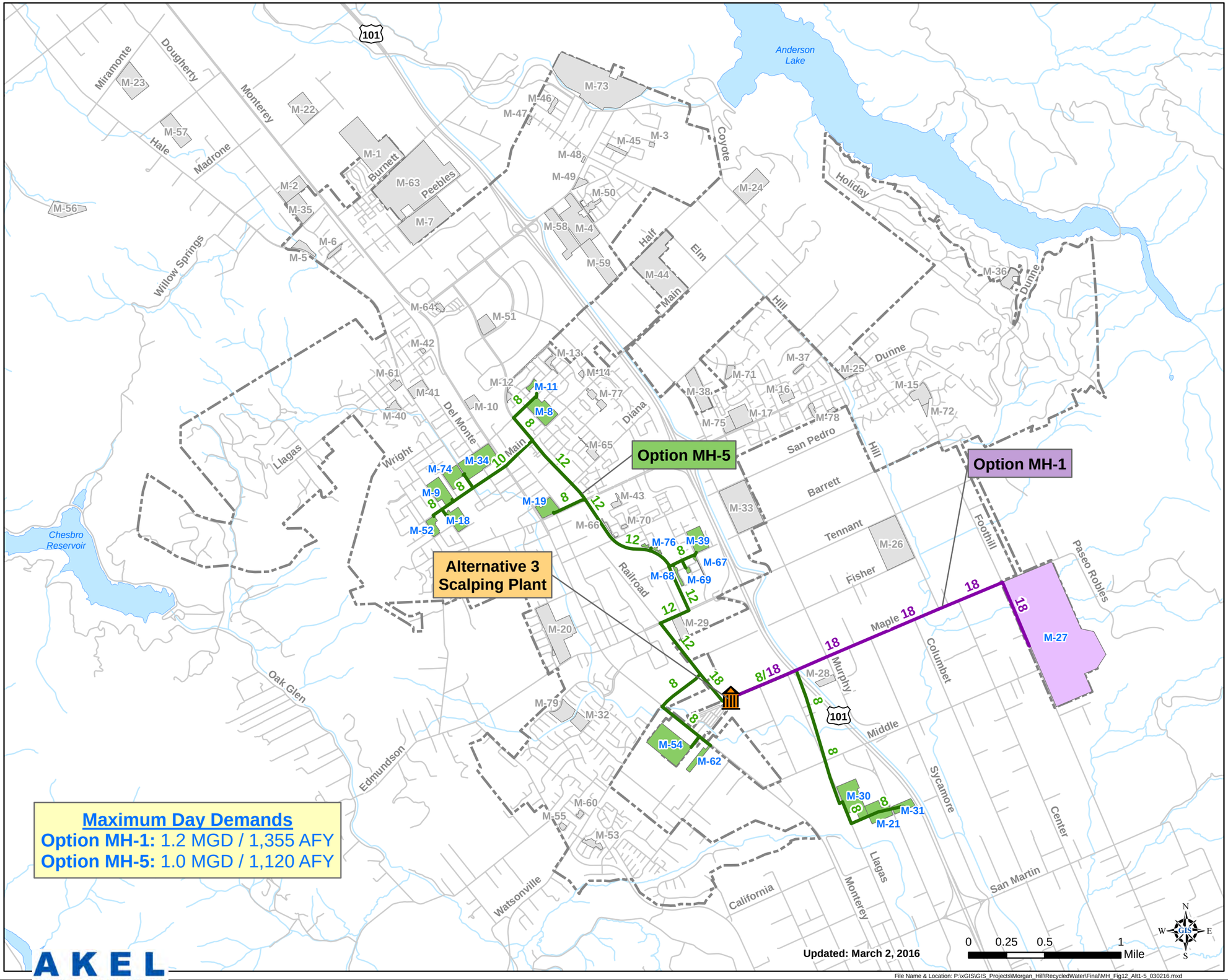
4.7 ALTERNATIVE SCALPING PLANT RECYCLED WATER DISTRIBUTION SYSTEMS

The two proposed distribution system alignment options for the scalping plant alternative are to either serve customers on the east or west side of Highway 101. Similar to the transmission main analysis, different system options are presented as customer preference, user interest, or connection viability is based on planning level assumptions. The total demands the hydraulic analysis will focus on are based on 1.0 MGD of recycled water for existing conditions and 2.25 MGD of recycled water for buildout conditions. The 2.25 MGD scalping plant alternative is based on the sewer flows for the general plan buildout of Morgan Hill (approximately 4.5 MGD).

The recycled water distribution system expansion options for this alternative are as follows:

- **Option 1 (1 mgd) and 7 (2.25 mgd):** Option 1 serves customers on the east side of Highway 101 and begins with an 18-inch main heading east on Maple from the proposed scalping plant and connects to the Institute Golf Course as shown in purple on Figure 12. Option 7 expands the recycled water system from 1 mgd to 2.25 and includes additional customers along Condit Road and Dunne Avenue as shown in purple on Figure 13.
- **Option 5 (1 mgd) and 6 (2.25 mgd)**: Option 5 serves customers on the west side of Highway 101 and begins with as 18-inch main extending north from the proposed scalping plant to connect customers along Butterfield Boulevard up to Main Street as shown in green on Figure 12. Option 6 expands the recycled water system from 1 mgd to 2.25 mgd and includes additional customers north along Butterfield Boulevard up to Burnett Avenue as shown in green on Figure 13.

The demands and users for each of the options are documented on Table 4 and costs for the distribution system options are on Table 5.



Maximum Day Demands
Option MH-1: 1.2 MGD / 1,355 AFY
Option MH-5: 1.0 MGD / 1,120 AFY

Legend

Proposed

- Alternative 3 Scalping Plant
- Option MH-1 Alignment
- Option MH-5 Alignment
- Option MH-1 Users
- Option MH-5 Users
- Other Potential Users
- City Limits
- Roads
- Creeks
- Lakes

Figure 12
Options MH-1 and MH-5
1 MGD Use

City of Morgan Hill
Recycled Water Study

CITY OF MORGAN HILL

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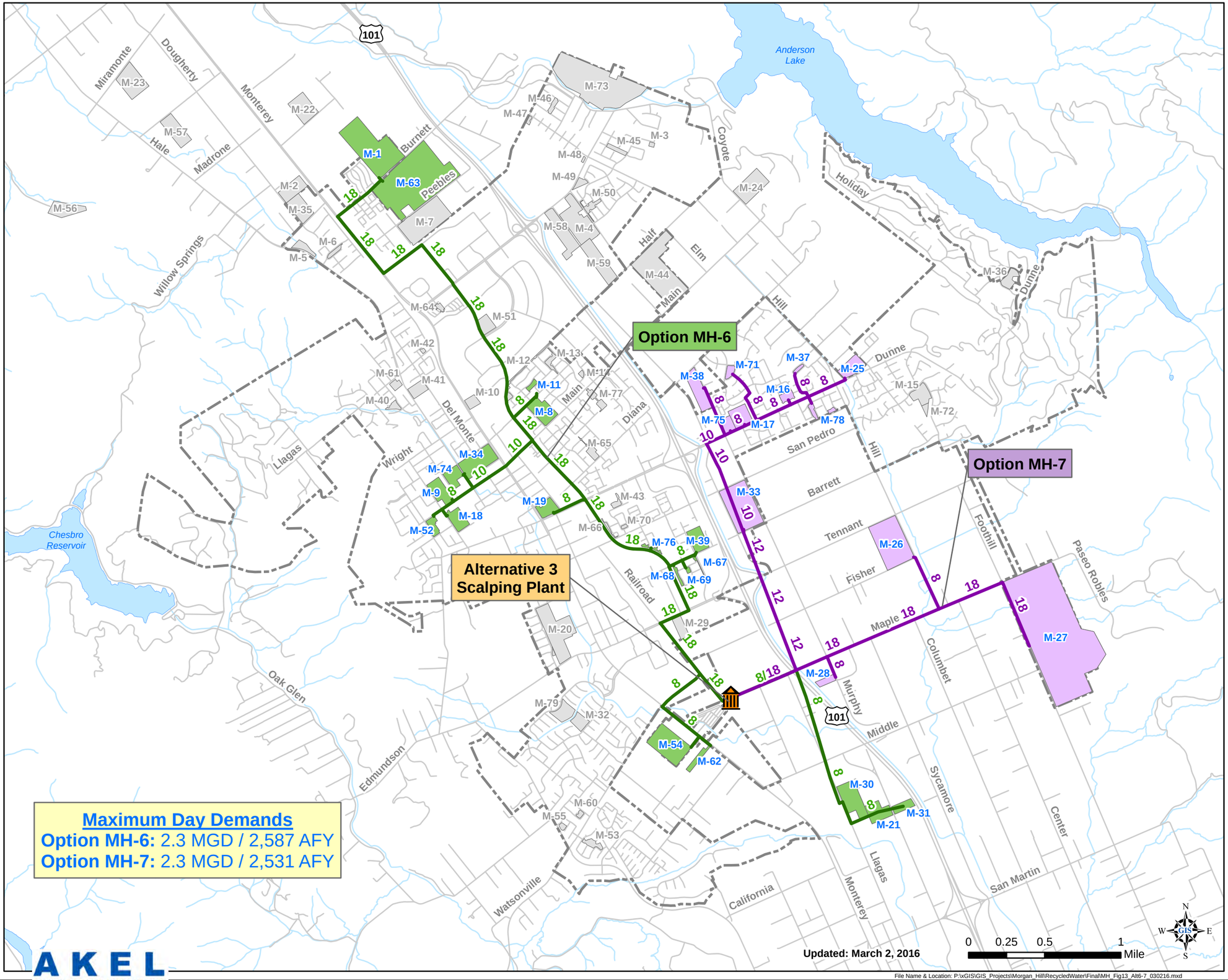

Maximum Day Demands
Option MH-6: 2.3 MGD / 2,587 AFY
Option MH-7: 2.3 MGD / 2,531 AFY

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Legend

Proposed

- Alternative 3 Scalping Plant
- Option MH-6 Alignment
- Option MH-7 Alignment
- Option MH-6 Users
- Option MH-7 Users
- Other Potential Users
- City Limits
- Roads
- Creeks
- Lakes

Figure 13
Options MH-6 and MH-7
2.25 MGD Use

City of Morgan Hill
Recycled Water Study

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CITY OF MORGAN HILL

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4.8 COLLECTION SYSTEM IMPACTS

A scalping plant diverts flow away from the sewer line for use in recycled water applications. This can cause substantial reductions in sewer system flows downstream of the scalping plant. If flows drop too low odor issues can arise from the anaerobic decomposition of organics. Clogging can also become an issue when flows are so low that debris does not get flushed through the system. A successful scalping plant would be designed to maintain minimum flows in the sewer line at all times, even during hourly minimums resulting from the diurnal flow pattern typical of collection systems.

Membranes are not well suited for large variations in flow rates. Large diurnal variations in sewer flows could therefore limit to the capacity of the MBR to an unacceptably small value, or influent flow equalization would be required. The scalping plant also would need to be sized so as to leave adequate flow in the sewer during times of minimum sewer flows.

4.9 IMPACTS TO SCRWA WWTP BIOLOGICAL

Returning waste activated sludge to the collection system, while eliminating the need for on-site solids treatment, could cause negative impacts on the SCRWA WWTP. The biological processes that would occur in a scalping plant would reduce BOD loadings to the SCRWA WWTP but could substantially change the composition of the influent wastewater. Inconsistent sludge wasting at the scalping facility could also cause downstream problems with the biological processes. Small changes in the influent wastewater composition could cause major problems with the SCRWA WWTP.

Before progressing with the planning of a satellite scalping plant, the potential effect to the biological processes at the existing central WWTP would need to be carefully evaluated. If it is determined that downstream effects would be unacceptable, on-site solids processing may be required. This would substantially increase the capital and operational costs.

4.10 IMPACTS TO CURRENT RECYCLED WATER USERS

The SCRWA WWTP maintains and operates a recycled water treatment and distribution system. During peak recycled water demands, SCRWA utilizes a majority of the plant influent to produce recycled water. A scalping plant that diverts flow from the collection system would negatively impact the SCRWA recycled water system by reducing plant inflows during critical periods of peak recycled water demand (i.e., summer months). This could result in an inability to meet current recycled water demands.

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5 EVALUATE EFFECTIVENESS OF GRAY WATER PROGRAM

5.1 BACKGROUND

Gray water systems collect residential wastewater from clothes washing machines, baths/showers, and bathroom wash basins for onsite irrigation. Utilizing gray water for onsite irrigation can offset potable water demand and allow for increased irrigation during times of water scarcity.

5.2 REGULATIONS

Title 24, Part 5, Chapter 16 of the California Department of Housing and Human Development Plumbing Code establishes the legal framework for permitting gray water systems in the State of California.

5.3 GRAY WATER DEFINITIONS

Gray water is defined as untreated wastewater that has not been contaminated by any toilet discharge, has not been affected by infectious, contaminated, or unhealthy bodily wastes, and does not present a threat from contamination by unhealthful processing, manufacturing, or operating wastes. In practical terms gray water generally includes discharges from clothes washing machines, showers, and bathroom washbasins but does not include discharges from toilets, kitchen sinks, or dishwashing machines. A gray water system collects and transports gray water for use in onsite landscape irrigation or disposal in a leaching field or mulch basin.

5.4 GRAY WATER SYSTEM TYPES

Gray water systems vary in complexity from inexpensive systems designed by homeowners to complex systems requiring professional design and installation. This section explores the most common types of residential onsite gray water recycling systems.

5.4.1 LAUNDRY-TO-LANDSCAPE

The simplest type of gray water system is known as a Laundry-to-Landscape System. A Laundry-to-Landscape System transports gray water from the washing machine discharge hose to the receiving landscape without altering any existing plumbing or utilizing pumps or storage devices. This type of gray water system can be installed by the home owner and does not require a permit. Several local agencies promote Laundry-to-Landscape gray water systems because of their relative simplicity and inexpensive installation and operation.

5.4.2 BRANCHED DRAIN

A Branched Drain System diverts gray water from shower/bath, wash basin, and clothes washing machine drainage pipes to the receiving landscape via a series of branching pipes under the force of gravity alone. This type of system requires a permit from the local enforcing agency.

5.4.3 PUMPED

A pumped system transports gray water from showers/baths, wash basins, and clothes washing machines to a small storage tank. A pump is used to transport the gray water to the receiving landscape. This type of system also requires a permit.

5.5 GRAY WATER SYSTEM REGULATIONS

The following is a listing of some of the relevant gray water regulations. For a complete list of gray water regulations see Chapter 16 of the California Plumbing Code, available online at: http://www.hcd.ca.gov/codes/state-housing-law/preface_et_emergency_graywater.pdf

- Gray water cannot pool or run off the receiving landscape
- Gray water systems must be designed to allow the user to direct flow to the sewer system to avoid pooling and runoff
- Gray water cannot be used in spray type irrigation methods (sprinklers)
- Gray water must not be used to irrigate root crops or food crops that touch the soil
- An owner's manual must be kept with a gray water system so future users can maintain and operate the system correctly
- The gray water system must be completely contained on the lot where the gray water is produced
- Any gray water system that is connected to the potable water distribution system must have a backflow prevention device

5.5.1 GRAY WATER CONSTRUCTION PERMIT

Section 1603A.0 of the California Plumbing Code requires a written construction permit issued by the local enforcing agency prior to the construction of any gray water system other than a Laundry-to-Landscape type system. To provide residents with a legal way to construct gray water systems, the Morgan Hill Community Development Division would need to establish a system to issue permits.

5.5.2 MODEL WATER EFFICIENT LANDSCAPE ORDINANCE

The Model Water Efficient Landscape Ordinance (MWELO) mandates local agencies to place restrictions on new and renovated landscapes in an effort to reduce water use to the lowest practical amount. In response to the current drought, the California Department of Water Resources has updated the MWELO to improve water savings. This update is pending final approval from the Office of Administrative Law. The revised ordinance includes an exemption from a majority of the MWELO requirements for certain landscapes irrigated entirely with gray water.

5.6 IMPLEMENTATION OF GRAY WATER SYSTEM IN MORGAN HILL

Large scale participation in a City wide gray water program would require homeowners and property managers to assume the responsibility of installing, maintaining, and operating gray water systems on their property. Neglected or improperly installed systems pose an environmental and public health risk.

5.6.1 EXISTING GRAY WATER PROGRAM

Morgan Hill residents are currently eligible for a $200 rebate to cover gray water system costs through the Santa Clara Valley Water District Laundry to Landscape Program provided they meet the program requirements. These requirements include conforming to the California Plumbing Code regulations for laundry to landscape gray water systems and an assessment by Santa Clara Water District officials. The assessment may include a series of questions or inspections before and after the installation of the gray water system.

5.6.2 OTHER LOCAL GRAY WATER REBATE PROGRAMS

Currently, many jurisdictions, including the City of Santa Cruz, the City of Santa Rosa, San Francisco Public Utilities Commission, and the City of Tucson, AZ, offer rebates from $150 to $1000 for customers who install a gray water system. Santa Cruz and San Francisco specify that the gray water system must be a Laundry-to-Landscape System while Tucson and Santa Rosa do not place this restriction on the rebate. These agencies also offer workshops, informational resources, and assistance to customers.

5.6.3 GRAY WATER IMPEDIMENTS

Major barriers to large scale participation in onsite gray water reuse systems include the potentially costly and time consuming permitting process, complex and expensive installation, maintenance costs, and environmental and public health concerns. A city-wide gray water incentive program that addresses all of the barriers stated above would be required to maximize participation.

5.6.4 EDUCATION AND OUTREACH

The first component of a successful gray water incentive program is education and outreach aimed at informing residents what a gray water system is and how they can implement one to conserve water. The information could present the benefits to users who install a gray water system including reduced water costs and the ability to irrigate landscaping more frequently without violating of the City's Level II Water Supply Shortage Water Use Restrictions. Workshops and brochures could be used to distribute this information.

5.6.5 TECHNICAL GUIDE

A technical manual could provide residents information including the types of gray water systems available, the laws and regulations associated with operating a gray water system, detailed instructions on how to install and operate a gray water system, and assistance in navigating the permitting process. The attached San Francisco Public Utilities Commission Gray Water Design Manual, published in 2012, could serve as an example.

5.6.6 REBATES

The City could offer additional rebates to residents who install a gray water system on their property to offset construction costs and encourage participation in the program.

5.6.7 LOCAL PERMITTING

A streamlined permitting process would reduce the time and cost of installing a gray water system and encourage participation. Laundry-to-Landscape systems do not require a permit and could be advertised as an easier method for homeowners to implement a gray water system.

5.7 IMPACT OF GRAY WATER SYSTEM ON ACHIEVING CONSERVATION GOALS AND IRRIGATION NEEDS

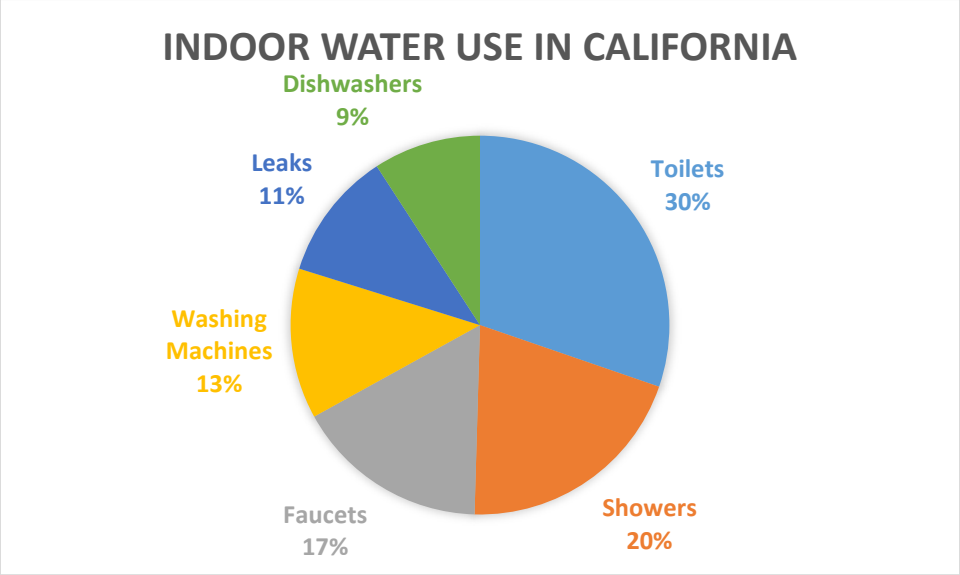
Utilizing gray water for landscape irrigation can offset potable water demand. The extent of potable water demand reduction will heavily depend on the participation rate, the type of gray water systems in use, and the method of irrigation.

5.7.1 RESIDENTIAL WATER REDUCTIONS

Predicting residential water demand reductions resulting from the installation of a gray water system is challenging because of the variety of gray water systems available and because the installation of the system may correspond to changes in landscaping practices or increased water conservation efforts.

The California Department of Water Resources estimates that indoor water accounts for approximately 31% of total urban water demand. Of that water, Figure 14 shows that 13% is recoverable as gray water in a Laundry-to-Landscape System and 45% is recoverable as gray water in a more comprehensive system (assuming half of faucet effluent comes from kitchen sinks and is not gray water.)

Figure 14 Indoor Water Use in California
Recycled Water Feasibility Evaluation
City of Morgan Hill



Multiplying the percent of indoor water use that is recoverable as gray water by the percent of total urban water demand that is used indoors gives an estimate of the percent of urban water

that is recoverable as gray water. Multiplying by the participation rate provides an estimate for the actual fraction of water that could be recovered as gray water.

Table 14 shows the percent of urban water that is available for onsite gray water reuse approximated using the method described above. It is important to note that not all of this gray water will displace potable water demand. Time of use and distribution issues may lead to some gray water not being utilized. Therefore, the actual urban water demand reductions achieved from a gray water incentive program would likely be lower than these values.

Table 14 Estimates of Water Available for Gray Water Reuse
Recycled Water Feasibility Evaluation
City of Morgan Hill

Percent of Urban Water Available for Grey-Water Reuse				
Gray Water System Type	Participation Level			
	1%	10%	50%	100%
Laundry-to-Landscape	0.04%	0.43%	2.17%	4.34%
Comprehensive	0.14%	1.40%	6.98%	13.95%

5.8 EFFECT OF GRAY WATER SYSTEMS ON SCRWA WWTP AND CURRENT RECYCLED WATER CUSTOMERS

A gray water system diverts water that would otherwise be destined for the sewer system to the receiving landscape. This will cause a reduction in the influent flows of the South County Regional Wastewater Authority (SCRWA) Wastewater Treatment Plant.

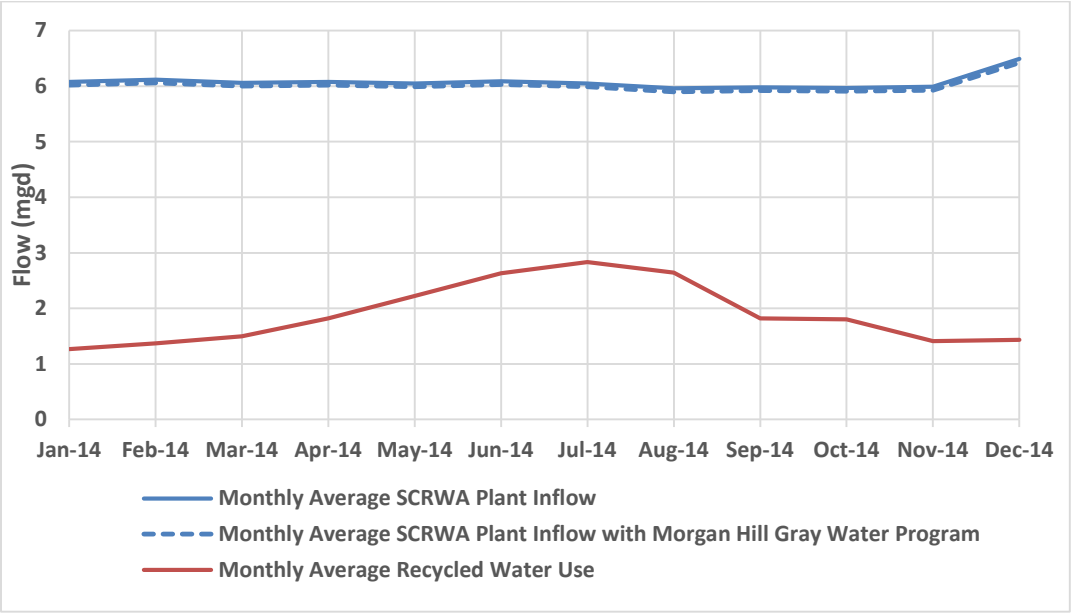
5.8.1 SEASONAL REDUCTIONS IN WWTP INFLUENT

Gray water systems will not reduce wastewater treatment plant inflows uniformly throughout the year. During the wet season more gray water will be routed through the sewer system to avoid pooling and runoff in the receiving landscape. If 50% of Morgan Hill Residents implement a Laundry-to-Landscape type gray water system, Table 11 indicates there would be up to a 2% reduction in urban water demand. Assuming all of this flow is redirected away from the sewer system and 40% of SCRWA WWTP influent comes from the Morgan Hill service area, a reduction in SCRWA WWTP influent flows of around 1% would be expected.

5.8.2 CURRENT SCRWA RECYCLED WATER USE

Figure 15 shows that the SCRWA WWTP currently recycles approximately 40% of its inflow during dry weather periods. This figure shows the effect of a gray water program on SCRWA plant influent assuming approximately 25% of residents implement a Laundry-to-Landscape type gray water system. At times of peak recycled water demand nearly 100% of the plant inflow is recycled. During these time periods the reduction in SCRWA WWTP inflows resulting from a gray water program in Morgan Hill could reduce recycled water supply to SCRWA customers.

Figure 15 SCRWA Plant Inflow and Recycled Water Demand
Recycled Water Feasibility Evaluation
City of Morgan Hill



5.9 BENIFITS AND COSTS OF PROMOTING GRAY WATER SYSTEMS

This section presents a summary of the benefits and challenges associated with promoting gray water systems in Morgan Hill.

5.9.1 BENIFITS OF PROMOTING A GRAY WATER SYSTEM

Potential to offset potable water demand:

Large scale participation in a gray water program could offset the demand for potable water by utilizing gray water instead of potable water of irrigation needs.

Allow for continued irrigation during water restrictions:

Implementation of a gray water system would allow residents to continue irrigation beyond allowable levels under a water restriction. Current water restrictions allow for irrigation only on specific days of the week.

Fulfill obligations of California Model Water Efficient Landscape Ordinance:

Utilizing a gray water system at landscapes regulated by the California Model Water Efficient Landscape Ordinance would exempt the landscape from a majority of the restrictions of the ordinance.

5.9.2 COSTS OF PROMOTING A GRAY WATER SYSTEM

Costs to water district associated with rebates:

While offsetting potable water demand could reduce variable costs associated with delivering potable water and potential future expansion costs, any agency providing rebates would be required to fund this upfront expense.

Installation and maintenance costs for homeowners:

Any installation or maintenance costs of a gray water system not covered by rebates would have to be assumed by homeowners.

Improperly installed systems can create environmental and health risks:

Given the distributed nature of residential gray water systems, installation and maintenance requirements would largely be assumed by homeowners. If systems are not installed or maintained properly, gray water can pool or runoff into the stormwater system or water bodies. This could pose and environmental or public health risk.

Permitting process could be a barrier to installation of gray water system:

Permitting gray water systems, while important for maintaining environmental and public health, could potentially induce costs and tie up resources to the enforcing agency.

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6 COST AND FEASIBILITY ANALYSIS

6.1 EVALUATION CRITERIA

The four recycled water utilization alternatives are evaluated based on the following criteria

- Technical feasibility
- Capital costs
- Operation and maintenance costs
- Regulatory considerations
- Value of recycled water supply

6.1.1 TECHNICAL FEASIBILITY

This section presents the anticipated technical challenges associated with each of the recycled water alternatives.

6.1.1.1 Bringing Recycled Water from SCRWA

There are no exceptional technical challenges identified for this alternative.

6.1.1.2 Using Recycled water for Recharge

The major technical challenge identified for using recycled water for groundwater recharge is the potential need for additional treatment. As described in Section 3, recycled water used for groundwater recharge could require additional treatment to meet the California Title 22 regulations. These treatment facilities would like include an RO process which would necessitate the development of a RO concentrate disposal solution.

6.1.1.3 Scalping Plant

Several technical challenges are identified for this alternative. Firstly, operating a satellite treatment facility requires additional staff with wastewater treatment plant operations experience on a part time or full time basis. Secondly, a scalping plant could cause odor and clogging problems in the downstream collection system. Lastly, scalping flow off of the sewer main could create process performance issues at the SCRWA WWTP due to the change in composition of the incoming wastewater.

6.1.1.4 Gray Water System

The major technical challenge identified with promoting gray water systems is gray water systems are installed and maintained properly. Because gray water systems would be installed and maintained by homeowners, the City would need to make an effort to ensure systems remain functional.

6.1.2 CAPITAL COSTS

The purpose of this section is to provide a summary of the recommended recycled water system improvements and to provide cost estimates for future system expansion to Morgan Hill.

Costs developed in this study should be considered “Order of Magnitude” and have an expected accuracy range of **-30 percent** and **+50 percent**. Final costs of a project will depend on several factors including the final project scope, costs of labor and materials, and market conditions during construction.

Table 15 documents the cost estimating criteria used to develop the alternative costs. Included in this table are the unit costs for pipelines, a pump station cost equation, storage reservoir costs, land acquisition costs, O&M costs for the distribution system, and the cost estimating contingencies.

The capital costs for the projects identified for all alternatives are summarized on Table 16, Table 17, and Table 18.

Table 15 Cost Estimating Criteria

Recycled Water Feasibility Evaluation
City of Morgan Hill

Pipe Size (Inner Diameter) (in)	Unit Costs[1] ($/lineal foot)
8	132
10	159
12	174
14	198
16	210
18	215
24	261
30	352
36	412
Pump Stations	
Estimated Pumping Station Project Cost = 2.03 * 10^(0.7583*log(Q)+3.1951); where Q is in gpm	
Storage Reservoirs ($/gal)	
≤ 1.0 MG	$2.00
1.1 MG - 3.0 MG	$1.60
3.1 MG - 5.0 MG	$1.15
> 5.0 MG	$0.86
Land and Easement Acquisition Costs ($/sqft)	
Land Acquisition Cost	$15 per sqft
Easement Fees	30% of Land Acquisition Costs
Lot Size for Storage or Pump Stations	0.5 Acres
Operation and Maintenance Costs	
Purchased Power Costs[2]	
Per Kilowatt Hour	$0.20
Distribution System Maintenance Costs[3]	
Per Mile of Pipe	$3,500
General Administration Costs[3]	
Per Mile of Pipe	$1,900
Costs Estimating Contingencies[4]	
Estimating	20%
Construction	20%
Administration	30%

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Notes:

1. Unit Cost estimates per recent bid tabs and are based on the Engineering News Record (ENR) construction cost index (CCI) of 10037 for the 20 cities for July 2015.

2. kWh cost per PG&E rates

3. System maintenance and administration costs per 2004 Master Plan and escalated based on the Engineering News Record (ENR) construction cost index (CCI) for the 20 cities for July 2015.

4. Contingencies:
   - Estimating contingency of 20% to account for unforeseen events and unknown conditions.
   - Construction contingency of 20% to account for engineering design and construction management and inspection.
   - Administration contingency of 30% to account for administration and legal costs.

Table 16 Alternative 1 Distribution System Costs

Morgan Hill Recycled Water Feasibility Evaluation
City of Morgan Hill

Recycled Water from SCRWA WWTP to Morgan Hill - System Option Costs						
Item No.	Description	Size/Length	Unit	Unit Price		Total
Morgan Hill Transmission Main - Alternative 1[1]						
1	**Distribution System Pipelines**					
	24-inches in Diameter	47,500	ft	$261	$	12,398,000
	Sub-Total				$	12,398,000
2	**Land Acquisition**					
	Easement	1,425,000	sq. ft.	30% of $15	$	6,413,000
	Pump Station	21,780	sq. ft.	$15	$	327,000
	Sub-Total				$	6,740,000
	Total				$	19,138,000
			Contingencies			
			Estimating	20%	$	3,828,000
			Construction	20%	$	4,593,000
			Administration	30%	$	8,268,000
			Project Cost		**$**	**35,827,000**
Option 1 (1 MGD)						
1	**Distribution System Pipelines**					
	18-inches in Diameter	10,200	ft	$215	$	2,193,000
	Sub-Total				$	2,193,000
2	**Pump Station**					
	Pump Capacity (firm)	2,025	gpm		$	1,023,000
	Total				$	3,216,000
			Contingencies			
			Estimating	20%	$	643,000
			Construction	20%	$	772,000
			Administration	30%	$	1,389,000
			Project Cost		**$**	**6,020,000**
			Total Project Cost + Transmission Main to Maple Avenue		**$**	**41,847,000**
Option 2 (1 MGD)						
1	**Distribution System Pipelines**					
	8-inches in Diameter	11,100	ft	$132	$	1,465,000
	24-inches in Diameter	5,100	ft	$261	$	1,331,000
	Sub-Total				$	2,796,000
2	**Pump Station**					
	Pump Capacity (firm)	860	gpm		$	532,000
	Total				$	3,328,000
			Contingencies			
			Estimating	20%	$	666,000
			Construction	20%	$	799,000
			Administration	30%	$	1,438,000
			Project Cost		**$**	**6,231,000**
			Total Project Cost + Transmission Main to Maple Avenue		**$**	**42,058,000**
Option 3 (2.25 MGD)						
1	**Distribution System Pipelines**					
	8-inches in Diameter	5,700	ft	$132	$	752,000
	18-inches in Diameter	10,200	ft	$215	$	2,193,000
	24-inches in Diameter	5,100	ft	$261	$	1,331,000
	Sub-Total				$	4,276,000
2	**Pump Station**					
	Pump Capacity (firm)	2,900	gpm		$	1,343,000
	Total				$	5,619,000
			Contingencies			
			Estimating	20%	$	1,124,000
			Construction	20%	$	1,349,000
			Administration	30%	$	2,428,000
			Project Cost		**$**	**10,520,000**
			Total Project Cost + Transmission Main to Maple Avenue		**$**	**46,347,000**
Option 4 (2.25 MGD)						
1	**Distribution System Pipelines**					
	8-inches in Diameter	28,600	ft	$132	$	3,775,000
	10-inches in Diameter	5,400	ft	$159	$	859,000
	12-inches in Diameter	2,000	ft	$174	$	348,000
	24-inches in Diameter	14,800	ft	$261	$	3,863,000
	Sub-Total				$	8,845,000
2	**Pump Station**					
	Pump Capacity (firm)	2,400	gpm		$	1,164,000
	Total				$	10,009,000
			Contingencies			
			Estimating	20%	$	2,002,000
			Construction	20%	$	2,402,000
			Administration	30%	$	4,324,000
			Project Cost		**$**	**18,737,000**
			Total Project Cost + Transmission Main to Maple Avenue		**$**	**54,564,000**

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Notes:

1. Morgan Hill Transmission Main Limits: From SCRWA to Maple Ave.

Table 17 Alternative 2 Distribution System Costs

Recycled Water Feasibility Evaluation

City of Morgan Hill

Recharge Pipeline Project						
Item No.	Description	Size/Length	Unit	Unit Price		Total
Recharge Pipeline - Alternative 1[1]						
1	**Distribution System Pipelines**					
	24-inches in Diameter	59,900	ft	$261	$	15,634,000
	Sub-Total				$	15,634,000
2	**Pump Station**					
	Pump Capacity (firm)	5,200	gpm		$	2,091,000
	Sub-Total				$	2,091,000
3	**Land Acquisition**					
	Easement	1,797,000	sq. ft.	30% of $15	$	8,087,000
	Pump Station	21,780.0	sq. ft.	$15	$	327,000
	Sub-Total				$	8,414,000
	Total				$	26,139,000
			Contingencies			
			Estimating	20%	$	5,228,000
			Construction	20%	$	6,273,000
			Administration	30%	$	11,292,000
			Total Project Cost		**$**	**48,932,000**

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1. Recharge Pipeline Project Limits: From SCRWA to Main Ave.

11/18/2015

Table 18 Alternative 3 Distribution System Costs

Recycled Water Feasibility Evaluation
City of Morgan Hill

Scalping Plant - Distribution System Option Costs						
Item No.	Description	Size/Length	Unit	Unit Price		Total
Option 1 (1 MGD)						
1	**Distribution System Pipelines**					
	18-inches in Diameter	12,900	ft	$215	$	2,774,000
	Sub-Total				$	2,774,000
2	**Pump Station**					
	Pump Capacity (firm)	2,025	gpm		$	1,023,000
	Sub-Total				$	1,023,000
	Total				$	3,797,000
			Contingencies			
			Estimating	20%	$	759,000
			Construction	20%	$	911,000
			Administration	30%	$	1,640,000
			Total Project Cost		**$**	**7,107,000**
Option 5 (1 MGD)						
1	**Distribution System Pipelines**					
	8-inches in Diameter	22,400	ft	$132	$	2,957,000
	10-inches in Diameter	2,700	ft	$159	$	429,000
	12-inches in Diameter	11,700	ft	$174	$	2,036,000
	18-inches in Diameter	1,500	ft	$215	$	323,000
	Sub-Total				$	5,745,000
2	**Pump Station**					
	Pump Capacity (firm)	1,400	gpm		$	775,000
	Sub-Total				$	775,000
	Total				$	6,520,000
			Contingencies			
			Estimating	20%	$	1,304,000
			Construction	20%	$	1,565,000
			Administration	30%	$	2,817,000
			Total Project Cost		**$**	**12,206,000**
Option 6 (2.25 MGD)						
1	**Distribution System Pipelines**					
	8-inches in Diameter	21,500	ft	$132	$	2,838,000
	10-inches in Diameter	2,700	ft	$159	$	429,000
	12-inches in Diameter	100	ft	$174	$	17,000
	18-inches in Diameter	27,400	ft	$215	$	5,891,000
	Sub-Total				$	9,175,000
2	**Pump Station**					
	Pump Capacity (firm)	2,550	gpm		$	1,218,000
	Sub-Total				$	1,218,000
	Total				$	10,393,000
			Contingencies			
			Estimating	20%	$	2,079,000
			Construction	20%	$	2,494,000
			Administration	30%	$	4,490,000
			Total Project Cost		**$**	**19,456,000**
Option 7 (2.25 MGD)						
	Distribution System Pipelines					
	8-inches in Diameter	12,700	ft	$132	$	1,676,000
	10-inches in Diameter	4,300	ft	$159	$	684,000
	12-inches in Diameter	5,100	ft	$174	$	887,000
	18-inches in Diameter	12,900	ft	$215	$	2,774,000
	Sub-Total				$	6,021,000
2	**Pump Station**					
	Pump Capacity (firm)	3,100	gpm		$	1,399,000
	Sub-Total				$	1,399,000
	Total				$	7,420,000
			Contingencies			
			Estimating	20%	$	1,484,000
			Construction	20%	$	1,781,000
			Administration	30%	$	3,206,000
			Total Project Cost		**$**	**13,891,000**

6.1.3 OPERATIONS AND MAINTENANCE COSTS

The operations and maintenance (O&M) costs for the distribution system include the following three components:

- **Purchased Power**: The purchased power accounts for the pump station power consumption. The average yearly flow and a power cost of $0.20 per kilowatt-hour (per PG&E rates) was used to calculate the annual power costs for the pump stations.
- **Distribution System Maintenance**: The annual distribution system maintenance costs were based on $3,500 per mile of pipe. This cost is based on the 2004 Master Plan and escalated based on the ENR-CCI.
- **General Administration**: The annual general administration cost is based on $1,900 per mile of pipe. This cost is based on the 2004 Master Plan and escalated based on the ENR-CCI.

The O&M cost estimates are documented on Table 19 for the Morgan Hill Recycled Water Alternatives.

Table 19 Alternatives O&M Costs

Recycled Water Feasibility Evaluation
City of Morgan Hill

Description	SCRWA WWTP to Morgan Hill[1]			
	Option 1 (1 MGD)	Option 2 (1 MGD)	Option 3 (2.25 MGD)	Option 4 (2.25 MGD)
Purchased Power	$110,000	$89,000	$200,000	$236,000
Distribution System Maintenance	$7,000	$11,000	$14,000	$34,000
General Administration	$4,000	$6,000	$8,000	$18,000
Estimating Contingency (20%)	$24,000	$21,000	$44,000	$58,000
Annual O&M Costs	**$145,000**	**$127,000**	**$266,000**	**$346,000**

Description	Morgan Hill Transmission Main - Recharge Pipeline
	SCRWA To Maple Avenue
Purchased Power	$841,000
Distribution System Maintenance	$31,000
General Administration	$17,000
Estimating Contingency (20%)	$178,000
Annual O&M Costs	**$1,067,000**

Description	Scalping Plant Alternatives			
	Option 1 (1 MGD)	Option 5 (1 MGD)	Option 6 (2.25 MGD)	Option 7 (2.25 MGD)
Purchased Power	$100,000	$97,000	$214,000	$207,000
Distribution System Maintenance	$9,000	$25,000	$34,000	$23,000
General Administration	$5,000	$14,000	$19,000	$13,000
Estimating Contingency (20%)	$23,000	$27,000	$53,000	$49,000
Scalping Plant Operation	$1,500,000	$1,500,000	n/a	n/a
Annual O&M Costs	**$1,637,000**	**$1,663,000**	n/a	n/a

Note:
1. Not including Morgan Hill Transmission Main

6.1.4 REGULATORY CONSIDERATIONS

The following sections provide a summary of the regulatory challenges associated with each of the alternatives.

6.1.4.1 Bringing recycled water from SCRWA WWTP

This alternative comes with very limited regulatory considerations because the recycled water produced at the SCRWA WWTP is already permitted as disinfected tertiary effluent according to the Title 22 Recycled Water Regulations.

6.1.4.2 Using Recycled Water for Recharge

Regulatory requirements for using recycled water for recharge include complying with Article 5.2 of the Title 22 Recycled Water Regulations. Actions would include developing an engineering report for the RWQCB and the DDW to demonstrate compliance with Title 22 regulations and potential tracer studies, analytical modelling, or numerical modelling, to demonstrate sufficient underground detention time for the recycled water.

6.1.4.3 Scalping Plant

Recycled water from a scalping would need to be designated as tertiary disinfected recycled water by the DDW. The treatment processes at the scalping plant would need to be validated to show they provide sufficient bacterial and virus removal. Additionally, a CEQA review process would be required prior to the construction of a scalping plant.

6.1.4.4 Promoting Gray Water Systems

The regulatory framework is already in place for gray water systems in California. The only challenge would be creating a permitting system with the City of Morgan Hill to approve and regulate gray water systems.

6.1.5 VALUE OF RECYCLED WATER SUPPLY

The value of the recycled water provided by each alternative will depend on its quality, quantity, and availability of the recycled water.

6.1.5.1 Bringing recycled water from SCRWA WWTP

Recycled water delivered from the SCRWA WWTP to customers in Morgan Hill, would be of lower value because recycled water availability would not correspond with recycled water demand. This is because current customers already use a majority of the recycled water supply during peak demand periods. Recycled water use in Morgan Hill would be limited to times when there is a surplus supply of recycled water, like wet months and during off demand times of the day.

6.1.5.2 Using Recycled Water for Recharge

Using recycled water for recharge would provide the highest value recycled water. This is because all surplus recycled water can be stored in the groundwater aquifer and then used during peak demand periods. Additionally, if the Title 22 Recycled Water Regulations for Groundwater Replenishment Projects are met, this water would be suitable for potable use.

Groundwater is sold by the City as part of its drinking water supply which means recycled water supplied to the aquifer would provide increased revenue when it is sold as drinking water. This revenue would be greater than the revenue expected from the sale of recycled water.

6.1.5.3 Scalping Plant

The quantity of recycled water produced by a scalping plant would be limited by the amount of wastewater produced upstream of the scalping plant. Wastewater intercepted by a scalping plant would likely otherwise be diverted to the tertiary treatment facilities at the SCRWA WWTP. Typically, recycled water is sold to customers for less than the price of drinking water, but the cost to produce it, based on the estimates provided above, would be far higher. For this reason, there is little value associated with operating a scalping plant to produce recycled water.

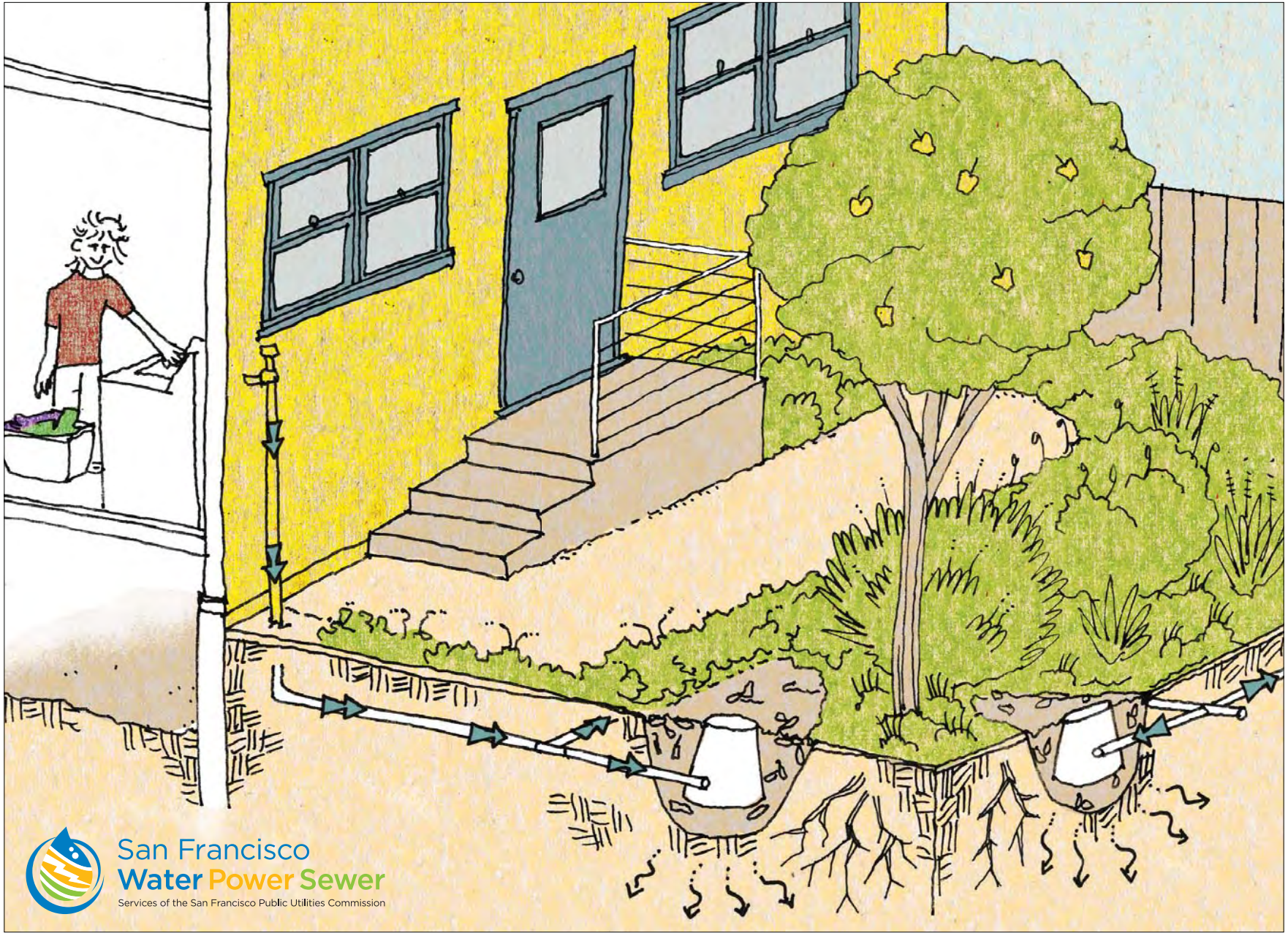
6.1.5.4 Promoting Gray Water Systems

Recycled water produced from gray water systems is of low value. This is because it is only available during times when the gray water is being produced, it is only available on the site where it is produced, and it is only a fraction of the total wastewater that is produced.

6.2 RECOMMENDEDED ALTERNATIVES

Should the City wish to pursue the use of recycled water, the recommended alternative, based on technical feasibility, capital costs, operation and maintenance costs, regulatory considerations, and value of recycled water supply is to use recycled water for groundwater recharge. This alternative would provide a large supply of water during off-peak periods that could be stored when available and utilized when needed. This alternative does have challenges associated with meeting the water quality requirements for groundwater recharge; however, the supply of high quality drinking water warrants consideration of this challenge.

Attachment 1: San Francisco Public Utilities Commission Gray Water Manual



SAN FRANCISCO graywaterdesignmanual

for OUTDOOR IRRIGATION

June 2012 Version - Updates will be published as necessary

SAN FRANCISCO

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FOR OUTDOOR IRRIGATION

City of San Francisco

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San Francisco Public Utilities Commission

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San Francisco Information

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This guide gives an overview of the design, construction, permitting, and operation of graywater systems for outdoor irrigation, including laundry-to-landscape, branched-drain, and pumped systems.

Introduction

Overview of Guide

Why send your laundry water to be treated at a sewage treatment plant when you could use it to water plants and trees in your own yard instead? Sending water that's clean enough for other uses out of the house with the sewage doesn't make sense. That's why many Californians use their laundry and shower water to keep their landscapes green, even during times of drought.

The *San Francisco Graywater Design Manual for Outdoor Irrigation* is an educational resource for homeowners and professionals who want to install residential graywater systems for subsurface outdoor irrigation. In this guide, you'll learn about the benefits of graywater, when and where to use it, when not to use it, permitting requirements, what products to use, and suggested plants to irrigate.

The guide provides suggested methods for designing and installing a laundry-to-landscape system and a basic overview of the design and installation of branched-drain and pumped systems. The methods described in this guide may not be the only acceptable procedures

for designing and installing systems that meet current requirements. Each homeowner's circumstances are different: you must ensure that a graywater system on your property is designed and installed safely, is consistent with applicable code requirements, and is operated in a manner that causes no harm or damage to yourself or neighbors. If at any time you have doubts about undertaking the installation of a graywater system, please consult a professional installer.

San Francisco's Water Supply

Residents of San Francisco receive some of the highest quality tap water in the nation. Sierra snowmelt flows into the Tuolumne River, is stored in the Hetch Hetchy Reservoir, and travels 167 miles by gravity to San Francisco. Our regional water system carries pristine water to 2.5 million customers throughout San Francisco and the Bay Area. The San Francisco Public Utilities Commission (SFPUC) , provider of San Francisco's water, power and sewer, is committed to preserving this precious resource through conservation and by using local alternative supplies—such as recycled water, rainwater, and graywater—for non-potable purposes. Using laundry water for irrigation is one of many ways to conserve our drinking water supply and reduce flows to our wastewater system.

What is Graywater?

Graywater is water from washing machines, showers, bathtubs, and bathroom sinks. It is wastewater that can contain some soap, salts, hair, suspended solids and bacteria, but that is clean enough to water plants. Water from toilets, kitchen sinks, or wash water from diapers is not considered graywater in California.

Graywater (treated or untreated) is not the same as recycled water, which is highly treated wastewater from a centralized treatment facility. Recycled water is commonly used in other Bay Area cities, and the SFPUC is working on several recycled water projects in San Francisco.

Benefits of Graywater

Reusing graywater is an important component of sustainable water practices. There are many benefits of using graywater instead of potable water for irrigation.

Reusing graywater can:

- Decrease potable water use by 16 to 40 percent, depending on the site (Cohen 2009).
- Decrease water and wastewater utility bills.
- Diversify the City's water portfolio and provide an alternate source of irrigation water, reserving treated potable water for high-quality water needs.
- Reduce the energy (approximately 2 watt-hours per gallon of water) and chemicals needed to treat wastewater.

Another benefit of using graywater is that it connects us to our water supply, helping us understand where our water comes from and where it goes. Becoming conscious of our water supply encourages healthier product choices and engagement with our landscape. By reusing household graywater, we preserve water resources for other living things. In concert with water-wise landscaping, rainwater harvesting, and conservation, using graywater as a resource helps reduce dependency on imported water and protects watersheds.

Graywater Basics

Graywater is a unique source of water and must be used differently from potable water and rainwater. These are some basic guidelines for residential graywater systems:

- Do not store graywater more than 24 hours. If you store graywater, the nutrients in it start to break down and create bad odors.
- Minimize contact with graywater. Graywater can contain pathogens. All systems must be designed so that water soaks into the ground and is not accessible to contact by people or animals.
- Infiltrate graywater into the ground; do not allow it to pool or run off. You'll need to know how fast water soaks into your soil to properly design your system. Pooling graywater can provide opportunities for mosquitoes to breed, as well as for human contact.

Inform Your Gardener or Landscaper About Your Graywater System

Be sure to inform anyone who works in your yard about your new graywater system. Show him or her where the pipes and irrigation points are so that the pipes don't get accidentally punctured or the mulch basins altered or buried. Otherwise, your system could be unintentionally damaged by people who don't understand how it functions.

- Keep your system as simple as possible. Simple systems last longer, require less maintenance, use less energy, and cost less. Keep in mind that systems with pumps and filters require more commitment and regular maintenance.
- Install a diverter valve at a convenient location to allow for easy switching between the graywater system and the sewer system.
- Match the amount of graywater directed to your plants with their irrigation needs. See Appendix C for information about plant-friendly products; many products contain salts and boron, which harm most plants.

Graywater Regulations

Graywater use is legal in California. In August 2009, California's graywater regulations changed, allowing for lower-cost graywater systems to be installed legally, including some without the need for a permit. In San Francisco, a permit is not required for a laundry graywater system that meets the conditions listed in the next section, "When a Permit Is Not Required." For information about systems that do require permits, see the following section, "When a Permit Is Required." California's regulations for residential graywater systems can be found in Chapter 16A of the California Plumbing Code.

When a Permit Is Not Required

You can install a graywater system for outdoor irrigation without a permit if you meet **all** of the following requirements:

- Graywater comes from the washing machine only.
- Graywater system does not alter the household plumbing (you access graywater from the hose of the machine, not by cutting into the plumbing).
- Graywater system is for a one- or two-unit residential building.
- Graywater system follows 12 guidelines set forth in the California Plumbing Code (see Appendix B, "Operation and Maintenance Manual for Laundry-to-Landscape Graywater System").

When a Permit Is Required

You **need** a permit for a graywater system for outdoor irrigation that includes **any** of the following conditions:

- Graywater system collects water from showers, sinks, or baths.
- Graywater system alters the plumbing (you cut into the drainage plumbing to access the graywater).
- Graywater system is installed in a building that is not a one- or two-unit residential building.
- Graywater system includes a pump (besides the washing machine's internal pump) or a tank.

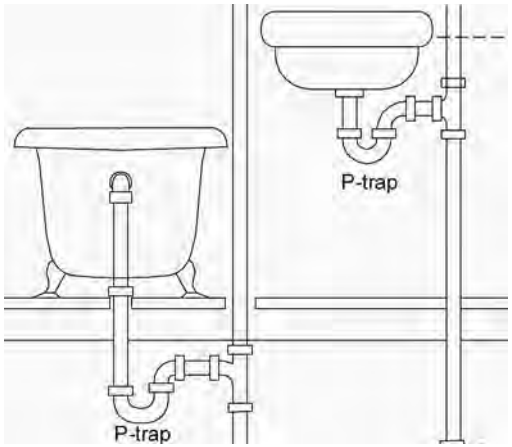
For additional information about permitting a graywater system, contact the Department of Building Inspection at 415-558-6088.

References

California Residential Graywater Code: California Plumbing Code, California Code of Regulations Title 24, Part 5, Chapter 16A. Available at http://www.hcd.ca.gov/codes/shl/2007CPC_Graywater_Complete_2-2-10.pdf

Cohen, Yorem, 2009. Graywater—A potential source of water. UCLA Institute for the Environment. Available at http://www.ioe.ucla.edu/reportcard/article.asp?parentid=4870

The shower p-trap is the copper pipe shaped like an upsidedown and sideways letter "p." In this example, the p-trap and shower drainage pipes are located below the shower/tub. Photo: Josh Lowe.



Developing a Graywater System

Graywater systems can range from the very simple to the very complicated. Follow these steps to create a well-functioning and safe system.

1. Start with conservation! Conservation is always the most economical and environmentally beneficial place to begin. You might find that your landscape doesn't require as much water as you've been giving it, or that there are easy ways to greatly reduce the amount of water your household uses. See the SFPUC's resources for conservation information to learn about ways to save water and money.

   - Before planning a graywater system, consider scheduling a free home water conservation consultation by contacting the SFPUC Water Conservation Section at 415-551-4730 or by visiting *http://conserve.sfwater.org/*. This evaluation can help you to assess your indoor and outdoor water use and to identify ways you can lower both by fixing leaks and taking other measures.
   - If you are not able to install a graywater system, you can still reuse water by collecting shower water in a bucket as the water heats up and using it to water your plants.

2. Determine which fixtures in your home are candidates for graywater capture.

   - Washing machines are usually the easiest place to begin. If your machine is in a room with an exterior wall, it's usually simple to send a pipe outside. If your machine is in an interior room, you'll need a way to run the pipe outside, either through a crawl space or basement.
   - Another potential fixture for graywater capture is the shower and bathtub faucet. Identify the shower drain pipe by going beneath the shower (for example, in the basement), looking for a "p-trap" (see image on left). The p-trap prevents sewer gases from entering the home. Run hot water in the shower and observe which pipe heats up. Make sure you do not tap into the toilet drain! A plumber can help reroute shower pipes. If your shower is

on the second story, and the pipes run inside the wall, the drain is probably combined with the toilet drain in the floor, making the shower graywater inaccessible without a major plumbing remodel.

3. Estimate the quantity of graywater your chosen source produces using the "Estimating Graywater Flows" section of this manual.

4. Analyze how water drains on your site and find out your soil type with a "soil ribbon test" and/or a low-cost laboratory analysis (required if your system needs a permit). In combination with your flow calculations, this analysis will help you determine how large your landscape distribution area will need to be.

5. Read about types of graywater systems and decide which is best for you. Figure 1 provides some guidance for your selection.

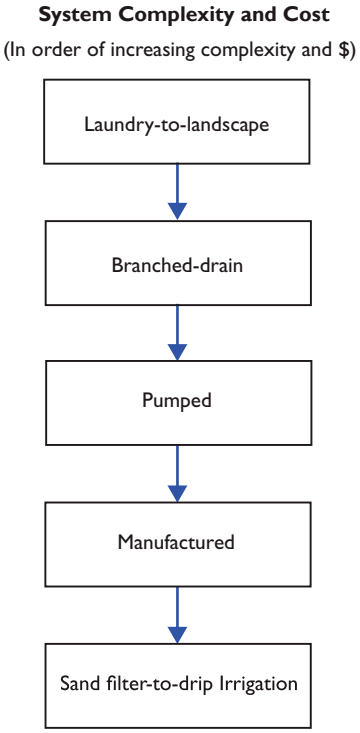
6. Read about setback requirements to determine your system layout.

7. Draw a sketch of your proposed system. If a permit is required, you'll need to submit a plot plan and details about the system to the San Francisco Department of Building Inspection (DBI). For more information, contact DBI at 415-588-6088. Note: If your current plumbing is not up to code, you'll need to upgrade the part of the plumbing affected by the installation of the graywater system. For example, if the shower drain is undersized, you will need to upgrade to 2-inch pipe.

8. Find an installer or install the system yourself.

9. Remember to label the system (3-way valve and all above-ground graywater pipes) and keep an operation and maintenance manual with it. If you sell your home, the manual must stay with the residence.

10. Operate and maintain your system.



System Types	Fixture Choices
Laundry-to-landscape	Washing machine only
Branched-drain	All fixtures [1]
Pumped system	All fixtures [1]
Manufactured systems	All fixtures [1]
Sand filter-to-drip irrigation	All fixtures [2]

1 Systems can use graywater from washing machine, shower, tub, or bathroom sink.

2 System typically only used for high graywater volumes.

All systems require a permit except the laundry-to-landscape system.

Figure 1. *Guidance for choosing your graywater system.*

Notes on Requirements for Calculating Graywater Flows

For Permitted Systems: The California Code of Regulations describes a specific method that must be used to calculate graywater flows for systems that require permits (Title 24, Part 5, Chapter 16A). This method is described on page 9 of this manual.

For Systems That Do Not Require a Permit: Laundry-to-landscape systems can be sized using the method described for permitted systems OR the method described in the section of this manual titled Irrigation Supply Calculations, found on page 10.

Start by Saving Water!

Saving water and money is easy! You can reduce your water use by about 35 percent just by installing water-efficient fixtures and appliances (see *http://conserve.sfwater.org/).*

You can obtain free high-efficiency showerheads and aerators and possibly qualify for a rebate on a water-efficient washing machine from SFPUC. Call 415-551-4730 for more information.

Sizing Your Graywater System

There are three steps to sizing your graywater system. It is important to follow these steps so that you can design a system that has adequate landscape distribution. Remember, state law requires that graywater irrigation systems never cause pooling or runoff.

Step 1: Estimate your graywater flows. There are different methods for estimating your graywater flows based on whether your system requires a permit or not. Follow the steps in the "Estimating Graywater Flows" section to estimate your graywater flows (page 9).

Step 2: Estimate the absorption capacity of your soils based on the methods outlined in the "Soil Absorption and Distribution Area" section (page 11).

Step 3: Use your graywater flow calculations and your soil absorption estimate to calculate the necessary size of your mulch basins (page 14).

After calculating the necessary size of your landscape distribution area (as described in the next section), record this information in the operation and maintenance (O&M) manual for your system (templates in Appendix B). Be sure to include the assumptions you used in your calculations. That way, if you sell your home and move out, the new owner will know how much water the system was designed for. If the new household produces more or less water, the new owner might need to make alterations to the system.

Estimating Graywater Flows

Permitted System Calculations

The California Code of Regulations indicates that graywater flows for permitted systems in single- and multi-family dwellings can be estimated based on records of water use, calculated based on local daily per-person interior water use, or calculated using a default method listed in the code (Title 24, Part 5, Chapter 16A). The following is the method listed in the code:

Step 1) The number of occupants in your household must be calculated as:

2 occupants in the First Bedroom

1 occupant in Each Additional Bedroom

Step 2) Graywater flows must be calculated as follows:

Showers, Bathtubs, and Washbasins (combined): 25 gallons per day (gpd)/occupant

Washing Machines: 15 gdp/occupant

Step 3) Multiply the number of occupants (as calculated above, not the actual number of people who live in the home) by the estimated graywater flow in gpd per occupant to calculate the total estimated daily graywater flow.

Number of occupants x graywater flow per occupant
= total estimated daily graywater flow

In San Francisco, you must present calculations based on this default method to DBI when you apply for a permit (see Appendix E for an example). However, you may be able to reduce your graywater flow calculations if you consistently use less water in your home and can produce documentation of reduced graywater production for DBI's review. Please contact DBI if you would like to make alternate calculations based on reduced graywater production in your home. Note that it is best to contact DBI early in the process so staff can assist you in creating a well-designed graywater system that works for you and future occupants of your home.

Example Graywater Flow Estimate for Permitted Systems Using the Default Code Method

In a three-bedroom home of three people, the following volumes of graywater would be produced:

Number of occupants: Four. The three-person home would have four occupants using the permitted systems calculation method (two in the first bedroom plus one for each additional bedroom).

Shower graywater: 25 gpd x 4 people
= 100 gpd

Washing machine graywater: 15 gpd x 4 people
= 60 gpd

Total graywater produced: 100 + 60 gpd
= 160 gpd

Design for Highest Calculated Flow

Note that if your irrigation supply calculations (page 10) yield a higher flow than the permitted system calculations, you should size your system based on the irrigation supply calculations.

Example Graywater Flow Estimate Using the Irrigation Supply Calculation Method

In a three-bedroom, three-person household with a laundry-to-landscape system, each person does one load of washing a week, plus there is an extra load for towels, totaling four loads per week. Washing machine use is spread out across the week, sometimes two loads of laundry in one day. The household's front-loading washing machine is rated at 20 gallons per load.

Washing machine graywater (weekly flow): 4 loads per week x 20 gallons per load = 80 gallons per week

Washing machine graywater (daily flow): 2 loads per day x 20 gallons per load = 40 gallons per day

Irrigation during Vacations

Keep in mind that most types of simple graywater systems only irrigate when you are at home producing graywater. If you take frequent summer vacations or are away every weekend, you might want to plan for back-up irrigation, or you could simply ask a housesitter to water the plants. More complex systems, like sand filter-to-drip irrigation, typically include back-up irrigation (see page 31).

Irrigation Supply Calculations

(can also be used to size laundry-to-landscape systems)

Calculating how much graywater your home actually produces is an important step for all graywater systems. These calculations determine how much water is flowing to your plants, regardless of whether you have a permitted or non-permitted system. These calculations will help you ensure that your plants are not getting over- or under-watered.

Irrigation supply calculations can also be used instead of the permitted systems method to size the landscape distribution area for systems that do not require a permit. Hence, they can only be used to size the landscape distribution area for laundry-to-landscape systems.

Washing machines (weekly flow): __ gallons/load (the rating of your machine) x __ loads per week = __ gallons per week

Washing machines (daily flow): __ gallons/load (the rating of your machine) x __ loads on a typical laundry day = __ gallons per typical laundry day

Showers: __ gallons per minute (the flow rate of your showerhead) x __ minutes you shower x __ showers per day x actual number of home occupants = gallons per day

Note that if you regularly produce higher amounts of graywater in a single day, you'll need to consider this when you design your system. Examples include multiple loads of laundry in one day or baths. You will also need to consider situations where you produce atypical amounts of graywater. If you sometimes do five loads of laundry in one day, rather than spread them out over the week, you'll need to consider this when you design and operate your system. In cases of high flows, one option is to redirect the laundry water to the sewer system using the 3-way valve. Remember that you must design and operate your system to avoid graywater pooling and runoff.

Note that performing these calculations for your specific household fixtures yields the most accurate estimate of the amount of graywater available for your plants, yet it does not consider future changes. Volumes could vary if the size or habits of your household change over time or if a new owner moves in.

Soil Absorption and Distribution Area

Understanding the infiltration capacity of the soils in your yard is critical for designing your graywater system and sizing your landscape distribution area. The distribution area must be sized to allow the graywater to soak into the soil without pooling or runoff.

If your system requires a permit, you must provide DBI with the results of a laboratory soil analysis to confirm your soil type. See page 12 for details. To learn the basics about the soil in your yard, you should also conduct a simple soil "ribbon test," described below.

After you have identified your soil type via laboratory analysis (required for permitted systems) and/or a ribbon test, conduct a simple drainage test to find out how well water drains on your property. This drainage test will help ensure that you choose a good location for your graywater outlets.

Soil Ribbon Test

To conduct the soil ribbon test, take a small handful of soil in your hand, slowly moisten it with water, and knead it. Try to form the soil into a ball. Squeeze it to see if you can make a cast (an impression of your fingers). Place the ball of soil in your hand between your thumb and forefinger, gently squeeze the soil, and push it upwards into a ribbon (see image at right). Let the ribbon break from its weight. Don't try to mold the soil into a ribbon by rolling it in

Table 1. *Identifying Soil Type Using the Ribbon Test*

Characteristics of Soil Sample	Soil Texture or Soil Type
Soil does not stay in a ball. Loose and gritty feeling when moistened.	*Sand*
A cast, or molded imprint of your fingers, forms, but it breaks easily. It does not form a ribbon. Soil feels slightly gritty.	*Sandy loam*
A short ribbon can be formed but breaks when about ½ inch long.	*Loam*
A ribbon can be formed. It is moderately strong until it breaks at about ¾ inch length. Soil feels slightly sticky.	*Clay loam*
The soil can easily be formed into a ribbon that is an inch or more long. Soil feels very sticky and gritty.	*Sandy/silty clay*
The soil can easily be formed into a ribbon that is an inch or more long. Soil feels very sticky and smooth.	*Clay*

Source: Adapted from Alameda County Waste Management Authority and Source Reduction and Recycling Board (StopWaste.org), 2010, and Thein, S.J., 1979.

Soil forms a "cast," an impression of your fingers. Photo: Josh Lowe.

Soil ribbon being squeezed between thumb and finger. Photo: Josh Lowe.

your palms, as this will give inaccurate results. See Table 1 to identify the texture or type of soil you have. You should conduct a ribbon test at several locations on your property to understand the variability of soil characteristics.

Laboratory Test

If your system requires a permit, you must provide DBI with the results of a soil analysis. This requirement can be fulfilled by submitting a soil sample to a laboratory for an inexpensive soil texture analysis (see Appendix F for local laboratories) or by providing an existing soil analysis to DBI. The soil sample must be taken from the area to be irrigated with graywater. If there is more than one type of soil, representative samples from different areas must be taken. An example of an existing soil analysis is a geotechnical study done for your property. Note that the geotechnical report must be signed and stamped by a licensed engineer or geologist.

Drainage Test

Identifying your soil type (either by ribbon test or laboratory analysis) does not always provide enough information about how well water will infiltrate in a particular location, as deeper soils could differ from surface soils, or hardscape (for example, an old cement patio) might be buried under your yard. Urban yards can be full of surprises! To ensure that water drains properly in the location you would like to irrigate with graywater, you should conduct a simple drainage test, as described below.

This drainage test is optional, as it is not required by the code. If you plan to use graywater to irrigate sections of your yard that you already irrigate, and you know that water drains well, you might not need to conduct the drainage test. If you are unsure about how water drains, the drainage test can help you choose appropriate locations for irrigating with graywater. Remember, pooling and runoff of graywater is never allowed, so if you have poor drainage with pooling, you will have to redesign your system.

1. Dig a hole, approximately 1 foot deep, in the area where you plan to infiltrate graywater. Insert a ruler or stick marked with inches into the hole (Figure 2).

2. Fill the hole with water and let it soak in. Repeat this several times so that the surrounding soil is saturated when you take your reading.

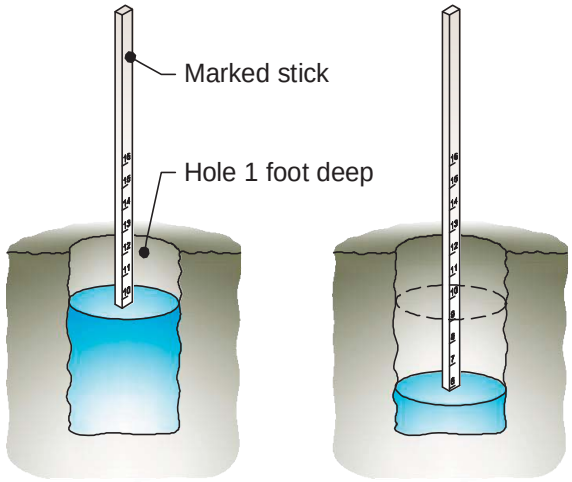


Figure 2. *Drainage test.*

3. Fill the hole with water again; this time record how long it takes for the water level to go down a few inches. If it drains approximately 1 inch per hour or faster, you have adequate drainage for irrigating the area with graywater.

4. If it takes longer than two hours for the water level to go down 1 inch, or the hole doesn't drain all day, don't use graywater to irrigate this area. Try another location to see if the drainage is better. If you irrigate an area that does not have adequate drainage, you could have pooling and runoff. Plants could also be damaged by water-logged soil, so make sure to irrigate only properly draining soils, or amend your soil by adding compost to improve drainage.

Calculating Your Landscape Distribution Area

Once you know how many gallons per day your home produces (see the Estimating Graywater Flows section), have identified your soil type (either by ribbon test or laboratory analysis), and know that water drains well in the area you wish to irrigate, you can calculate how large an area you need to ensure proper drainage of graywater.

To calculate your landscape distribution area, you will need the following information:

- Gallons of graywater generated each day
- Soil type (to be used with Table 2)

Table 2. *Minimum Irrigation Area for Different Soil Types*

Soil Type	*Square Feet of Area Needed to Infiltrate Each Gallon of Graywater (per day)*
Coarse sand or gravel	*0.2*
Fine sand	*0.25*
Sandy loam	*0.4*
Sandy clay	*0.6*
Clay with considerable sand or gravel	*0.9*
Clay with small amounts of sand or gravel	*1.1*

Source: Table 16A-2, Design Criteria of Six Typical Soils, California Plumbing Code Section 16A.

Example: Calculating Minimum Infiltration or Irrigation Area

If you identified your soil type as sandy loam, you would need 0.4 square feet per gallon of graywater (Table 2). If you produce 100 gallons of graywater per day, you'd multiply 0.4 square feet/gpd by 100 gpd to get 40 square feet, the minimum area needed for your graywater to infiltrate.

100 gpd x 0.4 square feet per gpd (from Table 2) = 40 square feet of total irrigation area

This irrigation area can be spread across different locations in your yard. For example, if you want to irrigate 10 trees and your total irrigation area must be 40 square feet, each mulch basin would need to be at least 4 square feet.

This calculation does not take into consideration the appropriate amount of water necessary for the plants; refer to Appendix D for plant water requirements.

Note: If your system incorporates drip irrigation, there is a different way to size the irrigation area; refer to Chapter 16A of the California Plumbing Code, Table 16A-3.

Multiply your gallons of graywater per day by the number corresponding to your soil type in Table 2. This calculation gives you the minimum area, in square feet, needed to infiltrate your graywater.

When you design your system, make sure that the total area (not volume) of your mulch basins is at least as large as the minimum distribution area calculated above. Your irrigation area can be larger, but not smaller. Record your system specifications in your O&M manual for future reference.

Protecting Groundwater

Graywater must be discharged a minimum of three feet above the groundwater table. Groundwater occurs deeper than three feet on most of the western side of San Francisco, but some areas, especially on the eastern side, can have shallower groundwater. If you don't know how deep groundwater is beneath your property, you can check by digging a hole three feet deep below your lowest anticipated graywater discharge point. If no water enters the hole, then it is safe to irrigate the area with graywater. If water enters the hole, the groundwater table is too shallow, and graywater may not be used for irrigation. If you dig a hole to check the depth to groundwater, do so during the irrigation season, as this is the time you'll be using graywater. During the rainy months, with any signs of pooling or runoff from rainfall, or in places where the groundwater table rises, all graywater systems must be shut off and graywater must be diverted back to the sewer.

References

Alameda County Waste Management Authority and Alameda County Source Reduction and Recycling Board, 2010. Bay-Friendly Gardening. Available at http://www.stopwaste.org/home/index.asp?page=8.

Thein, S.J., 1979. A Flow Diagram for Teaching Texture by Feel Analysis. Journal of Agronomic Education, 8:54-55.

Setback Requirements: Where Not to Put Your Graywater!

Your graywater system should irrigate plants without causing problems for you or your neighbors. A setback is a required distance between structures, such as between a building and another building, other structure, or property line. The purpose of setbacks is to avoid potential problems caused by nearby land uses. For example, you'll need to keep graywater a certain distance from your house to avoid damaging its foundation, from your neighbor's yard to maintain good neighborly relations, and from creeks to prevent contamination of freshwater. Table 3 lists setback requirements in San Francisco.

Table 3. *Setbacks Required in San Francisco*

	Minimum Distance (Horizontal) from	
	Irrigation Field (Feet)	*Tank (Feet)*
Building structures (not including porches and steps or covered walkways, patios, driveways, etc.)	*2*	*5*
Private property lines	*1.5*	*5*
Water supply wells	*100*	*50*
Streams and lakes	*100*	*50*
On-site domestic water service line	*0*	*5*
Pressurized public water main	*10*	*10*
Water table	*3 feet above (see note 1).*	*NA*
Retaining wall[2]	*2*	*NA*

Notes:

Unless otherwise noted, setbacks are from the California Plumbing Code (California Code of Regulations, Title 24, Part 5, Chapter 16A, Table 16A-1).

1. A test hole 3 feet deep without water can demonstrate that the site is far enough above the ground water table. The graywater system must be shut off in the rainy season.
2. Requirement specific to San Francisco.

Laundry-to-Landscape System

Description: The washing machine pump sends graywater from the drain hose out to the landscape through 1-inch tubing. The system does not alter the existing plumbing and does not require a permit. Best suited for irrigating trees, bushes, shrubs, small perennials and larger annuals.

Installation: Easy to install for the do-it-yourselfer or a professional.

Cost: Ranges from a few hundred dollars (installed by homeowner) to $1,000 to $2,000 (professional installation).

Laundry-to-Landscape System

System Overview

A laundry-to-landscape graywater system captures graywater from the discharge hose of your washing machine, enabling you to reuse the water without altering the existing plumbing in your home.

In this system, the hose leaving the washing machine is attached to a valve that allows for easy switching between the graywater system and the sewer. It is important to be able to switch to the sewer anytime you don't want to send the water outside, for example if you're using bleach, which could harm plants, or if the soil is saturated during the rainy season. The graywater is distributed through a 1-inch irrigation line with outlets directing water to specific plants (Figure 3). This system is low-cost, easy to install, and very flexible if you need to make future changes to your home or landscaping.

Parts You Will Need

You can purchase most of the parts you need from large irrigation stores; 1-inch brass 3-way valves are available from some plumbing supply stores, and complete laundry-to-landscape kits can be found online. See Appendix F for more information.

Assemble these parts:

1. 3-way valve
2. PVC 1-inch male adapter
3. 1-inch barbed male adapter
4. Hose clamp
5. PVC 1-inch x 1½-inch bushing
6. PVC 1½-inch female adapter (slip by FPT)
7. Auto vent (or air admittance valve)
8. 1-inch PVC tee
9. 1-inch barbed x slip adapter

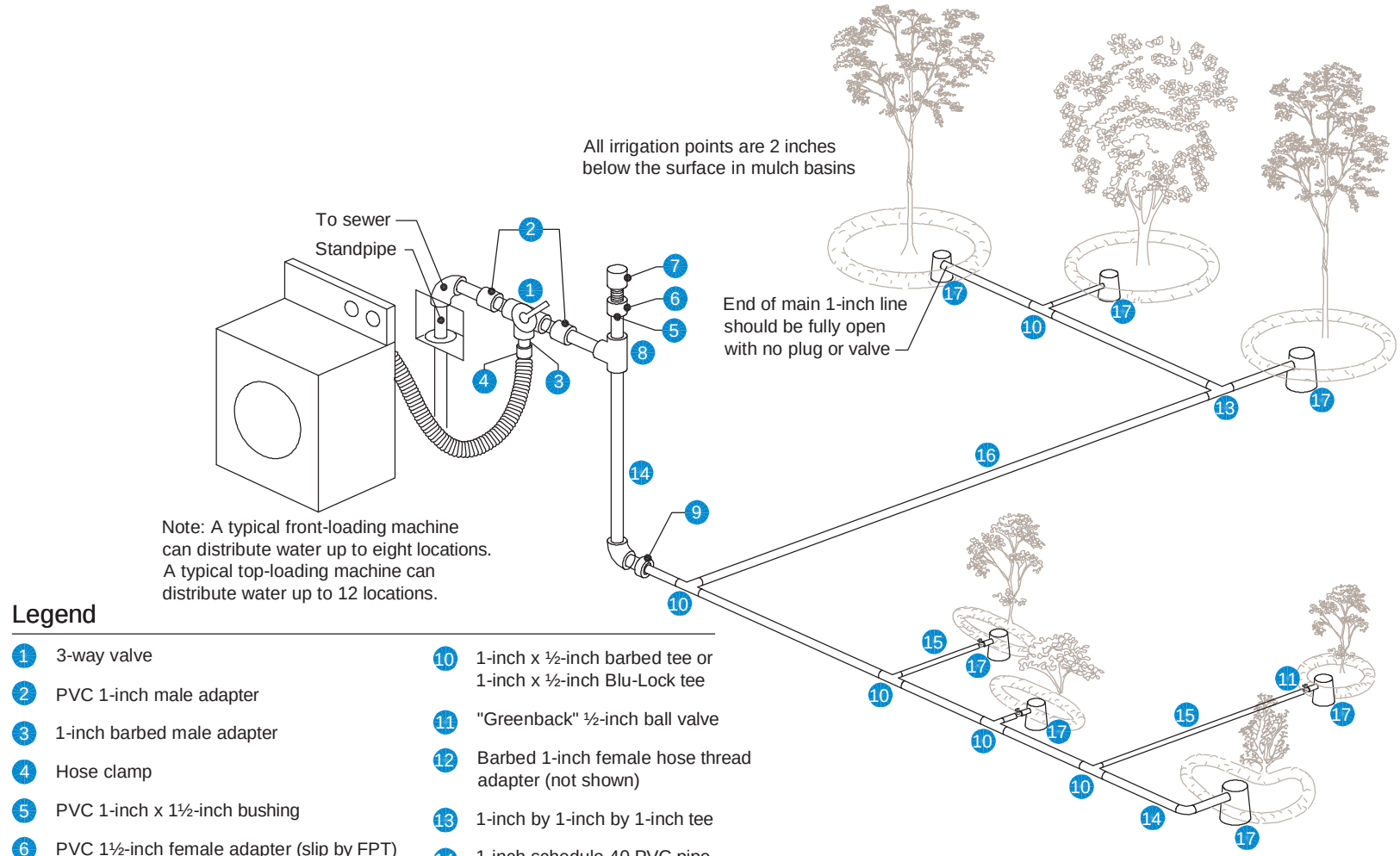
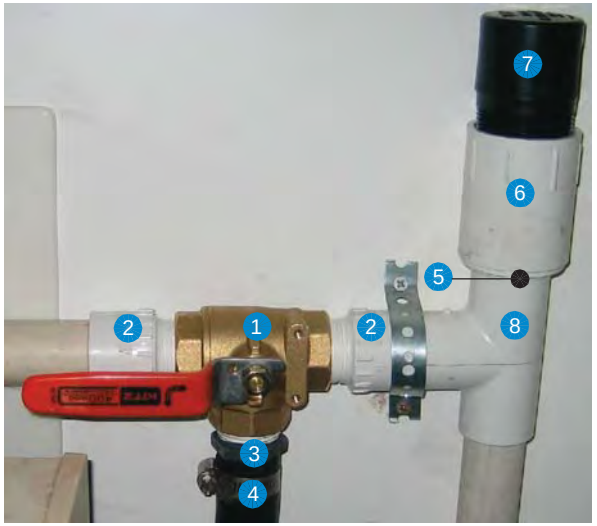


***Figure 3**. Laundry-to-landscape overview. Source: Clean Water Components.*



Legend

1. 3-way valve
2. PVC 1-inch male adapter
3. 1-inch barbed male adapter
4. Hose clamp
5. PVC 1-inch x 1½-inch bushing
6. PVC 1½-inch female adapter (slip by FPT)
7. Auto vent
8. 1-inch PVC tee

3-way valve for diverting laundry graywater to the landscape. Auto vent shown at right. Photo: Laura Allen.

Cleaning the Pump Filter

If your washing machine is not pumping out the water properly, the most frequent cause is objects (for example, coins or paperclips) getting stuck in the pump filter and blocking the flow of water. It is a good idea to check the pump filter before installing your graywater system. See the references at the end of this section for more information about how to clean a washing machine pump filter.

10. 1-inch x ½-inch barbed tee or 1-inch x ½-inch Blu-Lock tee
11. "Green or purple back" ball valve (as needed)
12. Barbed 1-inch female hose thread adapter
13. 1-inch by 1-inch by 1-inch tee
14. 1-inch schedule 40 PVC pipe
15. ½-inch poly tubing
16. 1-inch HDPE tubing
17. Mulch shield or valve box
18. Garden staples

Tools you will need:

- Measuring tape
- PVC cutting tools (ratcheting cutters or a saw)
- Two pairs of channel locks
- Level
- Tubing cutters
- Drill
- 1½-inch hole saw
- ¼-inch pilot bit
- ¼-inch masonry bit (if the wall is stucco)
- Caulking gun and adhesive caulk
- Hammer
- Chisel
- Tin snips
- Shovel and pickaxe

How to Build a Laundry-to-Landscape System

Step 1: Assess Your Site

Where is the easiest area to irrigate? Usually this area is closest to the washing machine and not uphill. Does this area need irrigation? If not, are there plants that need irrigation that you'd like to grow in this area? If not, is there another area needing irrigation where you could send the graywater?

Once you have identified the best place to irrigate, you'll need to figure out how to get the graywater to this landscape. Start in the laundry room. Imagine a pipe leaving the house near the machine. Is the machine on an exterior wall? If so, you'd drill through the wall to exit the building. Is the machine in an interior room? If so, is there a crawlspace or basement where you could drop down through the floor and run the pipe outside? Look for obstacles, such as doorways, sidewalks, patios, driveways, etc., on the way out. A narrow sidewalk can be cut with a concrete saw, or dug under, but a large driveway between the washer and the landscape could potentially be an insurmountable barrier.

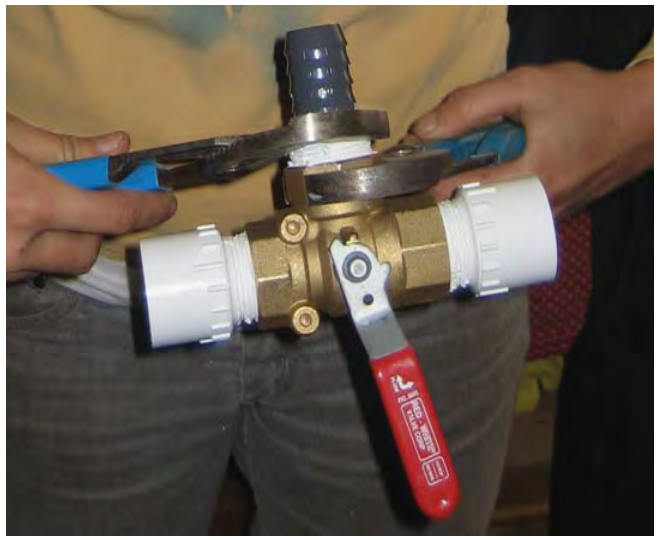
Below are general guidelines to help you select appropriate locations to irrigate using a laundry-to-landscape system. It is your responsibility to determine what is safe for your particular situation. If your washing machine is not operating properly or draining well, it is probably not a good idea to install a laundry graywater system. When in doubt, contact a pump specialist or graywater professional.

- Sloped yards: Don't distribute water uphill. The washing machine has an internal pump, but it is not designed to pump up a hill.

  If your yard slopes downhill from the location of the washing machine, the graywater distribution piping can extend as far as needed. On steep slopes, the tubing should be installed in a serpentine pattern (S-shape, like a switch-back trail) to slow down the water. Otherwise it will rush to the bottom of the hill, and you won't be able to irrigate the upper plants.

- Flat yards: For most machines, it is generally safe to distribute graywater up to 50 feet across a flat yard. Greater distances could result in damage to the washing machine pump, since friction losses increase with distance and put more pressure on the machine's pump.

Drilling a 1½-inch hole for pipe. Note: A pilot hole was drilled first. Photo: Laura Allen.



Tightening fittings onto the 3-way valve with channel locks. Photo: Laura Allen.

Important Considerations for Exterior Walls

Exterior walls within 3 feet of the property line must be fire-rated. If your pipe exits a fire-rated wall, then you must comply with applicable building and plumbing codes to ensure that the integrity of the wall is not compromised. Consult a professional or contact DBI with questions.

Gluing pipes on either side of a 3-way valve. Photo: Laura Allen.

Draw a simple sketch of your system, from the washing machine to the plants. Graph paper is provided in Appendix B. Collect the tools and parts needed.

Now you're ready to start building the system.

Step 2: Make an Exit for the Pipe

Identify where the pipe will exit the building. Be careful not to cut into electrical wires, pipes, or studs. Drill a ¼-inch pilot hole with a thin, long drill bit that can pass through the entire wall. Ensure you are not hitting anything in the wall. You may need to try more than one location if you hit a stud or other obstacle.

If the drill path is clear of electrical wires, pipes, and studs, and the hole exits in a good location on the outside of the building, use the pilot hole as a guide and drill with a 1½-inch hole saw to make a hole large enough for the 1-inch PVC pipe (#14). The type of bit you'll need depends on what the wall is made of: use stucco bits on stucco walls and wood bits on wooden walls. To make a clean hole on both sides, drill from both the outside in and from the inside out. After you finish installing your system, you will need to seal the hole with a waterproof adhesive, such as Sikaflex®, to prevent moisture from entering the wall.

If your washing machine is in an interior room and the pipe will exit the house through a crawlspace or basement, go under the house and look for potential obstacles. Then follow the same instructions for drilling as described above, although you only need to drill from the top down, since it won't matter what the hole looks like in the crawlspace.

Step 3: Prepare the 3-Way Valve

Note that numbers in parentheses refer to the parts list above.

1. Wrap Teflon® tape clockwise around the threaded fittings (two male adapters [#2] and one barbed male adapter [#3] fitting).

2. Insert the male adapters into the threads on both sides of the 3-way valve and turn gently, by hand, making sure not to cross-thread the plastic threads. Do the

same with the barbed male adapter, inserting it into the middle of the valve. Turn clockwise with your hands as tightly as you can.

3. With two pairs of channel locks, continue to tighten the fittings until very tight.

4. Remove the laundry drain hose from the sewer connection (utility sink or standpipe) and place a hose clamp (#4) over the end of the hose. Connect the hose to the barbed fitting on the tee and use the hose clamp to tighten and secure the hose in place, making a watertight seal. (If the hose is rigid plastic, heating the plastic can soften it and make it easier to slip over the barbed fitting. You can use a blow dryer or cup of hot water to heat the hose.) After the system is complete, you will check this seal by running the machine.

Note: These directions are written for a 1-inch laundry drain hose, which is the most common size. Some of the newer, ultra-efficient hoses are ¾-inch. If your hose is non-standard, you'll need to use a barbed fitting that fits your hose and then adapt it to a 1-inch male pipe thread fitting to attach to the 3-way valve. For example, if your hose is ¾-inch, you'll use a ¾-inch barbed male adapter threaded into a ¾-inch by 1-inch threaded bushing.

Step 4: Plumbing to and from the 3-Way Valve

1. Hold the 3-way valve (#1) up and look for a good place on the wall to mount it so that the handle can turn freely and is accessible. The valve MUST be above the flood rim of the washing machine: don't put it lower than the machine (see photo at right).

2. Choose the most direct route for plumbing one side of the valve to the sewer, and orient the other side of the valve towards the hole in the side of the house, or the floor, depending on your situation.

   Note: If your system exits through the floor, the auto vent will be inside the home, since you must put the auto vent at the high point in the system, usually directly above the hole in the floor. See Step 7 for instructions on installing the auto vent.

Legend

1. Auto vent (or air admittance valve)
2. Flood rim

The 3-way valve is slightly above the sewer connection (behind the machine), while the auto vent is about a foot higher than the flood rim of the machine.
Photo: Laura Allen.

1-inch Blu-lock HDPE tubing laid out in trenches. All tubing was buried after system was finished. Photo: Laura Allen.

Mulch basin around a dwarf peach tree being filled with wood chips. Photo: David Glover.

3. Measure all the pipe pieces you need, cut the 1-inch PVC (#14), and connect the piping and fittings without any glue. Once glued, the pipe will slide farther into the fitting to a lip on the interior, so take this into account when measuring. Leave a few inches of pipe sticking out of the hole on the outside of the building.

4. Mark all of the fittings and pipe so that when you glue them together, they are in the position you would like them to be.

5. One at a time, glue the pipe sections and fittings together with PVC glue, being sure to protect underlying surfaces from dripping glue. "Gorilla PVC" is a less toxic PVC glue (do not confuse "Gorilla PVC" with "Gorilla Glue").

6. Go outside and glue the branch of the tee onto the pipe sticking out of the wall. While the glue is wet, adjust the tee with a level so the long axis of the tee is pointing straight up and down. Remember, if the pipe goes through the crawl space or basement, the auto vent must be located inside the laundry room. Make sure the auto vent (see next step below) is accessible so that it can be changed if it wears out and needs replacement. If water ever leaks out of the auto vent, it must be replaced.

7. The auto vent should be at least 6 inches above the flood rim of the washing machine and, when possible, located outside in case it fails and leaks. To assemble the auto vent, follow these steps. Glue the bushing (#5) into the slip portion of the 1½-inch female adapter (#6). Wrap Teflon® tape on the threads of the auto vent (#7), and then thread the auto vent into the threaded side of the female adapter (#6) and tighten. Glue one end of a small 2-inch piece of 1-inch PVC pipe (#14) into the 1-inch side of the bushing (#5). Then glue the other end into the top of the tee (#8).

8. Measure, cut, and glue a piece of PVC pipe to extend from the bottom part of the tee to the ground. If there is a deck or other obstacle between your washer and the irrigation area, you will have to route the pipe around the obstacles. Try to maintain a downward slope whenever possible. Put a 90-degree bend at the bottom of the vertical pipe section and direct the pipe towards the landscape. Place the 1-inch barbed x slip adapter (#9) on the end of the pipe. This is where the 1-inch HDPE tubing (#16) will connect.

Step 5: Preparing the Landscape and Running the Irrigation Tubing

1. Dig mulch basins around the drip line of all the plants you wish to irrigate. The drip line is the exterior boundary of the plant, where the branches end. Mulch basins are created by removing soil and filling the empty space with mulch. If you can't dig a basin around the entire plant, dig a semi-circle, or trench on one side of the plant. The mulch basins should be between 6 and 12 inches deep, depending on the mature size of the plant. Smaller plants need less water and smaller basins.

2. Dig a trench, about 4 inches deep, from the PVC pipe to the first mulch basin. Continue the trench to all the basins, taking the most direct route possible while avoiding sharp turns. If possible, maintain a slight downward slope or at least a level gradient. If the system has dips and rises, it will be harder to get even distribution of water when you tune the system.

3. Make or buy a "valve box" or "mulch shield" for each graywater outlet (Figure 4). Mulch shields can be made out of 1- or 3-gallon flower pots. Put the pot upside down (so the bottom is on top) and make a "lid" by cutting the bottom of the pot so that it can be flipped up like a lid on a can (leaving a section intact to hold the "lid" in place). Drill a hole 2 inches below the "lid" for the graywater tube to enter. Then cut off the rest of the pot 4 inches below the hole you made for the graywater tube. If a more sturdy shield is needed, a valve box can be purchased and altered in a similar way.

4. Place each box or shield in a mulch basin. Make sure there is 2 to 4 inches of mulch underneath the mulch shield. The graywater outlet must enter the shield at least 2 inches below the ground surface.

5. Roll the HDPE tubing (#16) out in the trench to all the mulch basins, staking the tubing so it stays in place. At each irrigation point, cut the tubing and insert a 1-inch by 1/2-inch barbed tee (#10) into the tubing. Attach a short section of ½-inch poly tubing (#15) as needed to reach each basin, and insert it into the mulch shield.

6. Take a photograph of the yard before you bury the tubing! Put this picture in your O&M manual (templates in Appendix B) for future reference. After taking the

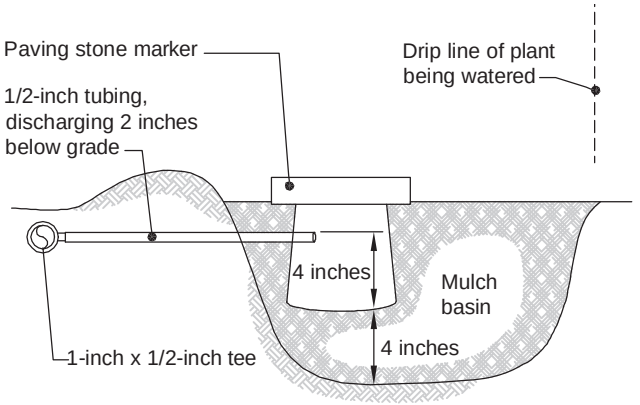


Figure 4. *Mulch shield placement.*

Homemade mulch shield. Photo: Laura Allen.

This 3-way valve creates two zones in the landscape. Water can be redirected from one zone to another zone by turning the handle. Photo: Laura Allen.

Adjusting flow by rotating the tees. Ball valves can be added to the ends of small tubes, if necessary.
Photo: David Glover.

photograph, bury most of the tubing so it is securely in place. Leave the areas with 1 x ½-inch tees (#10) exposed, as you might need to adjust them while tuning the system.

7. Multiple irrigation zones: If your site produces a lot of water and your plants are spread out in different sections of your yard, you might want to set up two irrigation zones. Having separate zones allows you to spread the water out to more places but requires someone to manually switch the system between zones. To install a second zone, add another 3-way valve at the desired location in the system, threading a male adapter by barb into each side of the tee. Run separate 1-inch tubes to different areas of the landscape. The valve directs water to each area as desired.

Step 6: "Tuning" the System

After you have laid out all the tubing, you need to test it to ensure that water flows out evenly from the multiple outlets. To do this, temporarily insert a barbed 1-inch female hose thread adapter (#12) into the tubing, where it would normally connect to the PVC pipe. Then connect a garden hose to this fitting. Turn the hose on, about medium-high flow, and then monitor the outlets.

If you notice that more water is exiting the first outlet and none is reaching the end, you can adjust the angle of the tees, turning them up or down depending on whether there is too much or too little water coming out. If the flow is still uneven after you've done that, add a ½-inch green or purple back ball valve (#11) to the first outlet and shut off the flow slightly. Do not use other types of ball valves, as they clog quickly. Is water coming out evenly among outlets now? If not, you may need to add another valve and repeat the process until water flows evenly from all the outlets. Avoid adding extra ball valves, because they are a point of potential clogging. NEVER put a valve or plug into the end of the main 1-inch line. If you restrict the end of the main line and your outlets clog, the washing machine pump could get damaged. If you have more than one 1-inch line, as when you use a 1-inch by 1-inch by 1-inch tee, and send two 1-inch lines in different directions, then it is okay to restrict one end, since there is a second end fully open.

Step 7: Testing the System

After you have tuned the part of the system outside your home, disconnect the hose and connect the tubing to the PVC pipe. Now you'll test the system with the washing machine. Run a load of laundry with the 3-way valve turned to the graywater system. As the water flows out, check the glued joints, making sure they are all watertight. Check the connection from the washer hose to the 3-way valve; this is a common place to have leaks. You might need to tighten the hose clamp or add a second clamp. Next, go outside and observe how water flows through the system. You might need to readjust the ball valve(s), since the water pressure from the machine will be different from that of the hose. After testing is complete, paint exposed PVC pipe with regular house paint, usually the same color as the building (to protect it from UV damage), and waterproof any holes.

Step 8: Labeling the System

Label the 3-way valve and aboveground graywater pipes (Appendix A). The 3-way valve must be labeled with clear instructions for changing the direction of graywater flow (to sewer or landscape). Aboveground pipes must be labeled with the words "CAUTION: NONPOTABLE WATER, DO NOT DRINK" at intervals of 5 feet or less.

Key Points

- Put the 3-way valve above the flood rim of the machine, in an accessible location inside the home.
- Put the auto vent at the high point of the system, at least 6 inches above the flood rim of the washing machine in an accessible location in case it needs to be replaced. If possible, locate the auto vent outside.
- Use 1-inch pipe and tubing, with 1-inch x ½-inch tees to send graywater to specific plants; do not use larger or smaller pipe for the main graywater line.
- Always leave one end of the 1-inch main line tubing fully open, with no valves or caps.
- Don't overwork your washing machine. Remember not to use the pump to send water uphill or too far across a flat yard (50 feet across a flat yard is typically a safe distance).

Exposed PVC pipe is painted to protect it from UV degredation. The hole is sealed with an adhesive sealant to prevent moisture from entering. Photo: David Glover.

Table 4. *Laundry-to-Landscape System: Operation and Maintenance Checklist*

Component	Inspection Schedule	O&M Activity	Action Needed
3-way valve	Annual	Check for leaks at washer hose and that label is in place	☐ Condition good ☐ Action needed • If leaking, tighten hose clamp. • Replace label if needed.
Auto vent	Annual	Check for leaks from auto vent	☐ Condition good ☐ Action needed • If leaking, replace the auto vent.
Piping and tubing	If you notice water in an unusual place	Check for leaks	☐ Condition good ☐ Action needed • If piping or tubing is damaged, cut out damaged section and reconnect with a 1-inch barbed coupling.
	Annual	Check for even distribution from outlets	☐ Condition good ☐ Action needed • Unclog hair or lint built up in the outlets. Open ball valves, check for clogs. If needed, flush the system with a hose: temporarily disconnect the tubing from the PVC fitting, attach the garden hose by barb fitting, and connect the hose to the system.
Mulch basins	Annual	Check to see if mulch has decomposed and water is pooling under graywater outlets	☐ Condition good ☐ Action needed • Remove decomposed mulch and add new mulch.

Operation and Maintenance

Table 4 summarizes O&M activities for laundry-to-landscape systems. Templates for O&M manuals are provided in Appendix B.

Second Standpipe Option for Laundry Graywater

Another option for a washing machine system is to install a second standpipe next to the existing standpipe (Figure 5). A standpipe is a vertical pipe into which the washing machine hose discharges. The existing standpipe should be plumbed to the sanitary sewer. The second standpipe can be plumbed to a graywater irrigation system.

In a second standpipe graywater system, the exterior graywater irrigation system should be identical to the branched-drain system described in the section titled "Branched-Drain System." There is no 3-way valve inside the house at the washing machine, and the hose from the washing machine is moved manually from one standpipe to the other. The second standpipe method adds no extra strain on the washing machine pump. If your machine is old or has any problems, and you are worried that a laundry-to-landscape system might not be good for the machine, you can install a second standpipe graywater system instead. This method does make it harder to distribute the water to plants than the laundry-to-landscape system, because it is a gravity-based system and does not take advantage of the washing machine's pump to distribute graywater.

The second standpipe option does not require a permit as long as the graywater system is for a one- or two- unit residential building and follows the 12 guidelines set forth in the California Plumbing Code (see Appendix B).

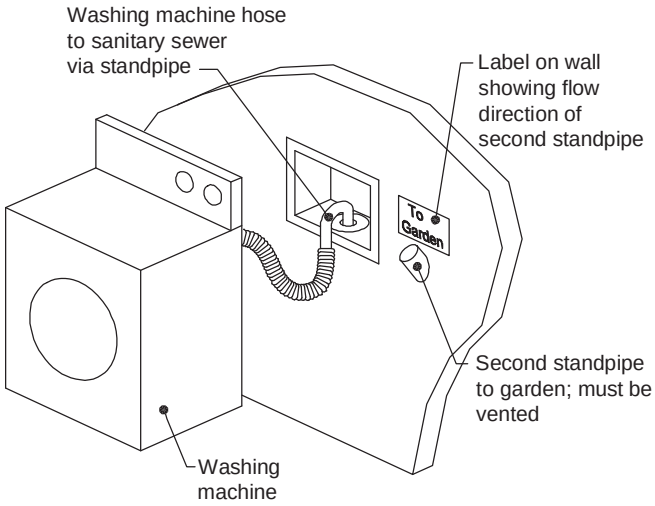


Figure 5. *Second standpipe option. Source: City of Berkeley.*

References

Clean Water Components.: http://www.cleanwatercomponents.com/education/greywater/laundry-landscape-greywater-system/

Create an Oasis with Greywater 5th Ed.: http://oasisdesign.net/greywater/laundry/index.php

How to clean the filter of your washing machine pump: http://www.ehow.com/how_6161420_clean-front-load-washing-machine.html

Branched-Drain System

Description: Graywater drains through a series of branching pipes and is dispersed into the landscape via mulch basin outlets. Branched-drain systems are typically installed on shower drains and/or sinks; however, they can also be installed on washing-machine systems that use the second standpipe variation. When installed on shower drains or sinks, branched-drain systems alter the existing plumbing and require a permit. A branched-drain system is best suited for irrigating trees, bushes, shrubs, and other larger perennial plants.

Installation: Installation difficulty varies greatly depending on the existing household plumbing. A solid understanding of plumbing is needed, as well as basic landscaping skills. Installation is more time-consuming than for a laundry-to-landscape system.

Cost: Costs can range from a few hundred dollars (installed by homeowner) to a few thousand dollars (professional installation).

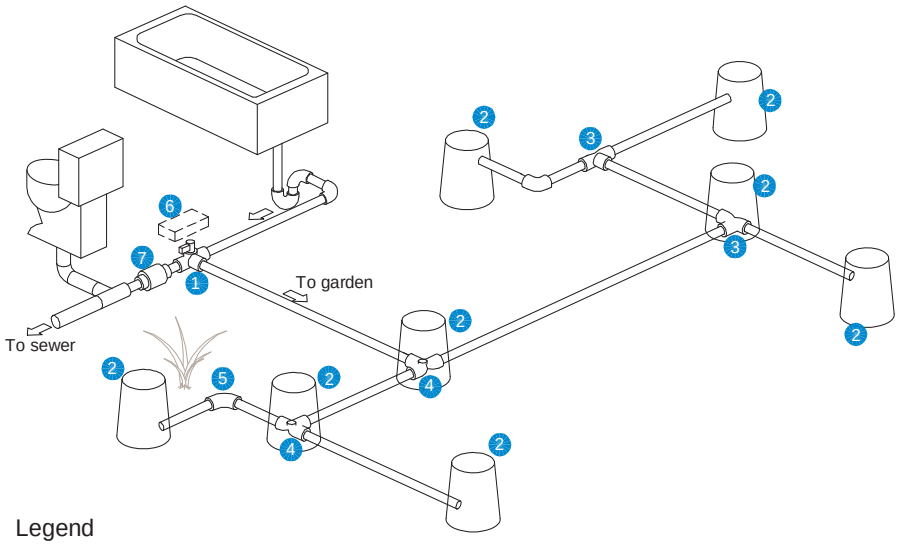


Figure 6. *Branched-drain system. Source: Cleanwater Components.*

Branched-Drain System

System Overview

A branched-drain system allows a homeowner to use graywater from other sources besides the washing machine. The system is simple and requires no electricity. A branched-drain system is driven by gravity flow; no pressure is provided by a washing machine pump or any other pump. This type of system usually distributes graywater from showers and/or sinks, although it is often used in the second standpipe system (for washing machines) described on the previous page. A branched-drain system distributes graywater to the landscape using standard 1½-inch or 2-inch drainage pipe (Figure 6). The irrigated area must be lower in elevation than the graywater source, and the entire distribution system must have a downward slope of 2 percent (¼ inch per foot). The graywater irrigation zone must be downhill relative to the graywater source. Branched-drain systems are best suited to irrigating trees or large shrubs. This kind of system can be time-consuming to construct, but once complete, it requires little maintenance and lasts a long time, since it has no moving parts to break.

How to Build a Branched-Drain System

Note that the following description provides a basic outline of the steps for installing this type of system, but you will need to consult other resources when you plan and install your system.

1. Assess your site: Identify the graywater pipes (shower, sink, or laundry), make sure that you can

access them, and install a 3-way valve before the pipes combine with the toilet drain. Think about how the pipe could be directed to your landscape, considering obstacles like driveways or patios. Identify appropriate plants to irrigate: this type of system is best for trees, shrubs, vines, and other large perennials.

2. Obtain a graywater permit from DBI. See Appendix E for more details.

3. Install a 3-way diverter valve in the drainpipe of the fixture you will be collecting graywater from (Figure 7). The valve must be installed after the p-trap and vent but before the connection to a toilet or kitchen sink drain. If you must install the valve in an inaccessible area because of space considerations, for example, in a small crawlspace, you can add a motor (called an actuator) to the valve and connect it to a switch in the bathroom or other convenient location.

4. Plumb the graywater pipe to your landscape, following standard plumbing techniques, strapping, maintaining a ¼-inch-per-foot gradient, using clean-outs (pipe fittings with a removable plug to allow access to the interior of a pipe, for example, for removing clogs) when needed, and properly sealing the hole you created to exit the building. When exiting the building, make sure not to damage electrical, gas, or plumbing pipes that could be located in the wall, and avoid structural beams and the building foundation. If you have any doubts about plumbing and/or drilling through floors or walls, call in a professional! Chapter 7 of the California Plumbing Code contains the drainage

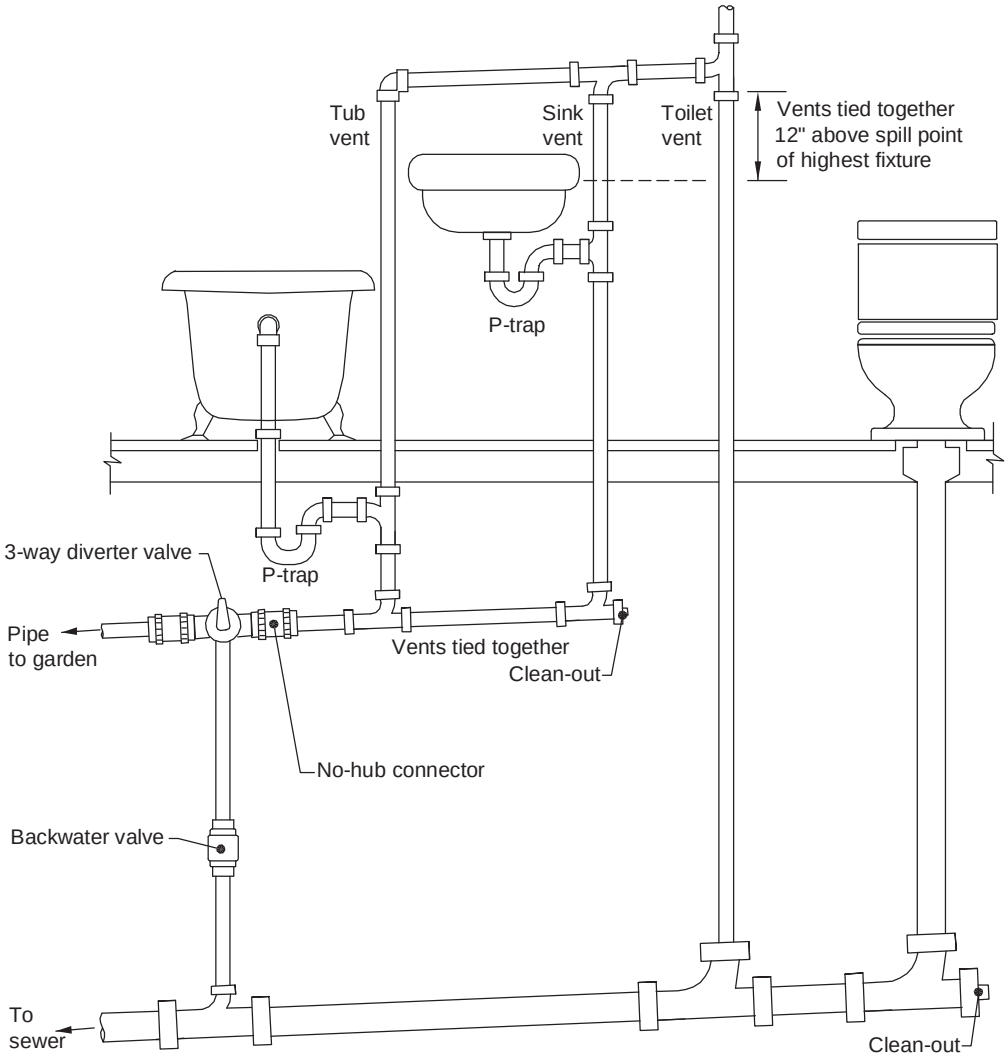


Figure 7. *Location of the 3-way valve in a shower or sink system. Source: Art Ludwig, Oasis Design.*

plumbing requirements that must be followed when you install the system.

5. Prepare the landscape: dig mulch basins around the drip lines of the plants to be irrigated, trench the pipe to the plants, and construct mulch shields for subsurface irrigation (Figure 8). Make sure that the graywater is discharged at least 2 inches below ground surface and that it falls through the air onto 4 to 6 inches of mulch.

6. Pipe must slope at least 1/4 inch per foot, which is the standard slope for drainage plumbing. The burial depth of the pipe does not have to meet standard depths for sewer pipes, since this is an irrigation system. In flat yards, start with the pipe buried as shallowly as possible (approximately 2 inches), as it will get progressively deeper. If yard is downward sloping, bury the pipe deep enough to prevent it from becoming exposed over time. Consult with DBI about proper depths in this situation.

7. Test the system by turning on the fixture(s), making sure that the graywater flows properly.

For more information about how to install a branched-drain system, see the book references in Appendix F.

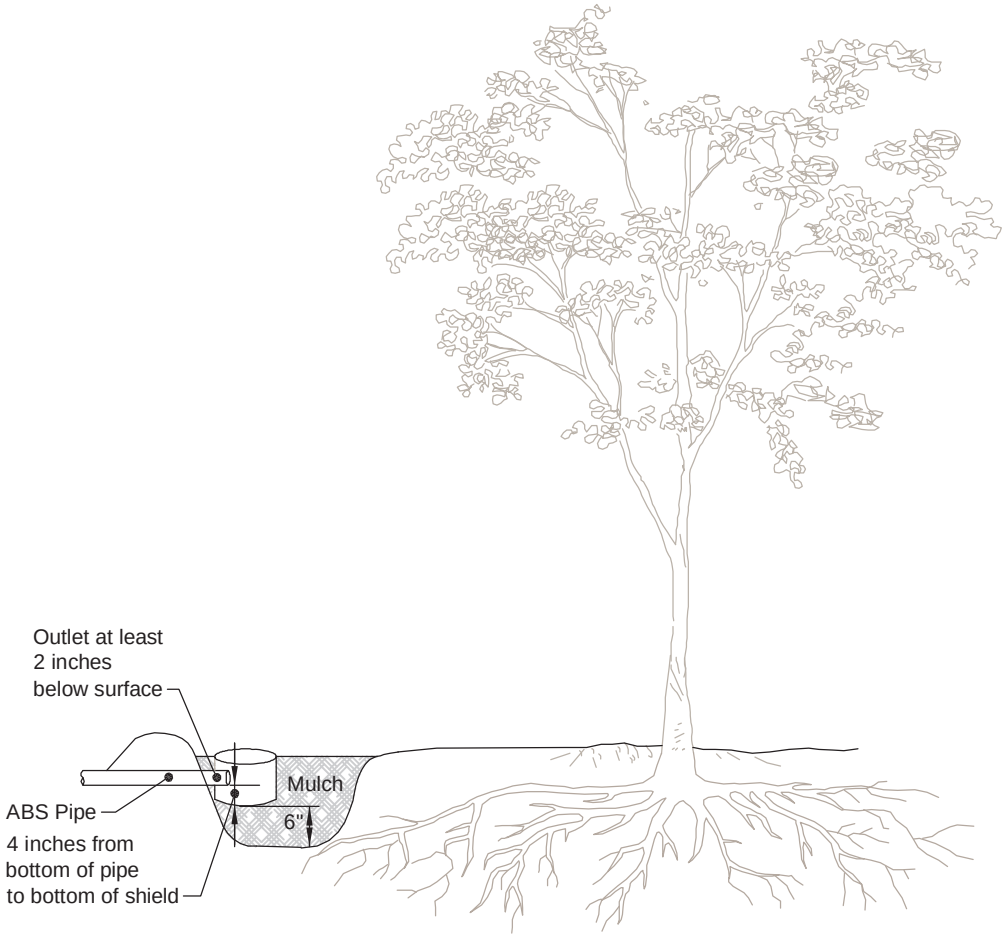


Figure 8. *Mulch shield inside of mulch basin. Note: Roots of a real tree would extend under basin and outside of drip line by many feet.*

Pumped Systems

Electricity and Water in California

In California, almost 20 percent of all electricity and over 30 percent of natural gas is used to pump, heat, and treat water. Graywater systems sometimes need to incorporate a pump, but the homeowner should carefully examine non-pumping options first to minimize the use of electricity. Pumped systems are most often installed when irrigation is needed uphill of the graywater source. Pumped systems can also be installed to pressurize graywater for a drip irrigation system, in which case the water must be filtered.

Overview of Pumped Systems

In pumped systems, graywater is directed to a holding tank for temporary storage (less than 24 hours) before being pumped to the landscape. If the system is to be used for drip irrigation, the graywater must be filtered before it reaches the drip emitters (see description of Sand Filter-to-Drip Irrigation system in the next section). The pumped system described below does not include filtration and therefore can only be used for sending graywater uphill, not for drip irrigation.

Pumped System with No Filtration

As illustrated in Figure 9, in a pumped system with no filtration, also referred to as a "drum with effluent pump system," graywater is directed to a watertight tank (also called a surge tank), from which an effluent pump

Pumped Systems with No Filtration

Description: Graywater from showers, sinks, or laundry is directed to a temporary holding tank and then pumped to the landscape, which can be uphill of the graywater source(s). This system usually alters the existing plumbing and always requires a permit; an additional electrical permit might also be required for the outlet that the pump is plugged into. These systems are best suited for irrigating perennials of any size and larger annuals, for example, corn.

Installation: Installation difficulty varies greatly depending on the existing household plumbing. A solid understanding of plumbing is needed, as well as basic landscaping skills. If a new electrical outlet is required, electrical skills are also required.

Cost: Costs can range from $500-$700 (installed by homeowner) to a few thousand dollars (professional installation).

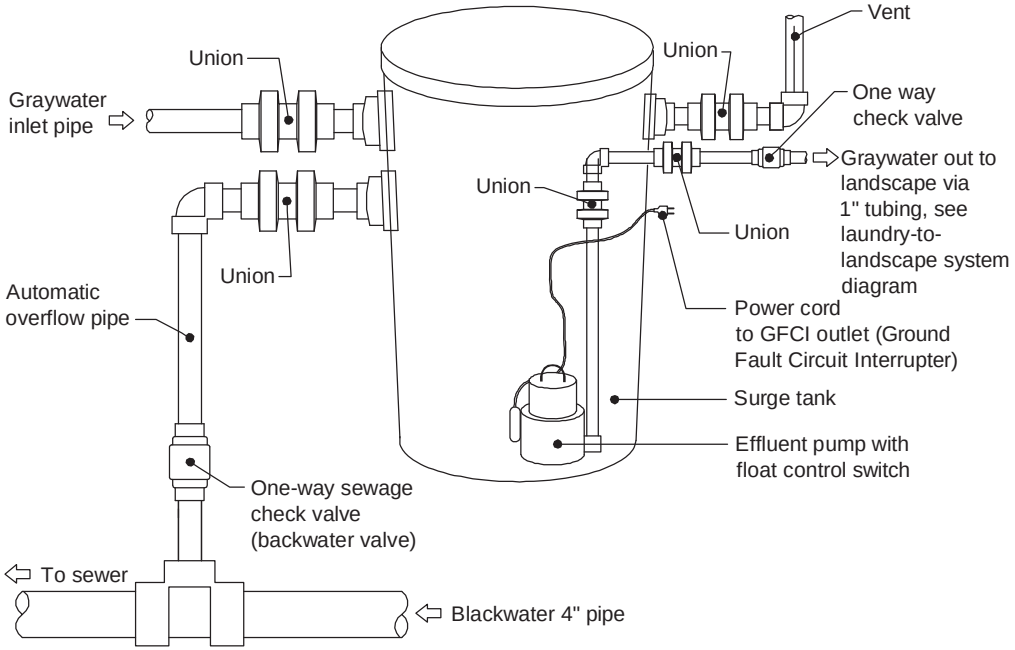


Figure 9. *Drum with effluent pump.*
Source: Robert Kourik, in Drip Irrigation for Every Landscape and All Climates.

discharges water through tubing to the landscape. This system is lower in cost and easier to install than a system that includes a filter for drip irrigation, but it is less water-efficient, since the outlets are larger.

It is possible to put in simple filters to capture hair and lint "upstream" of the surge tank, thus reducing the power required of the pump, but the filters need to be cleaned regularly. Cleaning a graywater filter is a smelly, slimy, and generally unpleasant task that is sometimes left undone, leading to clogged filters, possibly graywater overflows, and other undesired consequences. It is critical to understand the maintenance requirements of your system before installing it. See the Manufactured System section for information about other filtering options.

How to Build a Pumped System with No Filtration

Once you have determined that pumping the graywater is the only possible way to reach your landscape, the steps below provide a general overview for installing a simple pumped system with no filtration. Note that you will need to consult additional resources to build the system. Keep in mind that a pumped system is more complicated than the systems described previously.

1. Assess your site: Identify the graywater pipes (shower, sink, or laundry) and make sure you can access them. Identify a location for the surge tank and an outlet to plug in the pump. If there is an existing outlet nearby, you'll need to determine if the outlet can handle the additional electrical load of the pump. If you are unsure how to determine this, hire a professional. If you need to add an electrical outlet, an electrical permit will be required.

2. Apply to DBI for a graywater permit and for an electrical permit, if a new outlet or dedicated circuit is needed for the pump.

3. Install a 3-way diverter valve in the drain line of the desired graywater fixture, after the p-trap and vent but before the connection to a toilet or kitchen sink drain.

4. Install the surge tank and route the graywater to it. Check the California Plumbing Code for requirements for how to outfit the tank. Requirements include a union fitting, vent, overflow pipe with a backwater valve, and a swing-check valve on the

graywater pipe exiting the tank. Graywater may not be stored for longer than 24 hours, so size the tank so that it empties at least once a day.

5. Direct the irrigation line to the landscape using 1-inch tubing and reducing tee fittings at each plant. See Figure 3 for the laundry-to-landscape system for more details.

6. Prepare the landscape: dig mulch basins around the drip lines of the plants to be irrigated, trench the pipe to the plants, and construct mulch shields for subsurface irrigation.

7. Test the system by turning on the fixture(s), making sure that the graywater flows properly, the pump turns on when it should, and graywater is distributed evenly to the landscape.

Materials needed for a pumped system:

- 3-way valve
- ABS fittings
- Tank
- Effluent pump rated to pump ¾-inch solids
- Unions
- Backwater valve
- Swing-check valve
- 1-inch tubing
- Barbed fittings with ½-inch outlets
- Mulch

For more information about pumped systems, see the references in Appendix F.

Graywater sand filter at the Sunset San Francisco Idea House.
Photo: WaterSprout.

Sand Filter-to-Drip Irrigation

Description: Graywater flows by gravity to a temporary holding tank, is pumped through a sand filter to remove particles, and then is pumped to a drip irrigation system. An irrigation controller allows municipal water to supplement graywater as needed and also controls automatic cleaning of the filter. This system requires a permit for graywater and could require an electrical permit as well. In addition, a backflow prevention assembly must be installed on the municipal water supply line, and the assembly must be tested annually. This system is suitable for all plants, except for lawns.

Installation: Sand filter-to-drip irrigation systems should be installed by a professional.

Cost: System costs range from $7,000 to $15,000 (professional installation).

Other Graywater Systems

In addition to the systems described previously in this manual, there are other options for designing and installing more complex graywater systems. Some of these options are briefly discussed below. New construction or full plumbing remodels can give you access to more graywater sources than are typically available in a retrofit situation. With a larger volume of graywater available, more complex options might be appropriate for your situation. These systems are usually more expensive, can distribute water to more locations, and are a more water-efficient way to irrigate. Complex graywater systems are typically found in high-end residential new construction, especially houses seeking LEED (Leadership in Energy and Environmental Design). Such systems always require a permit.

Dual-Drainage Plumbing

If you are building a new house or doing a major plumbing remodel, you can ask the plumber to keep the graywater drains separate from the toilet and kitchen sink drains, enabling you to access all the household graywater in one pipe. This is dual-drainage plumbing. In this scenario, the graywater and black water (toilet and kitchen sink) pipes can combine either after they exit the house or "downstream" of a convenient location for installing a 3-way valve on the graywater pipe.

Sand Filter-to-Drip Irrigation

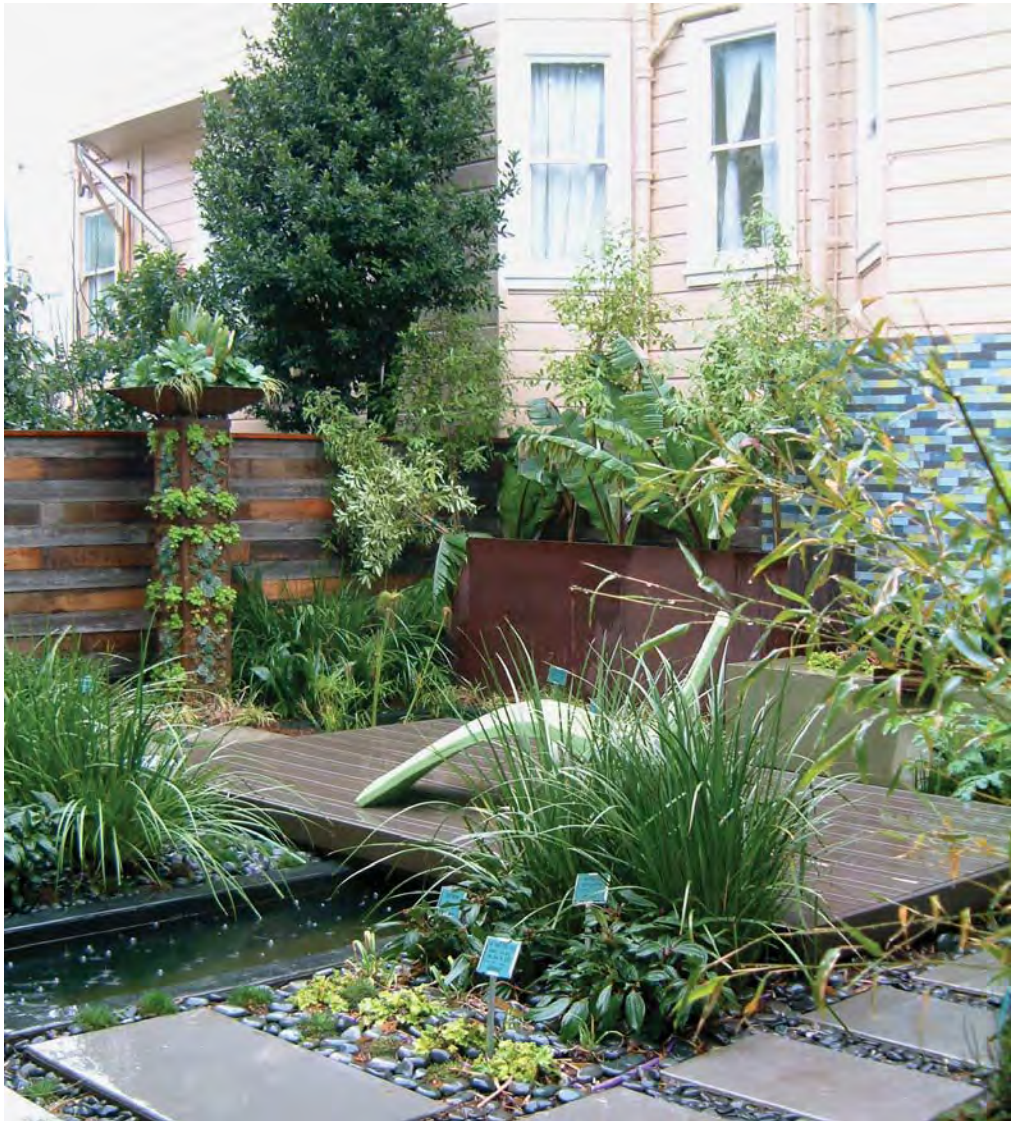
Drip irrigation is the most water-efficient form of landscape irrigation. For graywater to be used in a drip irrigation system, the dirt, hair, and lint must be filtered out so they won't clog the drip emitters. Graywater for drip irrigation is commonly filtered with a sand filter. Note that sand

filters only remove solids, not salts or chemicals, so it is still important to use graywater-friendly cleaning products (Appendix C).

In a sand filter-to-drip irrigation system, all the graywater from the house is plumbed to a holding tank, where the graywater is temporarily stored. An irrigation controller turns on an effluent pump in the holding tank when irrigation is needed. The pump sends the graywater through a sand filter, where the dirt, hair, and lint particles are filtered out. The filtered graywater then goes to drip irrigation tubing in the landscape. If there is not enough graywater, the system is set up to include municipal water. This type of system is fully automated and thus more complex and higher in cost than simpler systems, but it allows for greater flexibility in irrigation and can irrigate plants of any size and elevation relative to the house. The sand filter is cleaned automatically on a timed schedule: pressurized municipal water is sent backwards through the filter to remove debris, with the effluent water directed to the sewer. A reduced pressure principle backflow prevention assembly must be installed at the point of connection to protect the municipal (potable) water supply from accidental contamination with graywater. This assembly must be tested by a licensed tester upon installation and subsequently on an annual basis. Results must be sent to the Water Quality Division of the SFPUC. This system requires a plumbing permit and could require an electrical permit as well. Design must be reviewed and approved by the City's DBI.

Manufactured Graywater Systems

Several types of manufactured graywater systems are available for purchase in California. These systems typically filter graywater for use in graywater-compatible drip



This landscape is irrigated with graywater that has passed through a sand filter before entering the subsurface drip irrigation system. Note: The pond is not supplied by graywater and is lined so that graywater doesn't enter it. Photo: WaterSprout.

irrigation tubing. This makes it possible to irrigate smaller plants and to spread the water out over a larger area than is possible with other simple graywater systems or unfiltered pumped systems. Manufactured graywater systems are typically lower in cost than automatized sand filter-to-drip irrigation systems, but higher in cost than the previously mentioned simple systems. The technology for these types of systems is relatively new and still being developed, so their longevity is unknown. If possible, it would be helpful to talk to a homeowner who has owned and operated the system (and not just a sales person) for at least a year to learn more about how it functions. Because these systems incorporate filters, pumps, and sometimes disinfectant (in higher-technology versions), they have more components to maintain and replace. It is also important to find out the system's maintenance needs and learn how you'll know if the system isn't working properly. Since these systems typically require manual filter cleaning one solution is a maintenance contract with the installer, or training an existing on-site landscaper/gardener in system maintenance. This could help prevent system failures from lack of maintenance. All of these systems require a permit.

Indoor Use

In theory, graywater can be filtered, disinfected, and pumped back inside residential buildings to be used for toilet flushing and other non-potable uses. In practice, doing so is not very easy. There are currently rigorous water quality standards that need to be met for interior graywater reuse (California Code of Regulations, Title 22, Section 60301.230). While technology has been developed to meet these standards, it can be expensive for individual homes. Many of these systems also have kinks that need to be worked out.

Currently, it may be easier for most households to use rainwater for toilet flushing and graywater for outdoor irrigation.

Glossary

3-way diverter valve A valve that directs water in one of two directions: the sewer or the landscape. Diverter valves come in different materials and sizes.

ABS Acrylonitrile butadiene styrene, a black plastic pipe used in drainage plumbing. ABS pipe is used in gravity-based graywater systems, such as branched-drain systems. ABS is cut with a saw or tubing cutters and glued together with ABS glue, also called ABS cement.

Actuator A motor that attaches to the face of a plastic 3-way valve and connects to a plug-in transformer and a toggle switch so that a graywater system can be turned on or off from another location (usually inside the house).

Auto vent (also called air admittance valve, AAV, Studor valve, in-line vent) A device that allows air to enter a drainage plumbing system. In a graywater system, it prevents water being "sucked out" or siphoned out of the washing machine while it is filling. The auto vent must be located at the high point of the graywater system. This device must not be installed on the plumbing system of the house or unit, as this is not allowed under the San Francisco Plumbing Code.

Backflow preventer An assembly that prevents water from reversing its flow direction. Backflow preventers are used to protect the municipal water system from contamination, for example, by graywater from a sand filter-to-drip irrigation system. Backflow preventer assemblies must be tested annually by a licensed tester to ensure they're working properly. A reduced pressure principle backflow preventer (RP) is required for graywater systems that include municipal make-up water and do not have an air gap.

Backwater valve A type of swing-check valve used on the overflow pipe of a graywater tank. Its purpose is to prevent sewage from entering the tank in the event of a sewage clog.

Ball valve A device that shuts off the flow through a tube or pipe when a "ball" is turned inside the valve.

Barbed fitting Fitting used in the irrigation part of a laundry-to-landscape system. The tubing fits over the barbs and can be forcibly removed if needed. The connection may not be completely watertight; if a watertight connection is required, a hose clamp can be added. A Blu-Lock fitting, a special type of irrigation fitting, can be used as an alternative to barbed fittings. Blu-Lock fittings make a watertight seal and are easy to work with.

Branched-drain system A simple graywater system that uses standard drainage plumbing parts to distribute graywater by gravity out to the landscape.

Double ell (also called twin 90, double ¼ bend) A plumbing fitting that divides the flow in a branched-drain system. Typical sizes are 1½ and 2 inches.

Drainage test A test to determine how well water drains on a site.

Drip line The outer point of the leaves on a tree or shrub, where water would drip off onto the ground in a light rain. Trees should be irrigated at or beyond their drip lines; roots typically extend at least twice the distance from the trunk to the drip line.

Dual-drainage plumbing Separate plumbing systems for separate wastewater flows. As applied to graywater systems, dual-drainage plumbing separates graywater flows (laundry, sinks, and shower/baths) from toilet and kitchen sink wastewater, enabling the entire graywater flow to be accessed in one pipe.

Effluent pump A pump designed to pump wastewater, including graywater. A graywater effluent pump should be able to pass ¾-inch solids.

Emitter An outlet that discharges water into the landscape. Drip irrigation emitters have very small openings and thus must have adequate filtration if graywater is used. Unfiltered graywater requires emitters, or outlets, of at least 1/2 inch in diameter.

Evapotranspiration The combination of water transpired from plants and evaporated from soil and surfaces. The evapotranspiration rate, or ET, is one variable that determines how much irrigation plants require.

FHT (female hose thread) An adapter or fitting that has hose threads on the inside of the fitting. These hose threads are incompatible with pipe threads.

FPT (female pipe thread) An adapter or fitting that has standard pipe threads on the inside of the fitting.

Filter A device that captures lint, hair, and other particles in graywater to prevent clogging in the rest of the system.

HDPE/PE High density polyethylene or polyethylene, a type of plastic that is used in irrigation tubing. The manufacturing process for HDPE and PE produces fewer toxins than that for PVC, and they are also recyclable.

Loam Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Laundry-to-landscape system A type of graywater system that diverts laundry water directly to the landscape. This system does not require a permit in a one- or two-family dwelling so long as 12 guidelines are followed and the system does not alter the drainage plumbing.

MPT (male pipe thread) Pipes that have standard pipe threads on the outside of the adapter or fitting.

Manufactured system A type of graywater system purchased from a company. These types of systems usually incorporate a surge tank, a filter, and a pump.

Mulch A covering, usually of organic matter, placed on the soil surface. For graywater systems, the preferred mulch is large wood chips (not shredded wood or small chips), as the large chips take longer to decompose and thus require less frequent replacement.

Mulch basin An area created by removing soil and filling the empty space with mulch. Mulch basins are typically located in the drip line of a plant and are sized according to the amount of graywater entering them. Mulch basins create a large space for graywater to spread out and sink into the ground without pooling or runoff.

Mulch shield See valve box.

Overflow A pipe exiting a surge tank to allow graywater to flow to the sewer in case of pump failure. The diameter of the overflow pipe must be at least the size of the total of all inlet pipes to the tank.

P-trap A curved, U-section of drain pipe that holds a water seal to prevent sewer gasses from entering a building through a fixture's drain pipe.

Pathogens of concern Disease agents and viruses that enter graywater through contact with fecal matter or other infectious agents. Such pathogens could harm health if ingested.

Phytophthora (crown rot) A plant disease caused by water pooling at the base of the plant, or crown. Crown rot can be prevented by irrigating in the drip zone of the plant and locating the plant on a mound so its crown is above the elevation of the landscape.

Plot plan A simple aerial view drawing of the site, including the footprint of the building, property lines, municipal supply lines, graywater lines, and areas to be irrigated.

Pooling Pools or puddles of water at the surface. Pooling of graywater is not allowed under the California Plumbing Code and is also unsightly. Pooled graywater provides a place for mosquitoes to breed and the potential for contact by people or pets.

PVC Polyvinyl chloride, a material commonly used for pipes. The manufacturing process is highly toxic, so PVC pipe use should be minimized. PVC is used to make rigid 1-inch pipe that is easy to work with.

Reclaimed water See recycled water.

Recycled water Treated wastewater produced by a wastewater treatment plant.

Sand filter (or rapid sand filter)
Sand filters remove particles from graywater so the water can be used in a drip irrigation system. These filters do not remove salts or chemicals. To function properly, sand filters must be automatically backflushed with fresh water to clean them out. Sand filters are commonly used in pool and spa systems.

Sand filter-to-drip irrigation system
A type of graywater system that uses a sand filter to remove particles from graywater and distributes the water through graywater-compatible drip irrigation tubing.

Slip connection A connection of plastic fittings made by slipping one piece of pipe inside the fitting. These fittings must be glued with the appropriate glue (depending on pipe material) to create a watertight seal.

Surge tank A tank that temporarily collects graywater before it is pumped or drained out to the landscape. Surge tanks should not store graywater for longer than 24 hours.

Surfactants (anionic and nonionic)
Substances used in detergents and cleaning products to loosen dirt from fabric and prevent it from re-adhering. Surfactants can be made from plants or petro-chemicals.

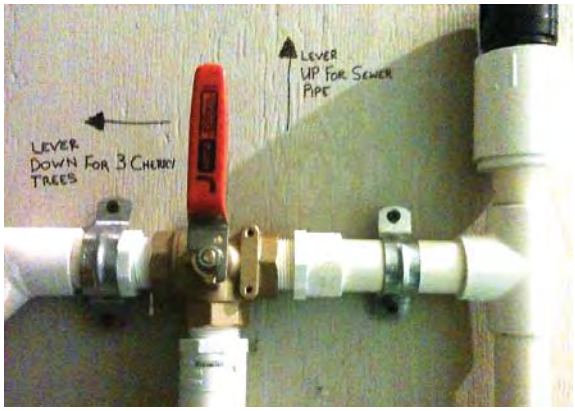
Swing-check valve (one-way valve)
A valve that allows water to flow in one direction only. Inside the valve is a flap that swings open in one direction; if water begins to flow backward, the valve closes and prevents water from passing. These valves are used in pumped systems when the irrigated area is higher in elevation than the pump. Note: do not confuse a "swing" check valve with a "spring" check valve, as they are not the same thing.

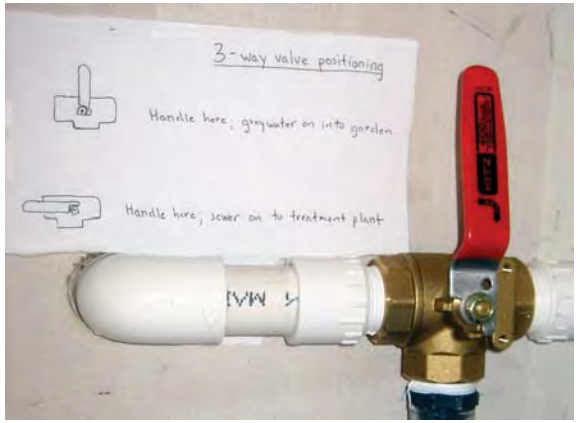
Valve box
Also called a mulch shield, a valve box is a subsurface cavity into which graywater is discharged. Graywater flows from the valve box into mulch. Air space between the outlet and the mulch prevents roots from growing back into the graywater pipe and clogging the system. Valve boxes can be purchased or made at home out of 1- to 5-gallon plastic pots, the size depending on the quantity of graywater to be discharged.

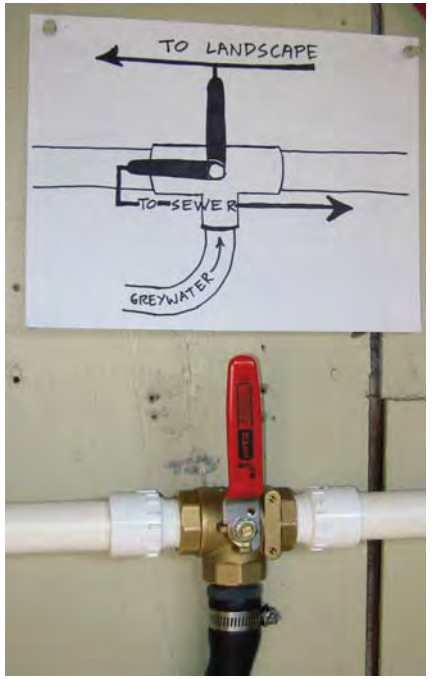
Water table
The upper surface of the saturated zone, where water fills the pore spaces of soil or rock.

Appendix A: Signs for Your Graywater System

- Your graywater system must be labeled so that all users (current and future) know how to turn it on and off. Sample signs are shown in the images to the right.
- You must label all above-ground graywater pipes as follows: "Caution: Non-potable water, do not drink" at intervals of 5 feet or less.
- Consider putting a reminder of what soaps to use on or near your machine, particularly if you share it with other people.







Examples of labeling the 3-way valve.

Appendix B: Operation and Maintenance Manual Templates

See *http://www.sfwater.org/landscape* for links to Microsoft Word versions of these templates. Graph paper is provided at the end of each template for use in drawing a plan of your graywater system.

Sample Operation and Maintenance Manual for Laundry-to-Landscape Graywater System

Congratulations on your new graywater system! This manual will help you maintain a well-functioning, water-saving graywater irrigation system. This manual is to remain with the building throughout the life of the system. Upon change of ownership or occupancy, the new owner or tenant must be notified that the structure contains a graywater system. A map showing the location of all graywater system components should be attached to this manual.

Insert the calculations you used to design your system here:

My washing machine uses _____ gallons per load.

My household does _____ loads of laundry per day on a typical laundry day.

My household does _____ loads of laundry per week.

Soil type _____

This system was designed to accommodate _____ gallons per day.

1. How do I turn my graywater system off?

To turn your graywater system off, turn the handle of the 3-way valve to direct the water towards the sewer or septic system. The first few times you do this, check to make sure the system is turning off and that your 3-way valve is labeled correctly.

These are common times you'll need to turn off your system:

- During the rainy season. Graywater may be used if there are extended dry periods during the typical rainy season, but the system must be turned off as soon as the rain resumes.
- When washing dirty diapers.

- When washing anything with chemicals, such as oily rags.
- Anytime you notice that the water isn't draining well and you see pooling or runoff.
- If you think your plants are receiving too much water.
- Anytime you use products that are harmful to plants (like bleach or harsh cleaners).

2. What products can I use in my graywater system?

It is important to use plant-friendly products when reusing your graywater. All products should be biodegradable and non-toxic. In addition, they should be free of salt (sodium) and boron (borax), two common ingredients that are non-toxic to people but are harmful to plants and/or the soil.

Chlorine bleach is harmful to plants and should be diverted, along with any other harmful products, to the sewer or septic system (by switching the 3-way valve). Hydrogen peroxide bleaches are less harmful and can be used instead of chlorine.

Another consideration with cleaning and personal care products, such as shampoos and conditioners, is their effect on the pH of the water. While many soaps do not change the water's pH, some do. In general, liquid soaps do not affect the pH, while bar soaps make the water alkaline (opposite of acidic). Certain acid-loving plants might not be happy with alkaline water. If you're uncertain if the pH is being affected, use the graywater to irrigate plants that are not acid-loving. Acid-loving plants include ferns, azaleas, camellias, rhododendrons, and blueberries.

For information about products that independent groups have found to be free of ingredients that may harm plants, see websites such as *http://greywateraction.org/content/greywater-friendly-products* and *http://www.harvestingrainwater.com/greywater-harvesting/greywater-compatible-soaps-and-detergents/*.

3. How do I maintain my graywater system?

The main thing you'll need to do to maintain your graywater system is periodically check on the mulch basins (the mulch layer the graywater flows into) and make sure the graywater is draining properly. If you notice any pooling or runoff, dig out the mulch basin and put in new mulch (wood chips or bark). Mulch usually needs to be replaced every one or two years.

At the beginning of the irrigation season, check to ensure that graywater is flowing out of the outlets evenly. If you notice uneven distribution, check the outlets for clogs, and manually remove any debris. If you notice that many of the outlets are clogged, you need to flush the system.

To flush the system, open any partially closed ball valves, making sure the end of each line is open. Pull the tubing off the PVC connection point and insert the barbed 1-inch female hose thread adapter. Attach a garden hose to the hose connection and turn the hose on high to flush particles out of the system. ***Any time you attach a garden hose to temporarily flush the system, you are required to have an anti-siphon valve or vacuum breaker on the hose bibb!*** When you are finished, be sure to readjust the ball valves for an even flow of graywater.

A basic operation and maintenance checklist for laundry-to-landscape systems is provided in Table B-1.

Table B-1. *Laundry-to-Landscape System: Operation and Maintenance Checklist*

Component	Inspection Schedule	O&M Activity	Action Needed
3-way valve	Annual	Check for leaks at washer hose and that label is in place	☐ Condition good ☐ Action needed • If leaking, tighten hose clamp. • Replace label if needed.
Auto vent	Annual	Check for leaks from auto vent	☐ Condition good ☐ Action needed • If leaking, replace the auto vent.
Piping and tubing	If you notice water in an unusual place	Check for leaks	☐ Condition good ☐ Action needed • If piping or tubing is damaged, cut out damaged section and reconnect with a 1-inch barbed coupling.
	Annual	Check for even distribution from outlets	☐ Condition good ☐ Action needed • Unclog hair or lint built up in the outlets. Open ball valves, check for clogs. If needed, flush the system with a hose: temporarily disconnect the tubing from the PVC fitting, attach the garden hose by barb fitting, and connect the hose to the system.
Mulch basins	Annual	Check to see if mulch has decomposed and water is pooling under graywater outlets	☐ Condition good ☐ Action needed • Remove decomposed mulch and add new mulch.

4. What are the 12 guidelines I must follow to comply with the law?

Under the 2010 California Plumbing Code (California Code of Regulations, Title 24, Part 5, Chapter 16A), washing machine systems in one- or two-unit residential buildings do not require a permit as long as the installer follows the 12 minimum requirements outlined in the code:

1. If required, notification has been provided to the Enforcing Agency regarding the proposed location and installation of a graywater irrigation or disposal system. *Note: A city, county, or other local government may, after a public hearing and enactment of an ordinance or resolution, further restrict or prohibit the use of graywater systems.*

2. The design shall allow the user to direct the flow to the irrigation or disposal field or the building sewer. The direction control of the graywater shall be clearly labeled and readily accessible to the user.

3. The installation, change, alteration or repair of the system does not include a potable water connection or a pump and does not affect other building, plumbing, electrical or mechanical components including structural features, egress, fire-life safety, sanitation, potable water supply piping or accessibility.

4. The graywater shall be contained on the site where it is generated.

5. Graywater shall be directed to and contained within an irrigation or disposal field.

6. Ponding or runoff is prohibited and shall be considered a nuisance.

7. Graywater may be released above the ground surface provided at least two (2) inches (51 mm) of mulch, rock, or soil, or a solid shield covers the release point. Other methods which provide equivalent separation are also acceptable.

8. Graywater systems shall be designed to minimize contact with humans and domestic pets.

9. Water used to wash diapers or similarly soiled or infectious garments shall not be used and shall be diverted to the building sewer.

10. Graywater shall not contain hazardous chemicals derived from activities such as cleaning car parts, washing greasy or oily rags, or disposing of waste solutions from home photo labs or similar hobbyist or home occupational activities.

11. Exemption from construction permit requirements of this code shall not be deemed to grant authorization for any graywater system to be installed in a manner that violates other provisions of this code or any other laws or ordinances of the Enforcing Agency.

12. An operation and maintenance manual shall be provided. Directions shall indicate the manual is to remain with the building throughout the life of the system and indicate that upon change of ownership or occupancy, the new owner or tenant shall be notified the structure contains a graywater system.

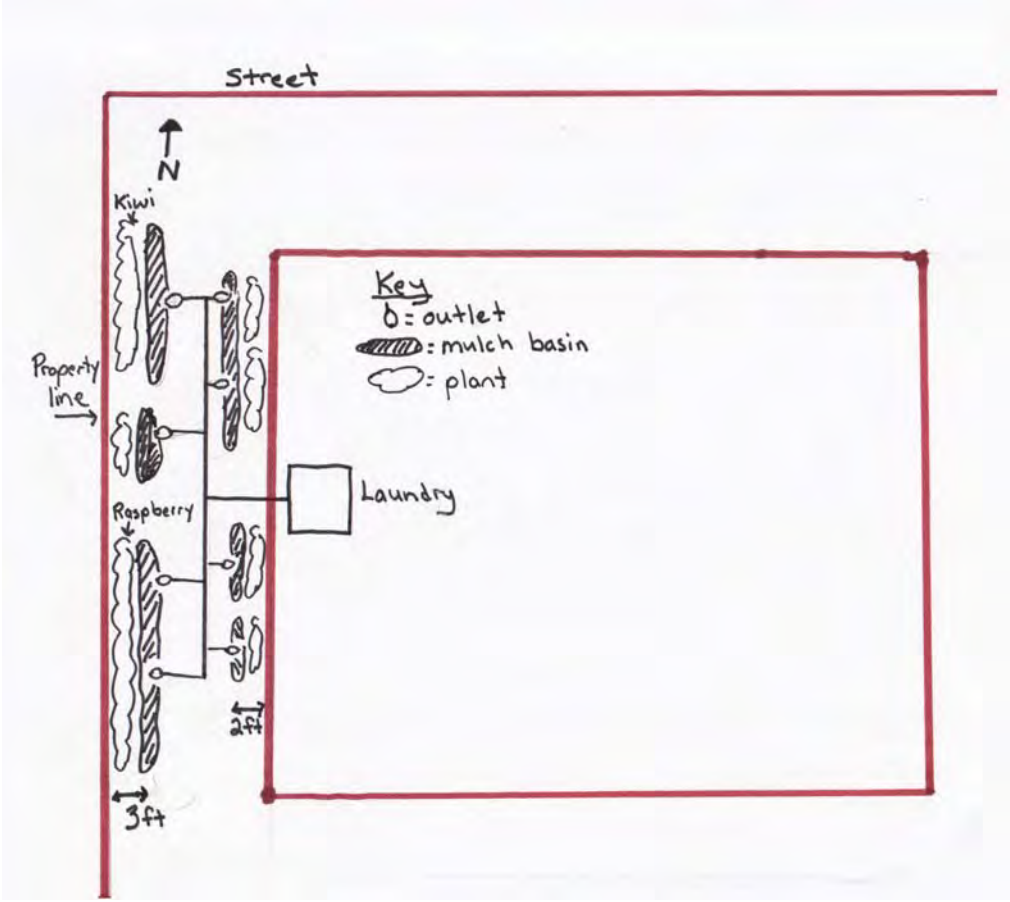
Creating a Simple Plot Plan

It is recommended that you sketch the layout of your laundry to landscape graywater system and attach it to your O&M manual. Guidelines for the sketch are listed below, and grid paper is provided on the next page. Attach photos of irrigation tubing taken after installation but before the tubing is covered with soil. Together, the sketch and photos will provide a good record of your system for future reference.

Guidelines for your sketch:

- Put in landmarks for reference, for example, the side of your home, sidewalk, fences, and street.
- Indicate where the pipe exits your home.
- Show the pipe, tubing, and mulch shields.
- Add setbacks between the system and your home, property lines, and other structures.
- Add a rough scale, for example, 1 inch = 10 feet.
- Add a north (or other direction) arrow.

This sketch is for your own use, so it can be as simple or detailed as you like. An example is shown at right.



Sketch: Laura Allen.

Graywater System Plot Plan

Address: _____ Date: _____

Sample Operation and Maintenance Manual for Branched-Drain Graywater System

Congratulations on your new graywater system! This manual will help you maintain a well-functioning, water-saving graywater irrigation system.

This manual is to remain with the building throughout the life of the system. Upon change of ownership or occupancy, the new owner or tenant must be notified that the structure contains a graywater system. A map showing the location of all graywater system components is attached to this O&M manual.

Insert the information you used to design your system here:

Estimated graywater flow (permitted systems calculation) _____

Soil type _____

Minimum size of irrigation or infiltration area required _____

Actual size of irrigation or infiltration area _____

Estimated graywater flow (irrigation supply calculations) _____

1. How do I turn my graywater system off?

To turn your graywater system off, turn the handle of the 3-way valve to direct the water towards the sewer or septic system. The first few times you do this, check to make sure the system is turning off and that your 3-way valve is labeled correctly.

These are common times you'll need to turn off your system.

- During the rainy season. Graywater may be used if there are extended dry periods during the typical rainy season, but the system must be turned off as soon as the rain resumes.
- When washing dirty diapers.

- When washing anything with chemicals, such as oily rags.
- Anytime you notice that the water isn't draining well and you see pooling or runoff.
- If you think your plants are receiving too much water.
- Anytime you use products that are harmful to plants (like bleach or harsh cleaners).

2. What products can I use in my graywater system?

It is important to use plant-friendly products when reusing your graywater. All products should be biodegradable and non-toxic. In addition, they should be free of salt (sodium) and boron (borax), two common ingredients that are non-toxic to people but are harmful to plants and/or the soil.

Chlorine bleach is harmful to plants and should be diverted, along with any other harmful products, to the sewer or septic (by switching the 3-way valve). Hydrogen peroxide bleaches are less harmful and can be used instead of chlorine.

Another consideration with cleaning and personal care products, such as shampoos and conditioners, is their effect on the pH of the water. While many soaps do not change the water's pH, some do. In general, liquid soaps do not affect the pH, while bar soaps make the water alkaline (opposite of acidic). Certain acid-loving plants might not be happy with alkaline water. If you're uncertain if the pH is being affected, use the graywater to irrigate plants that are not acid-loving. Acid-loving plants include ferns, azaleas, camellias, rhododendrons, and blueberries.

For information about products that independent groups have found to be free of ingredients that may harm plants, see websites such as *http://greywateraction.org/content/greywater-friendly-products* and *http://www.harvestingrainwater.com/greywater-harvesting/greywater-compatible-soaps-and-detergents/*. You can also find out what's in your products at *http://cosmeticdatabase.org*. In a shower, shampoo is fairly diluted so it is not as important as detergents in the washing machine.

3. How do I maintain my graywater system?

The main thing you'll need to do to maintain your graywater system is periodically check on the mulch basins (the mulch layer the graywater flows into) and make sure the graywater is draining properly. If you notice any pooling or runoff, dig out the mulch basin and put in new mulch (wood chips or bark). Mulch usually needs to be replaced every one or two years.

At the beginning of the irrigation season, check to ensure that graywater is flowing out of the outlets evenly. If you notice uneven distribution of graywater, check the outlets for clogs, and manually remove any debris you find. If you notice that many of the outlets are clogged, you need to flush the system. There could be some settling of the system over time, which could result in uneven distribution out of the outlets. You can readjust the slope of the double-ell (twin 90) flow splitters to even out the flow.

To "flush" the system, insert a garden hose into a clean-out and force water through the system. If there is a blockage, you can insert a "snake" to push out a clog.

4. What is required to keep my system legal and in compliance with the graywater code?

Under the 2010 California Plumbing Code (California Code of Regulations, Title 24, Part 5, Chapter 16A), the requirements below must be followed:

- The graywater system shall not be connected to any potable water system without an air gap or other physical device which prevents backflow and shall not cause the ponding or runoff of graywater.
- No graywater system or part thereof shall be located on any lot other than the lot that is the site of the building or structure that discharges the graywater, nor shall any graywater system or part thereof be located at any point having less than the minimum distances indicated in Table 16A-1.
- Water used to wash diapers or similarly soiled or infectious garments or other prohibited contents shall be diverted by the user to the building sewer.

- Graywater shall not be used in spray irrigation, allowed to pond or runoff and shall not be discharged directly into or reach any storm sewer system or any surface body of water.
- Human contact with graywater or the soil irrigated by graywater shall be minimized and avoided, except as required to maintain the graywater system. The discharge point of any graywater irrigation or disposal field shall be covered by at least (2) inches of mulch, rock, or soil, or a solid shield to minimize the possibility of human contact.
- Graywater shall not be used to irrigate root crops or edible parts of food crops that touch the soil.

Creating a Plot Plan

Permitted System

If your system requires a permit because you altered the existing plumbing to access sink or shower water, you will be required to submit a plan of your graywater system to DBI. Contact DBI for plot plan requirements. For an example of the level of detail that might be required, refer to the example plans in Appendix E of the Graywater Design Manual. Keep this plot plan with your O&M manual. Attach photos of irrigation tubing taken after installation but before the tubing is covered with soil. Together, the plan and photos will provide a good record of your system for future reference.

Unpermitted System

If you have a second-standpipe system for laundry graywater and have not altered the existing plumbing, it is recommended (but not required) that you sketch the layout of your graywater system and attach it to your O&M manual. Guidelines for the sketch are listed below, and grid paper is provided on the next page. Attach photos of irrigation tubing taken after installation but before the tubing is covered with soil. Together, the sketch and photos will provide a good record of your system for future reference.

Guidelines for your sketch:

Put in landmarks for reference, for example, the side of your home, sidewalk, fences, and street.

- Indicate where the pipe exits your home.
- Show the pipe, tubing, and mulch shields.
- Add setbacks between the system and your home, property lines, and other structures.
- Add a rough scale, for example, 1 inch = 10 feet.
- Add a north (or other direction) arrow.

Graywater System Plot Plan

Address: _____ Date: _____

Sample Operation and Maintenance Manual for Pumped Graywater System

Congratulations on your new graywater system! This manual will help you maintain a well-functioning, water-saving graywater system.

This manual is to remain with the building throughout the life of the system. Upon change of ownership or occupancy, the new owner or tenant must be notified that the structure contains a graywater system. A map showing the location of all graywater system components is attached to this O&M manual.

1. How do I turn my graywater system off?

To turn your graywater system off, turn the handle of the 3-way valve to direct the water towards the sewer or septic system. The first few times you do this, check to make sure the system is turning off when you want and that your 3-way valve is labeled correctly.

These are common times you'll need to turn off your system:

- During the rainy season. Graywater may be used if there are extended dry periods during the typical rainy season, but the system must be turned off as soon as the rain resumes.
- When washing dirty diapers.
- When washing anything with chemicals, such as oily rags.
- Anytime you notice that the water isn't draining well and you see pooling or runoff.
- If you think your plants are receiving too much water.
- Anytime you use products that are harmful to plants (like bleach or harsh cleaners).

2. What products can I use in my graywater system?

It is important to use plant-friendly products when reusing your graywater. All products should be biodegradable and non-toxic. In addition, they should be free of salt (sodium) and boron (borax), two common ingredients that are non-toxic to people but are harmful to plants and/or the soil.

Chlorine bleach is harmful to plants and should be diverted, along with any other harmful products, to the sewer or septic system (by switching the 3-way valve). Hydrogen peroxide bleaches are less harmful and can be used instead of chlorine.

Another consideration with cleaning and personal care products, such as shampoos and conditioners, is their effect on the pH of the water. While many soaps do not change the water's pH, some do. In general, liquid soaps do not affect the pH, while bar soaps make the water alkaline (opposite of acidic). Certain acid-loving plants might not be happy with alkaline water. If you're uncertain if the pH is being affected, use the graywater to irrigate plants that are not acid-loving. Acid-loving plants include ferns, azaleas, camellias, rhododendrons, and blueberries.

For information about products that independent groups have found to be free of ingredients that may harm plants, see websites such as *http://greywateraction.org/content/greywater-friendly-products* and *http://www.harvestingrainwater.com/greywater-harvesting/greywater-compatible-soaps-and-detergents/*. You can also find out what's in your products at *http://cosmeticdatabase.org*. In a shower, shampoo is fairly diluted so it is not as important as detergents in the washing machine.

3. How do I maintain my system?

You will be required to submit a plan of your graywater system with your permit application. Contact DBI for requirements. For an example of the level of detail that might be required, refer to the example plans in Appendix E of the Graywater Design Manual. Attach photos of irrigation tubing taken after installation but before the tubing is covered with soil. Together, the plan and photos will provide a good record of your system for future reference.

4. What is required to keep my system legal and in compliance with the graywater code?

Under the 2010 California Plumbing Code (California Code of Regulations, Title 24, Part 5, Chapter 16A), the requirements below must be followed:

- The graywater system shall not be connected to any potable water system without an air gap or other physical device which prevents backflow and shall not cause the ponding or runoff of graywater.
- No graywater system or part thereof shall be located on any lot other than the lot that is the site of the building or structure that discharges the graywater, nor shall any graywater system or part thereof be located at any point having less than the minimum distances indicated in Table 16A-1.
- Water used to wash diapers or similarly soiled or infectious garments or other prohibited contents shall be diverted by the user to the building sewer.
- Graywater shall not be used in spray irrigation, allowed to pond or runoff and shall not be discharged directly into or reach any storm sewer system or any surface body of water.
- Human contact with graywater or the soil irrigated by graywater shall be minimized and avoided, except as required to maintain the graywater system. The discharge point of any graywater irrigation or disposal field shall be covered by at least (2) inches of mulch, rock, or soil, or a solid shield to minimize the possibility of human contact.
- Graywater shall not be used to irrigate root crops or edible parts of food crops that touch the soil.

Creating a Plot Plan

You will be required to submit a plot plan of your graywater system with your permit application. For an example of the level of detail that might be required for simpler systems, refer to the example plans in Appendix E of the Graywater Design Manual. However, depending on system complexity, you may be required to provide additional details to DBI. Contact DBI for requirements. You may need to consult with a professional to assist you with your plans. Keep this plot plan with your O&M manual. Attach photos of irrigation tubing taken after installation but before the tubing is covered with soil. Together, the plan and photos will provide a good record of your system for future reference.

Graywater System Plot Plan

Address: _____ Date: _____

Appendix C: Products

Product Ingredients to Avoid

***Salt and sodium compounds*:** Salts can build up in the soil and prevent plants from taking up water. Over time, salt build-up can kill plants.

***Boron or borax*:** Boron is a plant micronutrient, but once plants have their boron needs met, it quickly becomes a microtoxin that damages plants. Since boron is non-toxic to people, it is a common element in ecological detergents. To avoid boron poisoning of your plants, do not use any soap or detergent that contains boron or borax.

***Chlorine bleach*:** Chlorine bleach kills soil microorganisms and can damage your plants. Do not use it in a graywater system! Hydrogen peroxide bleach can be used as an alternative.

Recommended Soaps and Products

Look for products that are free of the ingredients above. For information about products that independent groups have found to be free of ingredients that may harm plants, see websites such as *http://greywateraction.org/content/greywater-friendly-products* and http://*www.harvesingrainwater.com/greywater-harvesting/greywater-compatible-soaps-and-detergents/*. You can also read the back of detergent bottles. If a company doesn't list all its ingredients, you'll have no way of knowing if the product is safe for your plants or not. There are also soap alternatives for laundry machines, such as soap nuts, magnets, and balls that deionize the water.

Cleaners: Many cleaners have high levels of salts, contain harmful chemicals, and can be very basic (alkaline). In general, cleaning products made from vinegar are better for plants. Use cleaners sparingly.

Personal care products: If you are interested in learning more about the ingredients in your shampoos, conditioners, and deodorants, visit *http://cosmeticdatabase.org*, an on-line information site that allows you to investigate what is in your products.

Appendix D: What to Irrigate with Graywater and How Much Water to Use

Irrigation

The key to proper irrigation with low-tech graywater systems is to get an accurate estimate of how much graywater is produced and then match the available amount of graywater with the proper plants. Typically, plants with larger root zones, like trees and shrubs, can withstand times without irrigation, although they do better with regular watering.

"Hydrozoning" is keeping plants with similar water needs on the same irrigation cycle. This practice is important for conserving water in a landscape. In a landscape irrigated with graywater, it is important to put your water-loving plants in locations accessible to graywater while putting drought-tolerant plants in other areas. This way you can avoid the need for irrigation with potable water. Low-tech graywater systems typically supply only one hydrozone at a time, whereas more complex systems can supply multiple hydrozones.

The information below will help you estimate how much of your landscape can be irrigated using a graywater system.

A typical medium-sized fruit tree in San Francisco needs approximately 10 to 20 gallons of water per week during the dry season. Using this rough estimate, graywater from one load of laundry from a front-loading machine (approximately 20 gallons) could irrigate one to two trees per week; graywater from a top loader (approximately 40 gallons) could irrigate three to four trees per week.

Another easy rule of thumb for estimating plant water needs is to find the square footage of the plant's canopy and divide it by 4. This approximates the gallons per week the plant needs. For example, an apple tree with a canopy area of 80 square feet might need 80/4, or about 20 gallons per week. Note that drought-tolerant plants require much less water than estimated by this method!

This graywater system is used to irrigate plants with similar water needs. The fruit trees and larger perennials are irrigated from the laundry machine in one "hydrozone." Photo: Leigh Jerrard.

***Table D-1**. Water Needs of Some Common Plants*

Low (Species Factor 0.2)	Moderate (Species Factor 0.5)	High (Species Factor 0.8)
California poppy	Tulip tree	Birch
Pineapple guava	Apple tree	Willow
European grape	Fig tree	Coast redwood
Bougainvillea	(Most other fruit trees)	Kiwi
Lemon verbena	Shasta daisy	White Alder

Source: Water Use Classification of Landscape Species, California Department of Water Resources.

Source: California Irrigation Management Information System (CIMIS)

REFERENCE EVAPOTRANSPIRATION

Legend

1 COASTAL PLAINS HEAVY FOG BELT
Lowest ETo in California, characterized by dense fog

2 COASTAL MIXED FOG AREA
Less fog and higher ETo than zone 1

Monthly Average Reference Evapotranspiration by ETo Zone (inches/month)

Zone	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1	0.93	1.40	2.48	3.30	4.03	4.50	4.65	4.03	3.30	2.48	1.20	0.62	33.0
2	1.24	1.68	3.10	3.90	4.65	5.10	4.96	4.65	3.90	2.79	1.80	1.24	39.0

Figure D-1. *Reference evapotranspiration zones in San Francisco.*

You can also use an equation to estimate how much water your specific plants need. However, note that there are many variables that affect plant water needs, so any technique you use will be an approximation. The most important thing is to observe your plants and note how they are doing.

The equation for plant water requirements on the following page provides a method for calculating how many gallons per week a specific plant or planted area requires. To use this equation, you need the following information:

- **The area of the plants:** Estimate the planted area using the area of a circle for trees (the distance from the trunk to the drip line is the radius of the circle) or the area of a rectangle for rectangular-shaped planted areas.
- **The species factor of the plant(s):** Available at *http://www.water.ca.gov/wateruseefficiency/docs/wucols00.pdf* or in the *Sunset Western Garden Book*. The species factor is a number used to differentiate between the water needs of plants (high, moderate, and low). Table D-1 lists the species factors of some common plants in San Francisco.
- **The evapotranspiration, or ET, rate:** Available at *http://wwwcimis.water.ca.gov/cimis/infoEtoOverview.jsp#*. Evapotranspiration is a combination of water transpired from plants and evaporated from soil and plant surfaces.

Example: Estimating How Much Water Your Plants Need

A western San Francisco household has a yard with eight small fruit trees and native plants. The homeowners currently irrigate the trees using tap water, but they would like to use graywater from their washing machine instead. The homeowners estimate that they produce 60 gallons of graywater from their washing machine per week. The drip lines of the trees are 3 feet from their trunks.

The homeowners start by making a rough estimate of how much water the trees need. Since a medium-sized fruit tree requires between 10 and 20 gallons per week, they assume that their small fruit trees will need less than 10 gallons per week, or less than a total of 80 gallons for all eight trees.

For a more accurate estimate, they use the plant water requirements formula on page D-3. Three variables are needed for this calculation: area of the trees, species factor, and evapotranspiration (ET) rate.

Area of each tree: πr^2 = 3 x 3 feet x 3 feet = 27 square feet (note that π = 3.14, but 3 is close enough for this estimate)

Species factor: 0.5 (from *http://www.water.ca.gov/wateruseefficiency/docs/wucols00.pdf* or the *Sunset Western Garden Book*)

July weekly ET = 1.16 and April weekly ET = 0.82. For weekly ET divide monthly ET by four (July ET 4.65/4 = 1.16)

Using the plant water requirements formula:

Weekly plant water needs in July (in gallons) = 0.62 x 1.16 (July ET weekly) x 0.5 (species factor) x 27 square feet (area of each tree) = 9.7 gallons per week in July

Using the April ET weekly rate of 0.82, the homeowners calculate that each tree requires 6.9 gallons per week in April.

The homeowners estimate that if they split the 60 gallons equally between eight trees, each will get approximately 7 gallons a week. This is less than the peak irrigation need in July but enough for most of the year. They decide to install a laundry-to-landscape system, with graywater distributed equally to all eight trees. They plan to observe the trees in the summer. If the trees exhibit signs of water stress, they will supplement the graywater irrigation with tap water.

Evapotranspiration is given in inches per month or inches per day. You can convert this to inches per week. Figure D-1 includes a map of ET zones in San Francisco and ET rates for each month of the year.

Plant water requirements (in gallons per week) = 0.62 (conversion factor for the ET rate, converting inches to gallons) x planted area (square feet) x species factor (high, moderate, or low) x evapotranspiration (ET) rate (inches per week).

For simplicity, it is assumed that all the water goes to the roots of the plants, i.e., that the irrigation is 100 percent efficient.

Note that although July has the highest ET and thus the highest irrigation needs of the year, you don't need to irrigate at the July rate all year long. You could decide to irrigate your plants with graywater at less than their July requirement for most of the year, knowing that your plants might need additional water in July. Alternatively, if you have more graywater than your plants need, you could irrigate your plants according to their peak need all year round, even though they don't need that much water most of the year. If your drainage is good, slight over-watering with graywater will not harm your plants, although it is unnecessary.

To learn more about plant water requirements and evapotranspiration rates, visit the California Irrigation Management Information Systems (CIMIS) at *http://wwwcimis.water.ca.gov/*.

Graywater irrigates this row of fruit trees. Thick mulch from a local tree company has been placed over the pathway, as well as inside the mulch basins. Photo: Leigh Jerrard.

Edibles

You can safely irrigate edible crops with graywater, as long as the graywater does not touch the edible part of the plant. For example, the California graywater code prohibits watering root crops like carrots with graywater. It is possible that the graywater could contact the carrots, and someone who ate a carrot without washing it first could ingest graywater. It is generally easier to irrigate perennial plants and trees with graywater; good edibles to water can be fruit trees, fruiting vines, berries, and large perennials.

Any system that uses drip irrigation tubing can water all types of vegetables with the edible portion above the ground. Vegetable beds with larger annuals and food above the ground, like corn, beans, tomatoes, etc. can be watered with laundry and pumped systems, since it is easier to spread out the water to reach these types of plants with these pumped systems. In contrast, it is not as easy to irrigate vegetables with gravity-fed, branched-drain systems.

Easy Plants to Water

- Fruit trees adapted to your local microclimate
- Berries
- Riparian plants that like irrigation (willow, maple, birch, water-loving plants)
- Any plant that likes to be irrigated.

What Not to Water

- Root crops. Reason: Health risk. Someone ingesting a root crop without washing it could ingest graywater. The graywater code prohibits irrigation of root crops.
- Drought-established plants. Reason: Risk to plant. Plants that have never been watered before, like an oak tree, or an old citrus that was never irrigated, are used to extended dry periods and could be damaged by sudden frequent irrigation.
- Possibly acid-loving plants (depending on the pH of graywater). Reason: Risk to plant. Graywater tends to be basic (alkaline), and acid-loving plants might not do well with basic irrigation water. You can use pH-neutral liquid laundry detergents and put acidic bark in mulch basins to create acidic soil conditions. Common

acid-loving plants include ferns, azaleas, rhododendrons, camellias, and blueberries. You can look up the pH needs of your plants in a plant or gardening book. If the book doesn't mention pH or acidic conditions, it is generally safe to assume the plant doesn't need acidic conditions, as garden plants commonly prefer neutral or slightly alkaline conditions.

- Very sensitive plants. Reason: Risk to plant. Plants that are generally hard to grow, like some ferns and avocados, might not be a good choice for graywater irrigation.

Soil Health

To have healthy plants, you need healthy soils! Soils are alive with billions of beneficial organisms. These are some easy steps you can take to promote healthy soils in your yard:

- A few times a year, irrigate with rainwater or freshwater. A rainy day counts!
- Add compost to your soil.
- Use mulch.
- Don't use chemical pesticides or fertilizers.
- Only use plant-friendly products; salts and chlorine bleach can harm soil and soil microbes.

References

California Irrigation Management Information Systems (CIMIS) at: http://wwwcimis.water.ca.gov/f

Sunset Western Garden Book 8th Edition, 2007

California Department of Water Resources Water Use Classification of Landscape Species at: http://www.water.ca.gov/wateruseefficiency/docs/wucols00.pdf

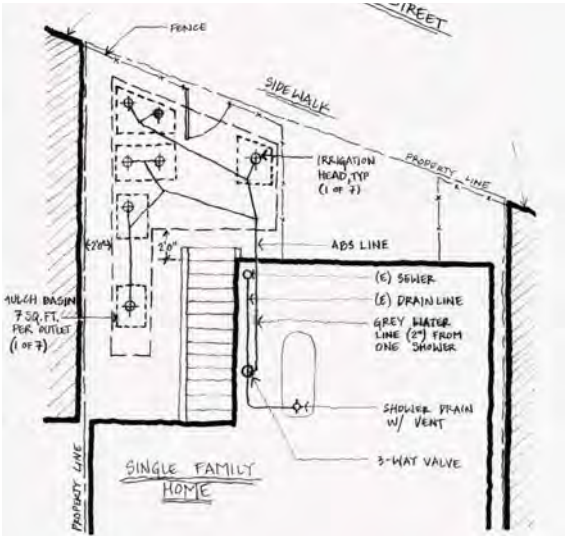
SFPUC Low Water Use and Climate Appropriate Plant List at: sfwater.org/landscape

DATE OF REPORT: 08/13/10

SOIL PHYSICAL CHARACTERISTICS

Sample ID	Lab Number	% Sand	% Silt	% Clay	Soil Texture
FRYRD	55218	66	20	13	SANDY LOAM

Sample laboratory results from a soil texture analysis.



Sample plot plan showing the street, building, setbacks, location of irrigation area, and size of mulch basins.

Appendix E: Worked Example with Sample Plot Plans and Permits

The following is a simplified example of the design and permitting steps followed by two San Francisco homeowners when they installed a branched-drain graywater system. Samples of the documentation submitted with their permit application are included. Elements of this worked example have been fictionalized for simplicity and clarity.

Note that if you are installing your own system, you will need to consult the applicable sections of this manual for an overview of installing your system, as well as consult additional resources for further guidance on branched-drain system installation details.

Step 1: Estimated the gallons of graywater generated by the shower fixture in a one-bedroom home using the permitted systems estimation method on page 9 of this manual.

- One-bedroom home = 2 occupants
- System uses graywater from a shower only: 25 gpd x 2 people = 50 gpd

Step 2: Identified the soil type.

Soil ribbon test indicated soil to be sandy loam. Soil was also sent to a laboratory for soil texture analysis, which confirmed the soil to be sandy loam.

Step 3: Calculated minimum irrigation, or infiltration, area based on soil type and gallons of graywater generated per day. This process is described on page 13 of this manual.

- As shown in Table 2 of this manual, "sandy loam soil" needs 0.4 square feet of infiltration area per gallon per day.
- 0.4 square feet per gallon per day x 50 gpd = 20 square feet

Step 4: Drew a plot plan (previous page) and plumbing detail (at right).

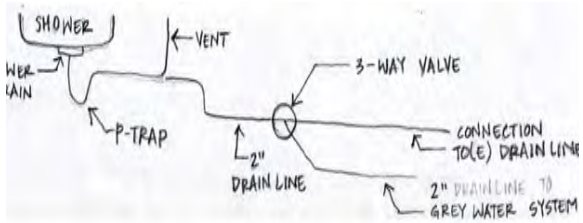
- In the plot plan, the flow was divided into seven outlets, with basins of 7 square feet each, totaling 49 square feet of infiltration area. This number is significantly higher than the minimum 20 square feet calculated using Table 2 of this manual, as the homeowners designed their system to spread the graywater out to many plants across their yard.
- The plumbing diagram on the right shows the 3-way valve located after the p-trap and vent, as well as the size of pipe used. The graywater pipe is 2-inch ABS (plastic), since it is for irrigation, while the rest of the plumbing is of cast iron.
- House had up-to-code plumbing, so it did not need to be upgraded.

Step 5: Applied for a permit.

Step 6: Constructed the system.

- Installed the system. This system started with the pipe shallowly buried (approximately 2 inches) and got deeper as the system progressed.
- Tested system.
- Buried straight runs of pipe. Runs with bends were left exposed for inspection.
- Labeled above-ground pipe.
- Labeled 3-way valve.
- Attached O&M manual under the 3-way valve.

Step 7: Called DBI to schedule an inspection.



Sample plumbing detail showing the 3-way valve connection after the p-trap and vent; pipe size shown as 2-inch, which is required for a shower drain.

PLUMBING PERMIT
CITY AND COUNTY OF SAN FRANCISCO
DEPARTMENT OF BUILDING INSPECTION

PERMIT # PP20100803886

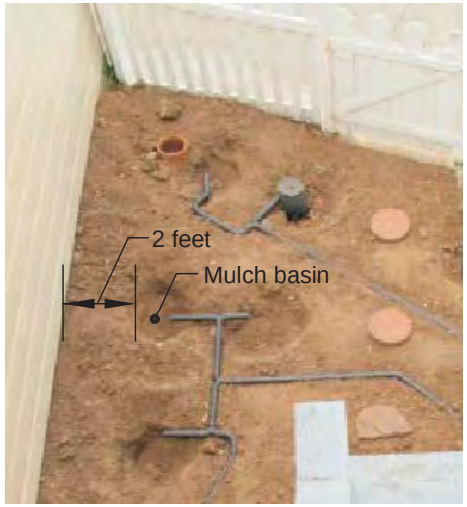
DESCRIPTION OF WORK COVERED BY THIS PERMIT:
Grey water system from bathroom showertub to yard.

* NOT VALID FOR PERMIT IF ANY EMPLOYEE DESCENDS INTO EXCAVATION DEEPER THAN 6'
Effective 8/7/2009 - Permit shall expire 1 year from date of issuance.

DO NOT WRITE BELOW THIS LINE - FOR OFFICIAL USE ONLY

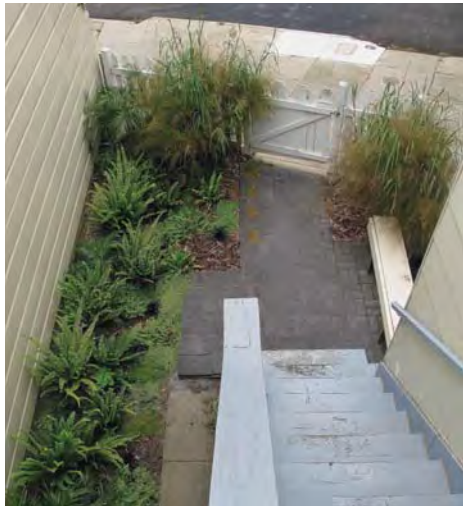
Date	Initials	Remarks
9/1/10	DZ	Grey water system Rgd

Sample graywater permit.

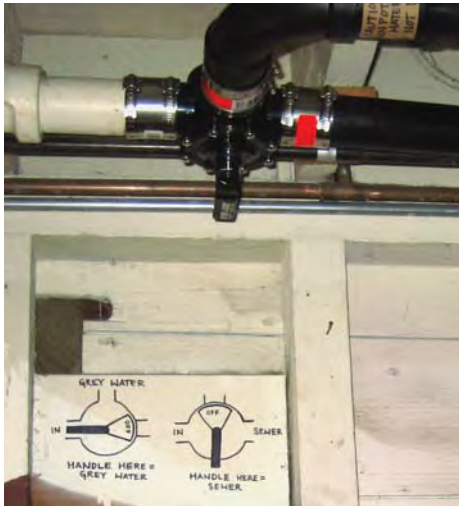


Sample image of a graywater system pre-burial. Photo: Josh Lowe.

Sample image of a completed graywater system after installation and planting. Photo: Josh Lowe.



Sample image of a completed graywater system after one year of operation and plant growth. Photo: Josh Lowe.



Sample image of a 3-way valve clearly labeled. Photo: Josh Lowe.

Step 8: Operated the system.

Notes from the homeowers one year after installing the graywater system: *"The graywater system is going great. We have not watered the yard with anything but the graywater since the weekend after we planted the plants. They are doing great and the ground cover is really taking off too."*

Appendix F: Information and Resources

San Francisco Information

San Francisco Public Utilities Commission: *http://sfwater.org/landscape*
Water Conservation and Urban Watershed Management Program
525 Golden Gate Avenue, San Francisco, CA 94102
Email: landscape@sfwater.org

San Francisco Department of Building Inspection: *http://www.sfdbi.org*
1660 Mission Street, San Francisco, CA 94103
Tel: (415) 558-6088
Fax: (415) 558-6401

San Francisco Department of Public Health: *http://www.sfdph.org/*
101 Grove Street, San Francisco, CA 94102-4505
Tel: (415) 554-2625

California Residential Graywater Code:
http://www.hcd.ca.gov/codes/shl/2007CPC_Graywater_Complete_2-2-10.pdf

Additional Resources

Note that the following lists are not comprehensive and contain only a few of the resources available to homeowners designing and installing graywater systems. The inclusion of these organizations and resources is intended to assist homeowners and designers in their process and does not imply any endorsement by the SFPUC.

Websites

Oasis Design Graywater Information Site: *http://www.oasisdesign.net/greywater*

Greywater Action: For a Sustainable Water Culture: *http://www.greywateraction.org*

California's Integrated Water Reuse Management Center: *http://www.whollyh2o.org/*

Books

Create an Oasis with Greywater, by Art Ludwig. 19th Revision, Oasis Design. 2009.

Golden Gate Gardening: Year-Round Food Gardening in the San Francisco Bay Area and Coastal California, by Pam Pierce. 1998.

Classes

Greywater Action: *http://www.greywateraction.org/*

The Ecology Center: *http://www.ecologycenter.org/*

The Garden for the Environment: *http://www.gardenfortheenvironment.org/*

Plants

California Irrigation Management Information System: *http://wwwcimis.water.ca.gov*

Laboratories for Soil Analyses

A&L Western Agricultural Laboratories
1311 Woodland Ave #1
Modesto, CA 95351
Telephone: (209) 529-4080
http://www.al-labs-west.com/

Control Laboratories Inc.
42 Hangar Way
Watsonville, CA 95076
Telephone: (831) 724-5422
http://compostlab.com/

Materials

Urban Farmer Store (kits for laundry-to-landscape systems): *http://urbanfarmerstore.com/*

Clean Water Components (kits for graywater systems): *http://cleanwatercomponents.com*

Bayview Greenwaste (for mulch): *http://bayviewgreenwaste.com/*

Local tree trimmers (for wood chips)

SAN FRANCISCO

graywater design manual

FOR OUTDOOR IRRIGATION

San Francisco Water Power Sewer

Services of the San Francisco Public Utilities Commission

Printed on post-consumer recycled paper.

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EMERGING TECHNOLOGIES AND SUSTAINABILITY

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1 BACKGROUND AND OBJECTIVES

The South County Regional Wastewater Authority (SCRWA) treats municipal wastewater to tertiary recycled water standards and plans to consider treatment alternatives to provide effluent for indirect potable reuse (IPR) and direct potable reuse (DPR). SCRWA treats wastewater from Gilroy and Morgan Hill. The treatment processes of SCRWA WWTP consist of influent screening, aerated grit removal, nitrification, denitrification, oxidation ditches, and secondary clarification. To meet recycled water demand, the WWTP diverts secondary effluent to a tertiary treatment process that meets the recycled water criteria of California's Title 22 unrestricted use classification. The tertiary treatment process consists of coagulation, filtration with sand filters, and chlorination. Currently, a UV disinfection system is under construction and upon completion will augment or replace chlorination.

Average yearly tertiary water quality is shown in Table 1. The concentrations of organics and disinfection byproducts (DBPs) are shown in Table 2. SCRWA is required to meet National Pollutant Discharge Elimination System (NPDES) for an emergency discharge to the local Pajaro River and a discharge limit is required for chlorodibromomethane.

Table 1: Average yearly tertiary effluent water quality at SCRWA

	Units	2009	2010	2011	2012	2013	2014
Total flow	MGM	26.65	19.38	16.72	26.04	29.54	30.08
Average daily flow	MGD	0.87	0.64	0.55	0.85	0.97	0.99
pH	-	7.24	7.23	7.23	7.23	7.17	7.20
Biochemical oxygen demand (BOD)	mg/L	2.00	2.25	2.33	2.67	2.58	3
Total suspended solids (TSS)	mg/L	1.00	1.00	1.08	1.50	1.08	1.75
Turbidity	NTU	0.36	0.42	0.40	0.50	0.42	0.35
Coliform	MPN/100 mL	2.00	2.33	2.08	2.00	2.08	<2
Nitrate-N	mg/L	3.18	3.73	3.45	2.92	3.33	2.36
Dissolved oxygen	mg/L	4.08	4.48	3.98	3.93	3.61	3.33

Table 2. Average organics and disinfection byproducts concentration at SCRWA.

	Units	Result
Total organic carbon (TOC)	mg/L	6.17
Bromodichloromethane	µg/L	25.99
Bromoform	µg/L	ND
Chloroform	µg/L	100.05
Dibromochloromethane	µg/L	4.78
Total Trihalomethanes (THMs)	µg/L	130.82

The objectives of this technical memorandum are to 1) summarize the water quality requirements for IPR and DPR projects, 2) provide process flow schematics of existing full-scale IPR and DPR plants to understand what might be required at SCRWA, and 3) address water quality sampling requirements and process modifications that may be required by SCRWA to comply with IPR and DPR water quality criteria.

2 IPR/DPR TECHNOLOGICAL BACKGROUND

2.1 INDIRECT POTABLE REUSE

The major treatment components of IPR are shown in Figure 1. In IPR, wastewater effluent is treated in an advanced water treatment facility. The treated water is stored in an environmental buffer and further treated in a water treatment plant or supplied by wells to a potable water distribution system. Examples of environmental buffers include groundwater aquifers and reservoirs. The Orange County Water District (OCWD) in California uses groundwater aquifers as the environmental buffer while the City of San Diego, California is planning on using the San Vicente reservoir, a surface water impoundment.

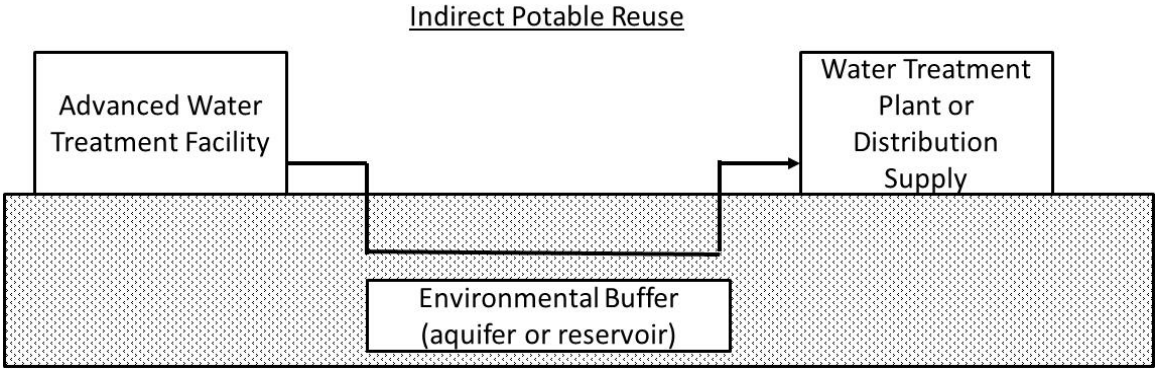


Figure 1. Schematic of major treatment components for indirect potable reuse (adapted from Tchobanoglous, 2014).

2.1.1 WATER QUALITY CRITERIA AND MAJOR TREATMENT PROCESSES FOR IPR

California regulations for IPR groundwater recharge are shown in Table **3**. The DDW Regulations Related to Recycled Water are included in Appendix A. Previously, the California Department of Public Health (CDPH) draft regulations for groundwater recharge required a retention time of six months in the environmental buffer (CDPH, 2008). This timeframe was based on the assumption that one log of virus reduction could be achieved for each month of residence time in the groundwater aquifer which would be adequate to meet public health concerns even when tertiary effluent was recharged.

Table 3. California regulations for groundwater recharge into potable aquifers (NWRI, 2010), (CDPH 2014).

Recycled water quality limits	Other selected requirements
• ≥ 5 log virus inactivation	• Industrial pretreatment and source control program
• ≤ 2.2 total coli/100 mL	• ≥ 80% dilution for spreading
• ≤ 2 nephelometric turbidity units (NTU)	• ≥ 50% dilution for spreading applications (to start) that provide RO and advanced oxidation
• ≤ 0.5 mg/L TOC of wastewater origin	• ≥ 50% dilution for injection (to start)
• Drinking water MCLs	• Minimum 3 separate treatment processes to achieve 12-log virus, 10-log Giardia, and 10-log Cryptosporidium reduction
• Action levels for lead and copper	• Monitor recycled water and monitoring wells for priority toxic pollutants, chemicals with state notification levels specified by DDW, and unregulated constituents specified by DDW
• Nitrogen limits depending on method used	• Operations plan
	• Contingency plan

New DDW regulations related to recycled water distinguish between IPR groundwater replenishment reuse projects (GRRPs) that utilize surface application from those that utilize subsurface injection. For both GRRP applications, the six month environmental buffer has been replaced with a treatment requirement that achieves a pathogen reduction specification of 12-log enteric virus reduction, 10-log Giardia cyst reduction, and 10-log Cryptosporidium oocyst reduction prior to recharge. At least three separate treatment processes must be utilized and each separate treatment process may be credited with no more than 6-log reduction, with at least three processes each being credited with no less than 1.0 log reduction. At a minimum, the recycled water shall fulfill the definition of filtered wastewater pursuant to section 60301.320 and the definition of disinfected tertiary recycled water, pursuant to section 60301.230 (CDPH, 2014). For each demonstrated month of underground retention, a 1-log virus credit reduction will be granted. A GRRP that meets the above stated filtration and disinfection requirements or provides full advanced treatment (FAT) or a demonstrated FAT equivalent of the entire flow used for groundwater replenishment and demonstrates at least six months retention underground will be credited with 10-log Giardia cyst reduction and 10-log Cryptosporidium oocyst reduction. All other log reduction credits must be validated for each of the treatment processes using a challenge test approved by the DDW. Surface spreading operations do not

require on-going monitoring of the pathogenic microorganisms or surrogate parameters to verify the performance of each treatment process's ability to achieve the credited log reduction. A tracer study must be utilized to demonstrate the retention time underground.

All drinking water maximum contaminant limits (MCLs) must be met along with a ≥ 5 log inactivation of virus in the treatment process. Typical treatment processes utilized for IPR applications are microfiltration (MF) or ultrafiltration (UF) followed by reverse osmosis (RO) and advanced oxidation processes (AOP). For AOPs, N-nitrosodimethylamine (NDMA) and 1,4 dioxane removal by at least 1.2 logs and 0.5 logs, respectively are required.

Monitoring requirements are specified for nitrogen compounds, and in order to maintain operations, the average of the results of four consecutive samples must not exceed 10 mg/L. Quarterly monitoring is required for inorganic chemicals (exclusive of nitrogen compounds) (Table 64431-A), radionuclide chemicals (Tables 64442 and 64443), organic chemicals (Table 64444-A), disinfection byproducts (Table 64533-A), and lead and copper (CDPH, 2014). One annual sample must be analyzed for secondary drinking water contaminants (Tables 64449-A and 64449-B) for compliance. Monitoring requirements are also in place for any diluent water used in calculating the recycled wastewater contributions (RWC), and they differ depending upon the quality of the diluent water.

The initial maximum RWC shall not exceed 0.20 or an alternative initial RWC approved by the DDW. An alternative RWC up to 1.0 may be approved by the Department if a demonstration is made that the total organic carbon (TOC) concentrations will not exceed 0.5mg/L divided by the proposed initial RWC. For surface application GRRP, the soil-aquifer treatment (SAT) is assessed through monitoring of TOC, indicator compounds, and surrogate parameters as approved by the Department. Additionally, each quarter the GRRP shall monitor for priority toxic pollutants (chemicals listed in 40 CFR section 131.38) and chemicals specified by the Department based upon review of the GRRP's engineering report, the affected groundwater basin(s), and other Department-specified notification level compounds.

Alternatives to requirements in the CDPH June 2014 Regulations for surface spreading are considered if a suitable demonstration of public health protection can be made to the Department and written approval is granted from the DDW prior to its implementation. A public hearing may in some cases by required by DDW.

Groundwater recharge through sub-surface application mandates the use of full advanced treatment (FAT), which is the treatment of an oxidized wastewater as defined in section 60301.650 (CDPH, 2014). FAT is defined as use of a reverse osmosis membrane and a suitable oxidation process. In lieu of demonstrating that a sufficient oxidation process has been designed for implementation, demonstration that the oxidation process will provide at least 0.5-log reduction of 1,4-dioxane is required. If the AOP demonstration is performed, it must include monitoring of nine indicator compounds, with at least one from each of the following functional groups: hydroxyl aromatic, amino/acylamino aromatic, nonaromatic with carbon double bonds, deprotonated amine, akloxy polyaromatic, alkoxy aromatic, alkyl aromatic, saturated aliphatic, and nitro aromatic. Removal of at least 0.5-log is required for the first seven functional groups

and 0.3-log is required for the final two functional groups as supported by challenge testing. At least one surrogate or operational parameter that reflects removal of at least five of the nine indicator compounds must be selected pursuant to a prescriptive set of conditions. Each RO membrane element used in the project must achieve a minimum rejection of sodium chloride of no less than 99.0 percent and an average (nominal) rejection of sodium chloride of no less than 99.2 percent, as demonstrated through Method A of ASTM International's method D4194-03 (2008) with several substitute test conditions. These include operation at a recovery of no less than 15 percent; sodium chloride rejection based on three or more successive measurements performed in a specified manner; an influent pH no less than 6.5 and no greater than 8.0; and an influent sodium chloride concentration of no greater than 2000 mg/L that is verified prior to start of testing. During the first twenty weeks of full-scale operation, the membrane must produce a permeate with no more than five percent of the sample results having TOC concentrations greater than 0.25 mg/L, as verified through monitoring of at least a weekly frequency. On-going monitoring of performance (e.g. conductivity or TOC) indicating when integrity of the process has been compromised must also be proposed. This shall include at least one form of continuous monitoring with associated surrogate and/or operational parameter limits and alarm settings that indicate when integrity has been compromised.

2.1.2 EXAMPLES OF FULL-SCALE IPR PLANTS

2.1.2.1 ORANGE COUNTY WATER DISTRICT (OCWD)

Capacity: 70 MGD (Original) + 30 MGD (Expansion)

Operational: 2008

Treatment train: MF → RO → AOP

Capital cost (70 MGD): $481 Million

O&M cost (70 MGD): $34 Million per year

Table 4. Regulatory limits for common water quality parameters at OCWD.

Parameter	Units	Regulatory Limit
pH	-	6 - 9
Conductivity	µS/cm	900
TDS	mg/L	500
TOC	mg/L	0.5
Sodium	mg/L	45
Barium	mg/L	1
Fluoride	mg/L	2
Iron	mg/L	0.3
Sulfate	mg/L	100
Chloride	mg/L	55
Nitrate	mg/L as NO_3	3

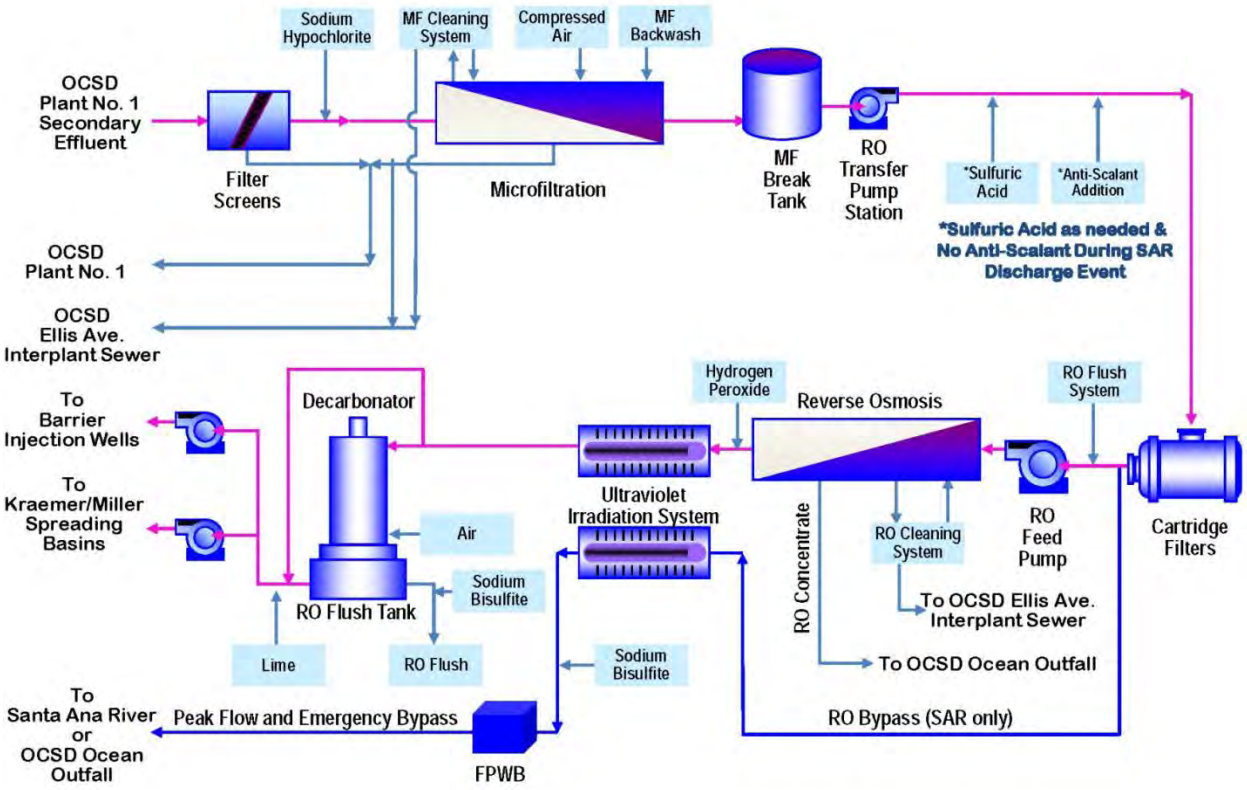


Figure 2. Treatment train schematic for OCWD.

2.1.2.2 WEST BASIN MUNICIPAL WATER DISTRICT – EDWARD C. LITTLE WATER TREATMENT PLANT

Capacity: 30 MGD

Treatment train: MF → RO → AOP

Feed water: TDS = 850 mg/L; pH = 6.6; Alkalinity = 220 mg/L as CaCO3; Nitrate = 0.19 mg/L

Finished water: TDS = 30 mg/L; pH = 5.7; Alkalinity = 18 mg/L as CaCO3; Nitrate = 0.19 mg/L

End use: Groundwater replenishment and industrial water (boiler feed)

Table 5. Regulatory limits for common water quality parameters at West Basin.

Parameter	Units	Regulatory Limit
Conductivity	µS/cm	300
TDS	mg/L	800
Barium	mg/L	1
Fluoride	mg/L	2
Iron	mg/L	0.3
Sulfate	mg/L	250
Chloride	mg/L	250
Boron	mg/L	1.5

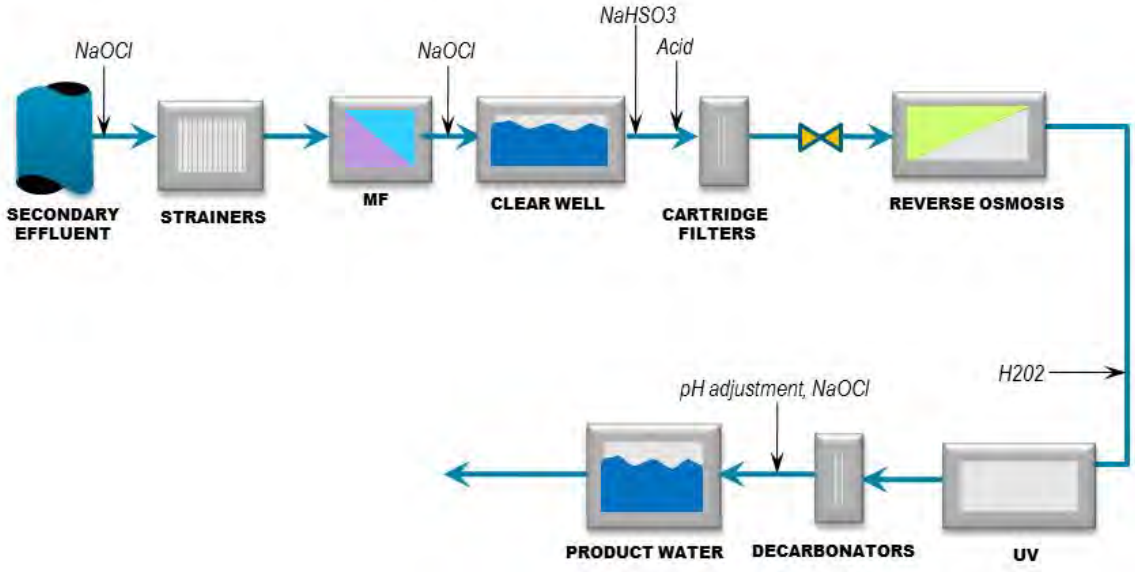


Figure 3. Treatment train schematic for Edward C. Little Recycling Plant.

2.1.2.3BEDOK NEWATER FACILITY, SINGAPORE

Capacity: 22 MGD

Treatment train: MF → RO → UV

Feed water: TDS = 711 mg/L; pH = 6.8; Nitrate = 35 mg/L as N

Finished water: TDS < 150 mg/L; pH = 7.0 – 8.5; Nitrate < 15 mg/L

End use: Surface water (reservoir) replenishment

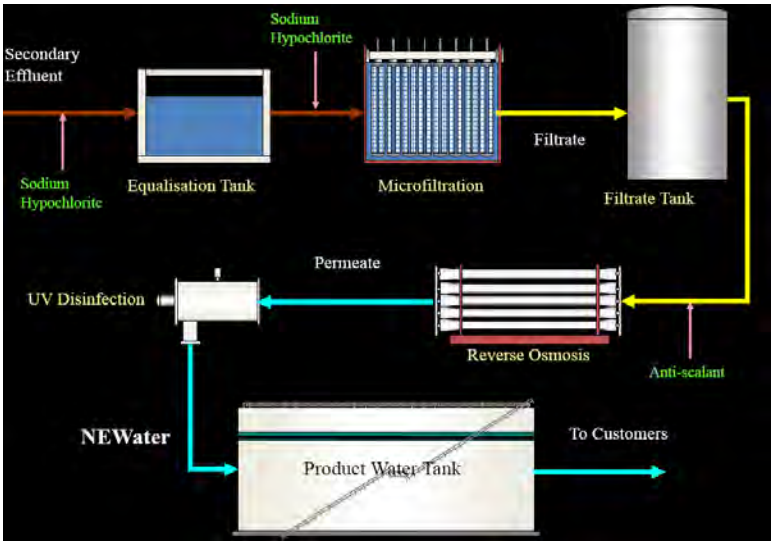


Figure 4. Treatment train schematic for Bedok NEWater treatment plant.

2.1.2.4 CITY OF SAN DIEGO, IPR DEMONSTRATION PROJECT

Capacity: 1 MGD

Treatment train: MF → RO → UV + H_2O_2

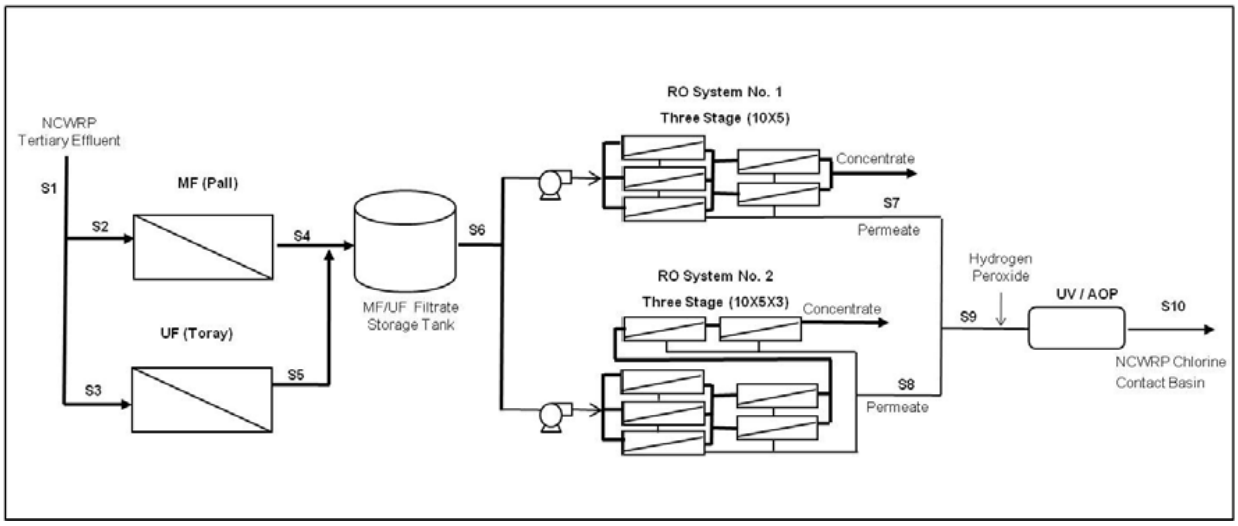


Figure 5. Treatment train schematic for City of San Diego Demonstration Project (DeCarolis, 2011; City of San Diego, 2014).

2.2 DIRECT POTABLE REUSE

A conceptual schematic of direct potable reuse (DPR) is shown in Figure 6. In DPR, primary/secondary effluent is treated in an advanced water treatment facility. The treated water is supplied into a raw water supply or into a drinking water treatment plant or directly into a potable water distribution system. Engineered storage buffers have been proposed in DPR systems to allow for quality assurance and further proof of the advanced water treatment performance reliability, especially for systems that need to compensate for product water variability with additional response time prior to introduction into water distribution systems.

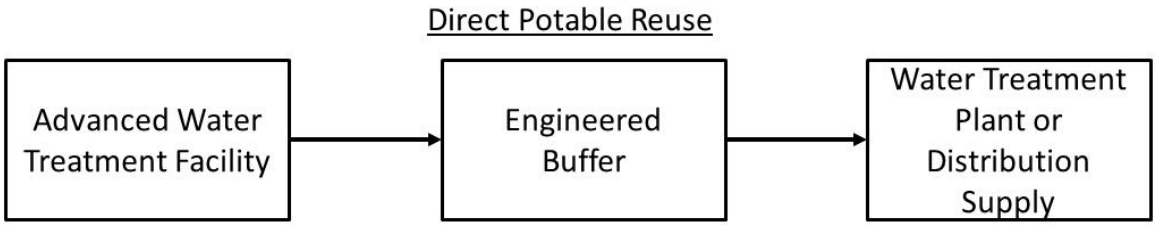


Figure 6. Schematic of major treatment components for direct potable reuse (adapted from Tchobanoglous, 2014).

2.2.1 WATER QUALITY CRITERIA AND MAJOR TREATMENT PROCESSES FOR DPR

The water quality goals for any potable water reuse project should be set based on the criteria that the water produced by the treatment processes is protective of human health, meaning that reuse projects must adequately deal with the two principal health threats of concern: microbial and chemical contaminants. The California State Water Resources Control Board is currently

investigating the feasibility of developing uniform water recycling criteria for direct potable reuse, however, no such regulations currently exist. Table 6 presents potential water quality criteria for DPR regulations. A stringent 12-10-10 microbial criteria is required with 12-log removal of viruses, 10-log removal of Cryptosporidium and 10-log removal of total coliforms. All drinking water maximum contaminant limits (MCLs) must be met along disinfection byproducts (DBPs) and trace organic chemicals removal to microgram per liter (µg/L) or lower levels. There are only two DPR full-scale facilities in the US (Big Springs, TX and Wichita Falls, TX). Both of these facilities have MF followed by RO and advanced oxidation. However, a full-scale plant in Africa (Windhoek, Namibia) does not include RO due to the low TDS of wastewater source. In California, RO may be required regardless of TDS concentration because it adds a barrier against microbial and emerging chemical contaminants.

Table 6. Water Quality Criteria for DPR applications (WRRF, 2011).

Chemicals	Criterion	Unit
Disinfection Byproducts		
THMs	80	µg/L
HAA5	60	µg/L
NDMA	10	ng/L
Bromate	10	µg/L
Chlorate	800	µg/L
Non-Regulated Chemicals[1]		
PFOs	0.4	µg/L
PFOA	0.2	µg/L
Perchlorate	6	µg/L
1,4 –Dioxane	1	µg/L
Chemicals of Potential Health Concern[2]		
Cotinine/Primodone/Dilantin	1/10/2	µg/L
Meprobamate/Atenolol	200/4	µg/L
Carbamazepine	10	µg/L
Estrone	320	ng/L
Steroid Hormones		
Ethynil Estradiol	-	-
17-B-Estradiol	-	-
Other Chemicals		
Sucralose	150	mg/L
TCEP	5	µg/L
DEET	200	µg/L
Triclosan	2,100	µg/L
Aesthetic Criteria		
Color	ACU ≤ 5	-
Odor	TON ≤ 3	-

Mineralization	TDS[3]	-
TOC	≤ 0.5	mg/L
Pathogens		
Enteric Virus	12 Log_{10} removal	-
Cryptosporidium spp.	10 Log_{10} removal	-
Total Coliform	9 Log_{10} removal	-

Key:

THM = Trihalomethane
HAA5 = Haloacetic Acids
NDMA = N-Nitrosodimethylamine
PFO = Perfluorooctanoate
PFOA = Perfluorooctanoic acid
TCEP = Tris(2-carboxyethyl)phosphine
DEET = Diethyltoluamide
ACU = Apparent Color Units
TOC = Total Organic Carbon
TON = Threshold Odor Number

Notes:

1- Of interest for public concern
2- Useful for the evaluation of the effectiveness of organic chemical removals by the treatment train
3- Similar to local supply

2.2.2 DPR TREATMENT SCHEMES

Different treatment schemes for DPR applications are shown in Figure 7. In treatment scheme (A), TDS removal is achieved using RO. However in treatment scheme (B) and (C), RO is not utilized in the treatment scheme. These two treatment schemes are more applicable for wastewater effluent with low TDS levels with minimal treatment required to meet drinking water TDS criteria of < 500 mg/L.

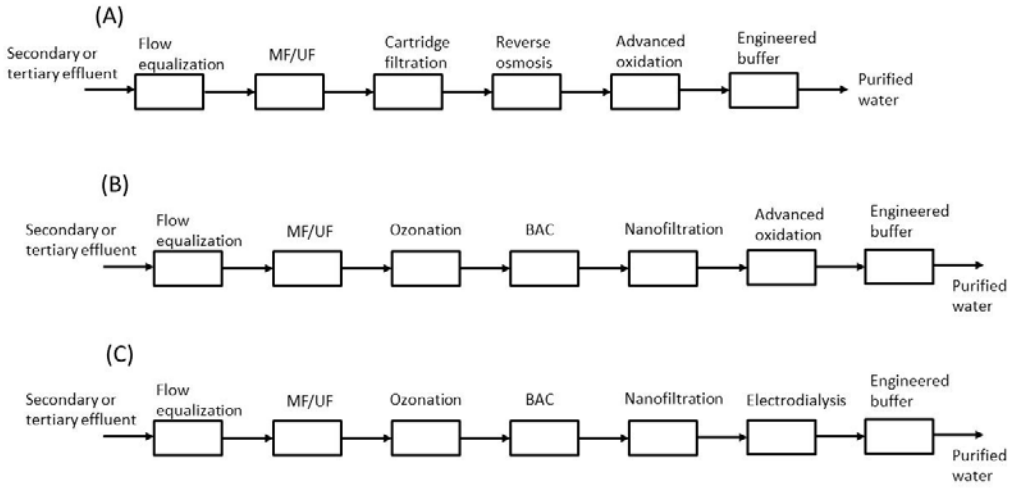


Figure 7. DPR treatment schemes with/without reverse osmosis (Tchobanoglous, 2012).

2.2.3 EXAMPLES OF FULL-SCALE DPR PLANTS

2.2.3.1 BIG SPRINGS, TEXAS

Capacity: 2 MGD

Water Recycle Plant: MF → RO → UV

Water Treatment Plant: Rapid mix, flocculation → sedimentation → filtration → disinfection

Cost: $9.5 Million ($2.59/1,000 gal)

10% – 39% blend with lake water

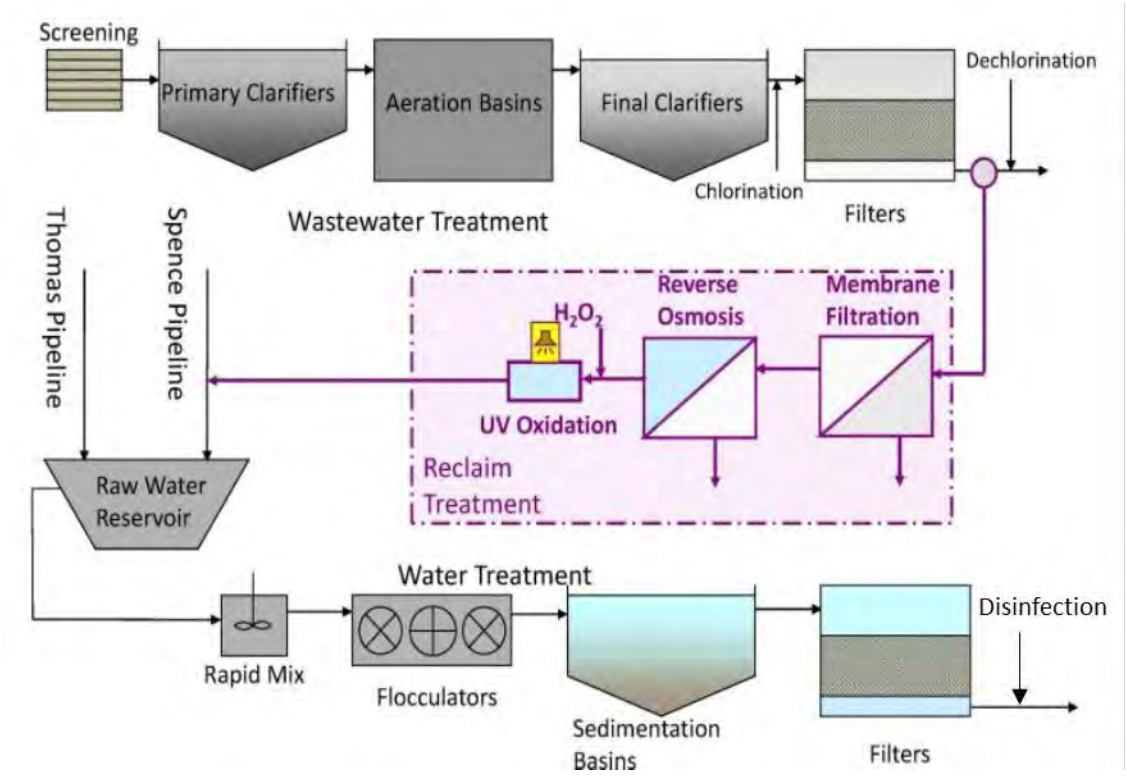


Figure 8. Schematic of DPR plant in Big Springs, Texas.

2.2.3.2 WICHITA FALLS, TEXAS

Capacity: 5 MGD

Water Recycle Plant: MF → RO

Water Treatment Plant: Pre-disinfection → coagulation → softening → flocculation → sedimentation → re-stabilization → filtration → fluoridation

Cost: $13 Million

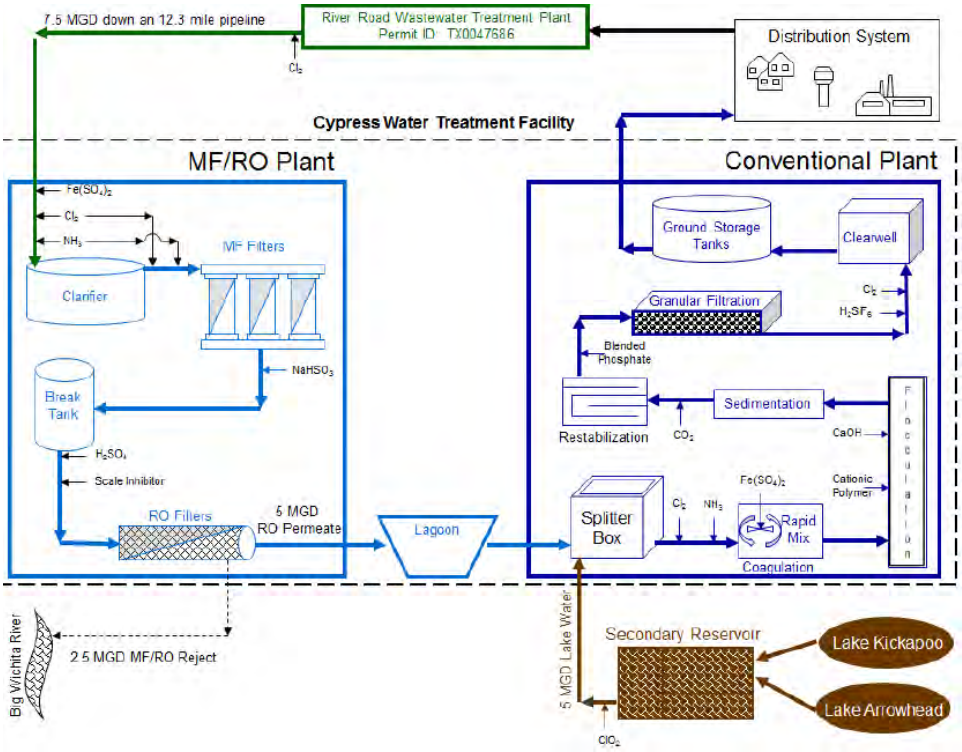
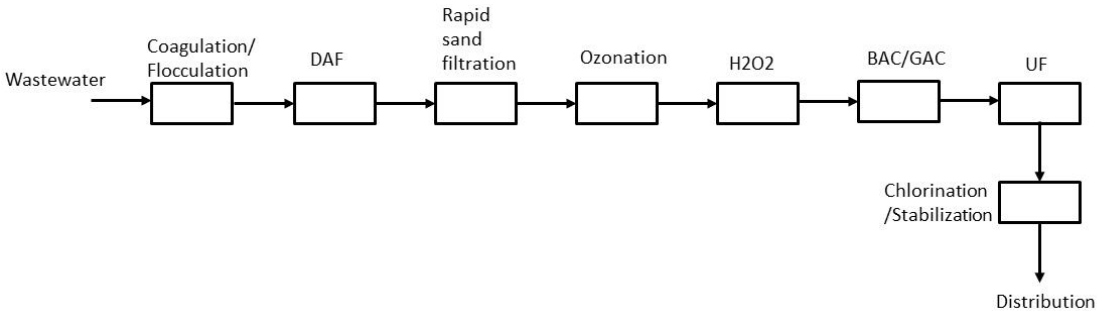


Figure 9. Schematic of DPR plant in Wichita Falls, Texas.

2.2.3.3 WINDHOEK, NAMIBIA



Capacity: 5.6 MGD

Figure 10. Schematic of DPR plant in Windhoek, Namibia (Pisani, 2005).

3 REGIONAL IPR/DPR EFFORTS

The City of San Jose partnered with the SCVWD to lead the preparation of the South Bay Water Recycling (SBWR) Strategic and Master Plan (SBWR, 2014). That report was published in December of 2014 and identifies a number of strategies for increasing the use of recycled water in the South Bay. Among these recycled water goals was an IPR/DPR use target of 40,000 acre-feet per year (AFY) by 2025 and 50,000 AFY by 2035. The study identifies three pathways for achieving these IPR/DPR goals.

Pathway 1 consists of recharging aquifers with the existing Los Gatos Recharge System using highly treated effluent from the existing Silicon Valley Advanced Water Purification Facility. Pathway 2 would include the construction of three new satellite advanced water purification facilities and percolation ponds that would produce high quality water for groundwater recharge. Pathway 3 is a DPR scheme that involves blending high quality effluent from the Silicon Valley Advanced Water Purification Facility with imported water supplies and discharging directly into the existing potable water distribution system.

3.1 RO Concentrate Management

RO treatment processes produce a high salinity waste stream referred to as RO concentrate. If not handled appropriately, RO concentrate can cause damage to aquatic ecosystems, degrade water quality, or contribute to the build of salts in the ground. Special accommodations need to be made to dispose of RO concentrate without causing unacceptable levels of harm to the environment. There is an ongoing effort to develop regional solutions to RO concentrate management in the south Bay region.

The SBWR Strategic and Master Plan considers multiple RO concentrate disposal alternatives but ultimately recommends returning RO concentrate to the San Jose/Santa Clara Regional Wastewater Facility via existing sewers or discharging RO concentrate directly to the bay via a new outfall to the South Bay at a location south of the Dumbarton Bridge.

More recently, a March 2015 workshop brought together district staff, consultants, and other stakeholders to prioritize the most feasible alternatives for RO concentrate management, and to establish action items necessary for their implementation. Table 3.5 presents the preferred RO concentrate management alternatives from this workshop.

Table 3.7: RO Concentrate Management Alternatives

Disposal Option	Disposal Method	Regional Comments
3	Existing regional deep water outfalls (SVCW or EBDA)	A regional solution using the existing SCVWD or EBDA deep water outfalls are potentially feasible. New concentrate pipelines would be needed to connect the ASPFs to the deep water outfalls.
4	Existing regional shallow water outfalls (Combination of Palo Alto, Sunnyvale, and RWF)	Each of the three south Bay outfalls could be used to accommodate an amount of RO concentrated disposal through blending with effluent. However, NPDES permit limitations and toxicity testing may limit the extent of this disposal strategy.
5	New Outfall north of Dumbarton Bridge	This option could be a regional concentrate disposal solution. New concentrate pipelines would be needed to connect the AWPFs to the outfall.
6	New south Bay outfall (to Coyote Point)	This option could be a regional concentrate disposal solution. New concentrate pipelines would be needed to connect the AWPFs to the outfall.
8	Engineered brine wetlands	This option was not carried forward as a potential option in Appendix 6D of the South Bay Water Recycling Master Plan, but could be a potentially feasible regional disposal option. This option could be combined with another disposal option where the engineered wetlands are used to treat the RO concentrate prior to disposal via existing outfalls or a new south SF Bay outfall.
12	Brine conditioning	Treatment strategies could be employed to remove NPDES permit and toxicity-causing constituents from the RO concentrate prior to discharge. Ongoing testing at the SVAWPC and other facilities could ultimately identify the cause of toxicity and provide the basis to identify appropriate conditioning technologies.

4 IMPLEMENTATION OF IPR/DPR IN SOUTH SANTA CLARA COUNTY

California does not currently have DPR regulations in place. While DPR has the potential to become a powerful tool in improving the SCVWD's water supply reliability, the lack of regulations would be a major obstacle to implementation.

The SCRWA WWTP utilizes sand filtration and a chlorination or UV disinfection process to produce tertiary disinfected recycled water. An IPR project could utilize surplus tertiary disinfected recycled water from the SCRWA WWTP. DDW regulations would allow for the use of this recycled water in aquifer recharge if it could be shown that there is at least six months of retention time before it travels to any potable supply well. Due to the density of potable supply wells in this region, wells would need to be taken out of use to meet this detention time requirement.

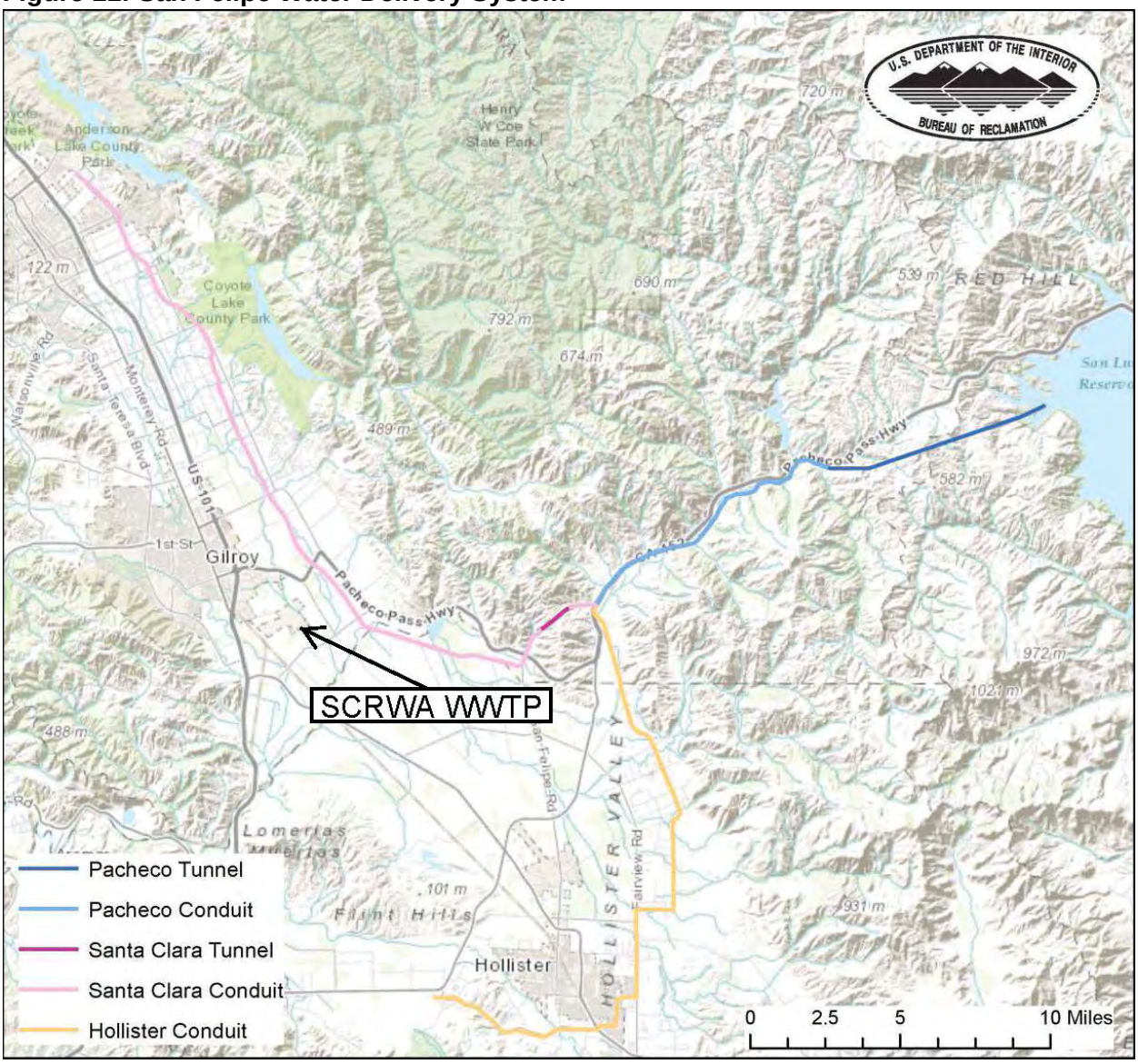
If the six month detention time cannot be achieved, additional treatment would be required before the water meets DDW standards for IPR. The level of additional treatment required would depend on if surface spreading or injection is utilized and the subsurface retention time. If an injection well is utilized, FAT would be required. Section 2.1.1 outlines current water quality regulations for IPR as well as typical treatment trains utilized and Section 4.3 describes how an appropriate treatment process can be selected.

An additional challenge to implementing an IPR program in the South County area is finding a suitable location for surface spreading ponds or injection wells. A recent high-level assessment by TODD Groundwater found no suitable locations in the Llagas Subbasin for IPR due to the density of potable supply wells and the response retention time and pathogen reduction times required by the Title 22 recycled water regulations. A calibrated groundwater model could potentially reduce the required retention time and allow for IPR in the far northwest and northeast corners of the basin near Morgan Hill and in the southern portion of the subbasin.

For a DPR project, a suitable method for delivering the recycled water to the potable water system would need to be developed. The San Felipe Division Project is part of the US Bureau of Reclamation's Central Valley Project. It delivers water from the San Luis Reservoir to agricultural, industrial, and municipal users in Santa Clara County as shown in Figure 11. The Santa Clara Conduit transports water from the San Luis Reservoir to the Coyote Pumping Plant before the water is treated in a water treatment facility and supplied to the District's potable water distribution system.

The Santa Clara Conduit is in close proximity to the SCRWA WWTP. Upon the adoption of DPR regulations, a DPR project that diverts tertiary effluent to new advanced water treatment facility, then to the Santa Clara Conduit could be considered. Recycled water diverted to the Santa Clara Conduit would blend with surface water from the Central Valley Project and supplement potable water supplies.

Figure 11: San Felipe Water Delivery System[1]



4.1 SUMMARY OF EXISTING SURFACE WATER RECHARGE EFFORTS

In addition to the natural recharge that occurs in the aquifers underlying southern Santa Clara County, the SCVWD operates several managed aquifer recharge facilities. These facilities enable the SCVWD to recharge aquifers with surplus surface water. Managed aquifer recharge occurs in the Main Ave. Ponds, San Pedro Ponds, Church Ave. Ponds, Madrone Channel, Llagas Creek, and Uvas Creek.

[1] Figure from 2013 Draining and Inspection of the Pacheco and Santa Clara Tunnels dated November 2013 by the U.S. Department of the interior Bureau of Reclamation South-Central California Area Office.

It is estimated that approximately 24,000 AFY of surface water enters the aquifers through managed recharge in these facilities. Of that water, 42 percent is imported water from the Central Valley Project. The remainder of the water used for managed aquifer recharge is from local sources.

4.2 RECYCLED WATER AVAILABLE FOR IPR/DPR

The SCRWA WWTP will have the capacity to produce 8.5 mgd of tertiary disinfected recycled water in accordance with title 22 regulations. During months of peak recycled water demand, current users utilize a majority of the available recycled water supply. Surplus tertiary effluent could be utilized for IPR/DPR. An analysis was performed to determine the monthly volume of surplus recycled water after current reclaimed water demands are met. The results of this analysis are shown in Table 7. This table shows that approximately 6,300 acre-feet of surplus recycled water is available.

Table 8: Surplus Tertiary Disinfected Effluent

Recycled Water Usage in Gilroy Baseline Alternative[1]												
Off-Peak Months			Peak Months							Off-Peak Months		Maximum Day Demand	Annual Average
January	February	March	April	May	June	July	August	September	October	November	December		
1,413 afy	1,668 afy	1,698 afy	2,868 afy	4,678 afy	6,563 afy	7,898 afy	7,568 afy	4,480 afy	3,029 afy	1,219 afy	1,103 afy	9,520 afy	3,682 afy
1.3 mgd	1.5 mgd	1.6 mgd	2.6 mgd	4.2 mgd	5.9 mgd	7.1 mgd	6.8 mgd	4.0 mgd	2.7 mgd	1.1 mgd	1.0 mgd	8.5 mgd	3.3 mgd
Potential Recharge in Morgan Hill[2]													
8,107 afy	7,852 afy	7,822 afy	6,652 afy	4,842 afy	2,957 afy	1,622 afy	1,952 afy	5,040 afy	6,491 afy	8,301 afy	8,417 afy	0 afy	5,838 afy
7.2 mgd	7.0 mgd	6.9 mgd	5.9 mgd	4.3 mgd	2.6 mgd	1.4 mgd	1.7 mgd	4.5 mgd	5.8 mgd	7.4 mgd	7.5 mgd	0 mgd	5.2 mgd

Potential Recharge Facilities Estimated Recharge Rate[3]	
Recharge Facility	**Annual Average Recharge Capacity (afy)**
Main Ave Ponds	2,700
Madrone Channel	10,500
Church Avenue Ponds	7,300
San Pedro Ponds	4,700

1. Peaking factors used for the monthly demands per SCRWA Reclamation Facility Order No. 98-052, 2014 Annual Report, Table 1: 2004 Reclamation Facility Monthly Averages
2. Recharge amount assumes 8.5 MGD recycled water treatment and includes the Baseline System Customer Demands
3. Recharge Facilities and Rates per Screening Level Assessment of IPR Reuse in the Llagas Subbasin, 2015 by Todd Groundwater

4.3 WATER QUALITY CRITERIA AND SELECTION OF TREATMENT SCHEME

To select a treatment process, the TDS levels of the tertiary treatment water is required. To consider a treatment scheme without RO, the tertiary effluent must meet all TDS requirements which will depend on the reuse application. For DPR the TDS must be below the drinking water criteria of 500 mg/L. If IPR is considered, the tertiary effluent must also be below the water quality objective for the Llagas basin set by the Regional Water Quality Control Board in the Basin Management Plan which is currently 300 mg/L. If the tertiary effluent does not meet these criteria, RO will be required. In addition, the selected treatment scheme must be able to remove microorganisms (12-10-10 rule), DBPs, and trace organic chemicals below regulatory limits.

DBP data provided for SCRWA is shown in Table 9. To meet IPR and DPR requirements, the TOC of the water must be treated depending on intended reuse applications. Similarly total trihalomethanes (THMs) must be < 80 µg/L in the distributed water to meet DPR regulations. Thus, more than 38.8% removal of THMs is required.

Table 9. Tertiary effluent water quality data provided for SCRWA.

Parameter	Units	2009	2010	2011	2012	2013	2014
Total Flow	MGM	26.7	19.4	16.7	26.0	29.5	30.1
Average Daily Flow	MGD	0.9	0.6	0.6	0.9	1.0	1.0
pH	units	7.2	7.2	7.2	7.2	7.2	7.2
BOD	mg/L	2.00	2.25	2.33	2.67	2.58	3.00
TSS	mg/L	1.00	1.00	1.08	1.50	1.08	1.75
Turbidity	NTU	0.4	0.4	0.4	0.5	0.4	0.4
Coliform	MPN/100	2.0	2.3	2.1	2.0	2.1	<2
Nitrate as N	mg/L	3.2	3.7	3.5	2.9	3.3	2.4
Dissolved Oxygen	mg/L	4.1	4.5	4.0	3.9	3.6	3.3

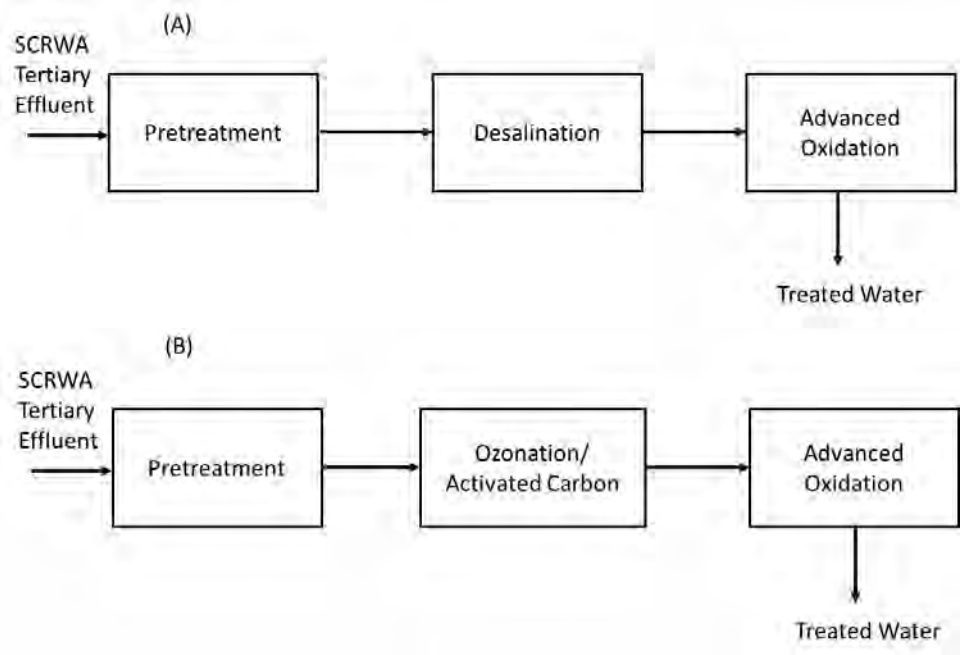
Table 10. Disinfection byproducts (DBP) data provided for SCRWA.

Parameter	Units	Value	Drinking Water MCL	Proposed PHG
TOC	mg/L	6.2		
Bromodichloromethane	µg/L	26.0		
Bromoform	µg/L	ND		
Chloroform	µg/L	100.0		
Dibromochloromethane	µg/L	4.8		
TTHMs	µg/L	130.8[1]	< 80	0.8

[1]Sum of average value of preceding four DBPs

4.4 RECOMMENDATIONS FOR SELECTION OF TREATMENT SCHEME

1. Conduct a detailed water quality analysis of the tertiary effluent at SCRWA. This water analysis should include all ions, metals, TDS, DBPs and trace organic chemicals, such as those listed in Table 6.
2. Perform a pilot-scale evaluation of one or more treatment schemes for IPR/DPR application. Treatment scheme with/without desalination is shown in Figure 11. When TDS of the tertiary effluent is close to drinking water standard (500 mg/L TDS), or the WQO (300 mg/L) if groundwater replenishment is being considered, then alternative treatment trains without RO need to be evaluated.
3. Meeting microbial removal regulation (12-10-10 rule) for DPR applications will also require the evaluation of the selected treatment scheme at the pilot-scale with microbial challenge testing studies.



Note: These are conceptual process trains; a complete water quality analysis needs to be reviewed to develop a more detailed process schemes.

Figure 12. Potential treatment scheme to achieve IPR/DPR at SCRWA.

REFERENCES

Chalmers, B., Yoder, D., Patel, M., Indirect potable reuse versus direct potable reuse – What's the difference, WateReuse Symposium, September 13, 2011. Available at: https://www.watereuse.org/sites/default/files/u3/Bruce%20Chalmers.pdf, Last accessed: December 1, 2014.

CDPH (2014) Regulations related to recycled water, http://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/RecycledWater.shtml

City of San Diego, City of San Diego water purification demonstration project, Final Report 2014.

DeCarolis, J., Development of a comprehensive testing and monitoring plan: City of San Diego advanced water purification demonstration facility, Proceedings of the WateReuse Symposium, 2011.

National Water Research Institute (NWRI), Regulatory aspects of direct potable reuse in California, White Paper, Available at: http://www.nwri-usa.org/pdfs/NWRIPaperDirectPotableReuse2010.pdf, Last accessed: December 1, 2014.

Pisani, P.L., Direct reclamation of potable water at Windhoek's Gaoreangab Reclamation Plant, Integrated Concepts in Water Recycling, 2005.

South Bay Water Recycling (SBWR), Strategic and Master Planning, Final Report, December 2014

Tchobanoglous, G., Direct potable reuse: A path forward. 2012 Water Reuse Conference, Boise, Idaho. Available at: http://www.deq.idaho.gov/media/829272-tchobanoglous-presentation-reuse-conference-2012.pdf, Last accessed: December 1, 2014.

WateReuse Research Foundation (WRRF), Examining the criteria for direct potable reuse, Final report 11-02-1, 2011.

Wichita Falls DPR Project, Available at: http://www.wichitafallstx.gov/index.aspx?nid=1595, Last accessed: December 1, 2014.

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EVALUATION OF SYSTEM RELIABILITY

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1 INTRODUCTION

Wastewater is reclaimed at the South County Regional Wastewater Authority (SCRWA) Wastewater Treatment Plant (WWTP) and distributed through the south Santa Clara County recycled water system to landscape irrigation, agricultural irrigation, and industrial users throughout the Gilroy area. These users rely on a consistent supply of recycled water service for their operations. This report was prepared in coordination with the South County Recycled Water Master Plan Update, to ensure the needs of the recycled water customers serviced by the south Santa Clara County recycled water system continue to be met. The purpose of this evaluation is to:

- Document the current level of reliability in the recycled water system
- Determine the level of service required by current and future recycled water customers
- Develop alternatives that could increase recycled water system reliability and meet required level of service
- Estimate costs for these proposed alternatives

No distribution system can be 100% reliable, which is why this report focuses on relative levels or reliability. A recycled water system with a high level of reliability can continue to meet customer recycled water demands in the event of planned system maintenance, loss of supply, or periods of increased demand. Many components of the existing system can be considered reliability measures, such as, standby pumps, redundant treatment facilities, backup power generators, and existing storage facilities. This report evaluates additional measures that could be implemented for the purpose of increasing the level of recycled water system reliability.

1.1 Recycled Water System

This section documents the existing recycled water production and distribution facilities that are the subject of this evaluation. The recycled water system is broken up into two categories. The treatment plant facilities include the processes that take secondary effluent wastewater and treat it to California Title 22 compliant tertiary disinfected effluent. The distribution system includes the pipelines, pump stations (two of which are on the SCRWA WWTP site), and storage tanks, that convey recycled water to customers.

1.1.1 Treatment Plant Facilitates

The South County Regional Wastewater Authority (SCRWA) operates a wastewater treatment plant (WWTP) that serves the cities of Gilroy and Morgan Hill. The SCRWA WWTP is permitted to treat a maximum average dry weather flow (average flow over the three driest months of the year) (ADWF) of 8.5 MGD. WWTP effluent is discharged to onsite percolation ponds or diverted to the tertiary treatment facility.

Secondary effluent is diverted to the tertiary treatment facilities in response to recycled water demand. The filter plant has four filter beds that operate as three duty and one standby. This configuration provides a firm filtration capacity of 9 MGD. Filter plant effluent is then disinfected in the chlorine contact basin that can treat a design flow of 8 MGD. A parallel UV disinfection

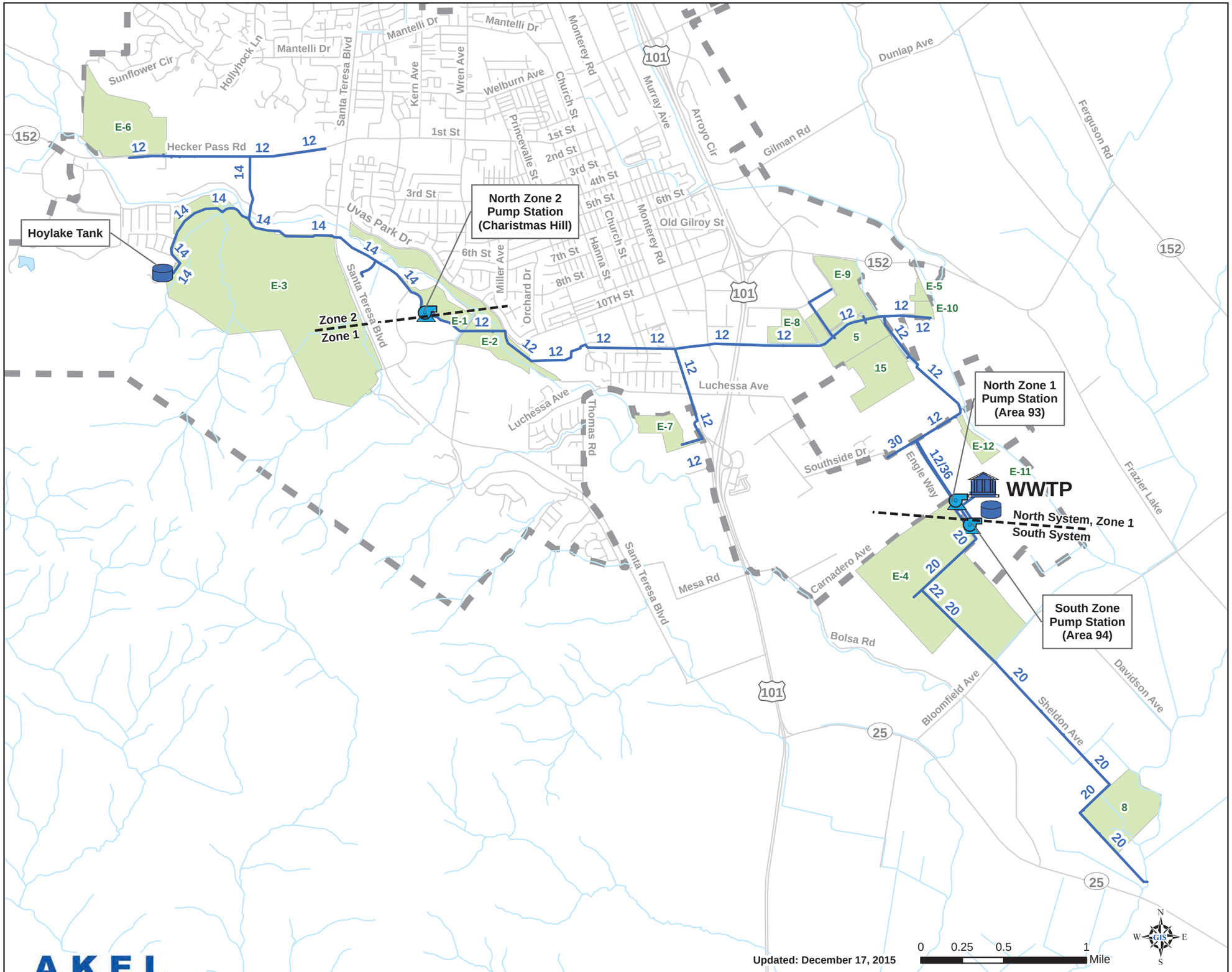
facility, with 9 MGD of disinfection capacity, is currently under construction. The treated tertiary wastewater effluent meets the State Water Resources Control Board (SWRCB) Title 22 Recycled Water Regulation requirements for tertiary disinfected water. This recycled water is permitted for use in various applications including landscape irrigation, crop irrigation, construction activities, and industrial applications.

There is an onsite recycled water reservoir with capacity to store three million gallons of recycled water. Plant operators use the reservoir when recycled water demand exceeds the capacity of the tertiary treatment facilities. Recycled water is stored in the reservoir during times of low recycled water demand. The reservoir is at an elevation below that of the chlorine contact basin and UV facility. As a result, water is pumped from the reservoir to the tertiary treatment system effluent channels by the reservoir return pumps. There are three reservoir return pumps in a 2 + 1 configuration. Pump Station 93 and Pump Station 94 supply recycled water from the tertiary treatment system effluent channels to the distribution system.

1.1.2 Distribution System

Pump Station 94 contains two pumps and supplies water to the southern portion of the recycled water system (South System) via the South Pipeline. The Area 94 Reclamation Pumps were installed as part of the 2004 Filter Plant Expansion Project. The pump station consist of two vertical turbine pumps. They are powered by VFDs with a maximum speed of 1780 RPM. The pumps were designed to operate at 2100 gpm at 170 feet of total discharge head (TDH). A third, identical pump is currently being installed in addition to the two existing pumps. This pump is being added to increase the maximum capacity and to improve system redundancy. The pipeline has turnouts that are used by agricultural recycled water customers along the pipeline. In addition to supplying recycled water for crop irrigation, the South Pipeline extends to an outfall in the Pajaro River and can be used by the SCRWA WWTP as an alternative discharge method to the onsite percolation ponds. There are no storage facilities along the South Pipeline.

Pump Station 93 delivers recycled water to the northern portion of the recycled water system(North System). Three 125 horsepower 1,200 gpm at 295 feet of TDH vertical turbine pumps currently deliver reclaimed water to the North Pipeline. The North System serves agricultural, landscape irrigation, industrial, and construction users. The North System includes the Hoylake Tank that provides 1.5 million gallons of recycled water storage. The existing distribution system is shown in Figure 1.



Legend

Existing

- WWTP
- Storage Tanks
- Booster Stations
- Recycled Water Pipelines
- Pressure Zone Line
- Existing Users
- City Limits
- Roads
- Creeks
- Lake

Updated: December 17, 2015

Figure 1

Existing System

South County Recycled Water System

Santa Clara Valley Water District /
South County Regional Wastewater Authority

Santa Clara Valley Water District

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1.2 Survey of Utilities that Provide Recycled Water Service

The following utilities were contacted to assess reliability measures taken by other utilities. The intention of this outreach was to draw upon the experiences of other utilities that provide recycled water to see what the effect of implementing, or not implementing, reliability measures in their recycled water systems has been. This section summarizes the recycled water system reliability measures that were reported by these utilities.

1.2.1 Dublin San Ramon Services District

Dublin San Ramon Services District (DSRSD) provides recycled water to customers for landscape irrigation and construction applications. They do not currently have any agricultural or industrial users. 22.9% of all water consumption within the DSRSD is met with recycled water.

The DSRSD provides advance warning to all of their recycled water customers when there is a planned interruption in service. During relatively short interruptions in service they are able to manage the distribution system to continue supplying recycled water to some of their customers. The DSRSD also has the capability to fill recycled water reservoirs in their distribution system with potable water; however, this capability is not often utilized. The DSRSD did not report any recycled water reliability issues.

1.2.2 East Bay Municipal Utility District

The East Bay Municipal Utility District (EBMUD) provides recycled water service to landscape irrigation customers as well as to local refineries for cooling water and for boiler feed water. The landscape irrigation users are supplied disinfected tertiary effluent with less need for reliability. Planned interruptions in service lasting a day or two have occurred for landscape irrigation customers with few consequences.

Recycled water supplied to the Chevron North Richmond refinery for use in cooling systems is also disinfected tertiary effluent produced in a facility dedicated to this customer. The facilities are relatively old, and were reported to have a low level of redundancy. This recycled water system is backed up with the potable water system both at the tertiary treatment facilities and at the refinery.

Recycled water utilized as boiler feed water is treated at EBMUD facilities in a microfiltration and reverse osmosis (RO) process. This treatment facility is relatively new and was funded by the refinery, and as a result, is reported to have a high level of redundancy. The facilities also provide a connection to potable water upstream of the MF/RO facilities. EBMUD did not report any issues with the reliability of their recycled water service for any of the three applications.

1.2.3 Central Contra Costa Sanitary District

The Central Contra Costa Sanitary District (CCCSD) provides recycled water to landscape irrigation users and to dual plumbed systems for toilet flushing. CCCSD recycled water users do not require a high degree of reliability. CCCSD reported that they would potentially provide water delivery service in the event of an extended interruption in recycled water service.

CCCSD advises any of their recycled water customers, for whom an interruption in service would cause problems, to provide their own onsite backup. Two users were reported to provide onsite backup of their recycled water supplies. Both customers used recycled water for toilet and urinal flushing. One of these customers provided a potable water supply backup with an air gap tank, and the other agreed to provide portable toilets in the event of an interruption in recycled water service.

1.2.4 San Francisco Public Utilities Commission

The San Francisco Public Utilities Commission (SFPUC) Westside Recycled Water Project will begin construction in early 2016 to provide recycled water for landscape irrigation, golf course irrigation, and lake filling with a max day demand of approximately 4 mgd. The recycled water distribution system will have two storage tanks, one of which can be filled with potable water in the event of an interruption in recycled water service. The two tanks combined have enough storage to provide one day of supply.

There is no redundancy in the recycled water distribution system; however, the recycled water treatment processes have built in redundancy. Additionally, there is storage between the microfiltration and reverse osmosis treatment processes in the recycled water treatment train.

2 RECYCLED WATER SYSTEM RELIABILITY ASSESSMENT

This section documents the components of the existing recycled water system that contribute to its level of reliability and the level of reliability required by the current recycled water customers.

2.1 Existing and Planned Reliability

A three million gallon recycled water storage reservoir is currently located on the SCRWA WWTP grounds. This storage facility is utilized to meet peak recycled water demands when the demand exceeds the capacity of the tertiary treatment facilities or the influent plant flow. This reservoir also provides a temporary backup supply if the tertiary treatment facilities go down. The reservoir is upstream, and below the recycled water distribution pump so it does not provide any redundancy to the recycled water pumping or distribution system.

An additional six million gallon storage recycled water storage reservoir is planned for installation adjacent to the existing reservoir. This will bring the total onsite recycled water storage to nine million gallons. That project is included as a potential reliability measure for SCVWD recycled water customers even though it is being considered by SCRWA district staff independently of this effort.

The treatment facilities have a high level of redundancy built in. A high level of reliability is required of the secondary treatment facilities to ensure NPDES permit requirements are always met. The tertiary treatment facilities also have built in redundancy including the standby filter bed, and the UV disinfection basin that is currently under construction. Additional reliability measures include standby power and standby pumps.

There are currently two distribution system pumping stations located at the SCRWA WWTP with the area Pump Station 93 pumping to the North System and the Pump Station 94 pumping to the South System. Figure 2 shows that the Pump Station 93 currently operates within its firm capacity while the Pump Station 94 currently operates above its firm capacity. This is identified as a less reliable component of the overall system because during maximum demand, there is no redundant pump. In 2015, one of the two pumps in Pump Station 94 was down, resulting in only one pump with no standby. An additional pump is currently being added to Pump Station 94, which is expected to increase the firm capacity above the current South System recycled water demand. This will improve the reliability of this component of the recycled water system.

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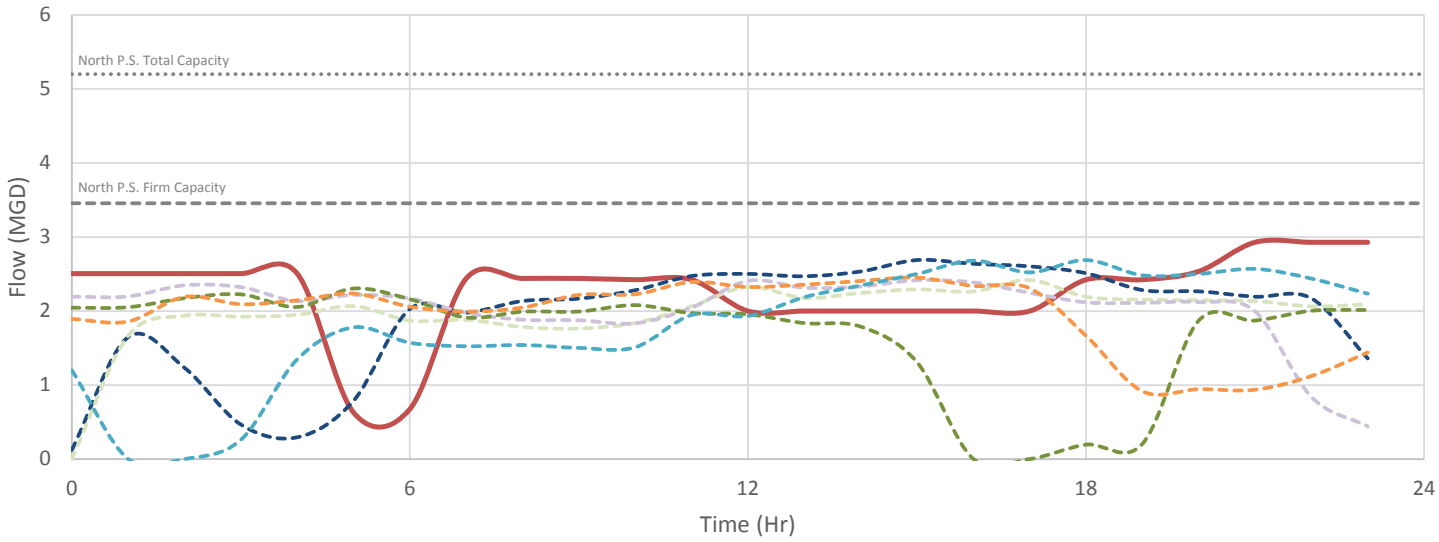

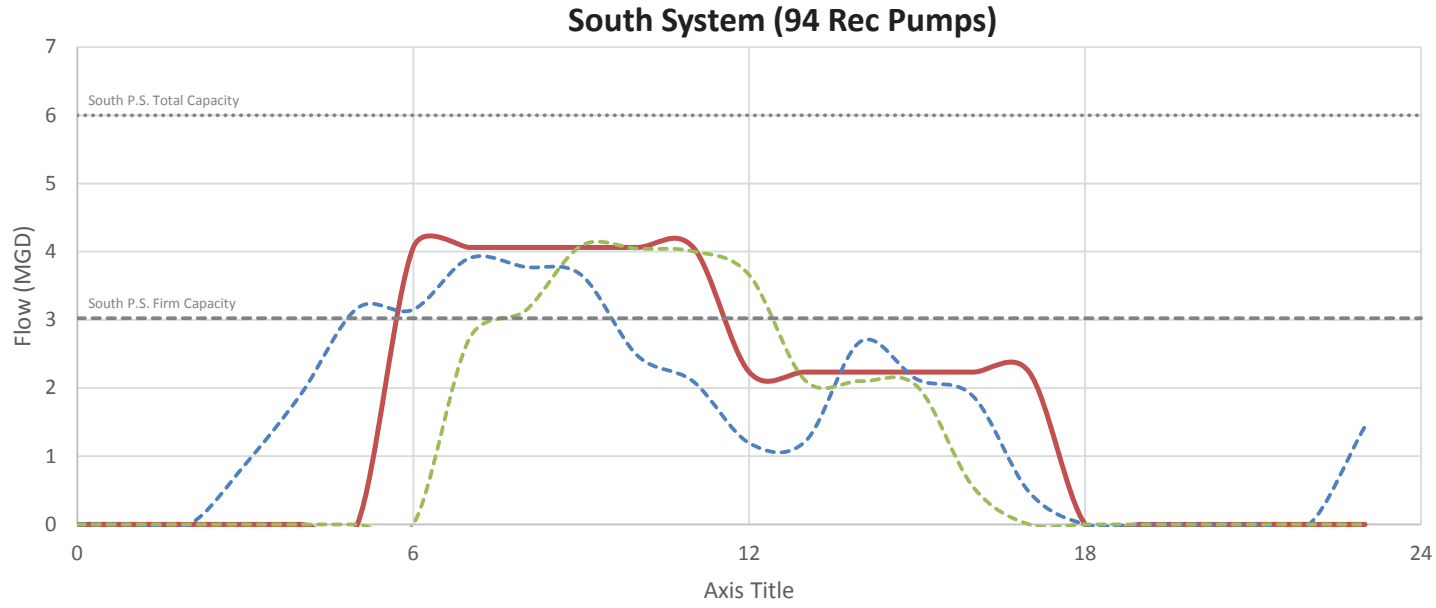

September 21, 2015

LEGEND

- Hydraulic Model: North System
- 6/9/2015
- 6/30/2015
- 7/2/2015
- 7/10/2015
- 7/14/2015
- 7/30/2015
- Ex. Max P.S. (North) Design Flow
- Ex. Firm P.S. (North) Flow

- Hydraulic Model: South System
- 7/9/2015
- 6/11/2015
- Ex. Max P.S. (South) Design Flow
- Ex. Firm P.S. (South) Design Flow

Figure 2

Maximum Day Recycled Water Distribution System Pumping

South County Recycled Water System

Santa Clara Valley Water District/South County Regional Wastewater Authority

Santa Clara Valley Water District

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2.2 Current Recycled Water Customers Level of Service Assessment

Thirteen customers currently receive, or plan to receive, recycled water from the SCRWA WWTP. Each customer was classified in one of the following categories

- Landscape irrigation
- Crop irrigation
- Industrial
- Construction

Table 1 shows how much recycled water is allocated to each of the use applications.

Table 1: Recycled Water Use Applications

Use Application	Number of Customers	Recycled Water Used in FY 2014 (AF)
Landscape Irrigation	8	685
Crop Irrigation	3	234
Industrial	1	83
Construction	1	0

Table 2 presents all the current recycled water customers in addition to recycled water customers that plan to begin service in the near term.

Table 2: Recycled Water Customers

Label	Site Name	Recycled Water Application(s)	Backup Supply	Onsite Storage	Usage 2014 Calander Year (AFY)
E-3	Eagle Ridge Golf Course	Blended with well water to irrigate golf course	Well water	Onsite storage pond	455
E-4, E-8	Mission Ranches (partnered with Obata)	Crop irrigation North Lands and SCRWA Bufferlands farms	Not for all parcels	No	234
E-6	City of Gilroy Golf Course	Golf course irrigation	Potable water	Onsite storage tank	129
E-5, E-10	Gilroy Calpine Cogeneration Facility	Recycled water provides cooling tower water to the facility.	Well water	No	83
E-7	City of Gilroy Sports Park	Landscape irrigation and sports field irrigation	Potable water	Onsite storage tank	32
E-1, E-2	Christmas Hill Park	Landscape irrigation	Potable water irrigation at facility	No	26
E-9	McCarthy Business Park	Irrigate medians and sidewalk strips	No	No	15
E-12	Gilroy Police Department Shooting Range	Landscape irrigation	No	No	1
8	C & E Farms	Crop Irrigation			0
NA	Fiorio Farms	Crop Irrigation			0
5	United Natural Foods	Landscape Irrigation			0
NA	Glen Loma Ranch	Construction Activities			0
NA	Merritage Homes	Landscape Irrigation			0
Total					975

The level of service required by the recycled water customers depends heavily on their use application and whether or not they have a backup supply of recycled water. Landscape irrigation customers can likely work around interruptions in recycled water service lasting several days, especially if they are planned. Other utilities providing recycled water to only landscape irrigation customers reported that these customers do not demand a high degree of reliability.

Agricultural customers who rely on both recycled water and well water could also likely deal with interruptions in recycled water service lasting several days. However, agricultural customers who use recycled water as their sole supply of irrigation water may experience the loss of a crop if interruptions in recycled water service extend past 48 hours.

One agricultural customer contacted for this study reported several different parcels that are irrigated with recycled water. One 25 acre parcel had no water supply other than recycled water and no on site recycled water storage facilities. The customer stated that an interruption in service lasting several days, during critical times of the crop cycle, could result in the complete loss of the crop. Shorter interruptions in recycled water service, lasting several hours to a day, would not pose a problem. Other parcels belonging to this customer were reported to have well water in addition to recycled water. For these parcels, interruptions in recycled water service would not result in the loss of a crop.

In addition to these recycled water customers, the SCRWA WWTP relies on recycled water for plant processes. In 2014 the SCRWA WWTP used over 1,000 acre-feet of recycled water. Recycled water is conveyed to various process areas using the utility water pumps which means plant recycled water use is not depended on the operation of the recycled water distribution pumps or the recycled water distribution pipeline. The plant use of recycled water is reliant on the proper operation of the tertiary treatment facilities.

Given the type of recycled water users and the feedback received from the agricultural user, the following level of service requirements are defined for this project:

- Avoid unplanned interruptions in service exceeding 48 hours
- Meet peak hour and peak day recycled water demand
- Provide adequate pressure for customer use (See section South County Recycled Water Master Plan Section 3.3.3)

3 POTENTIAL RELIABILITY MEASURES

Six potential measures to increase system reliability were evaluated as a part of this study.

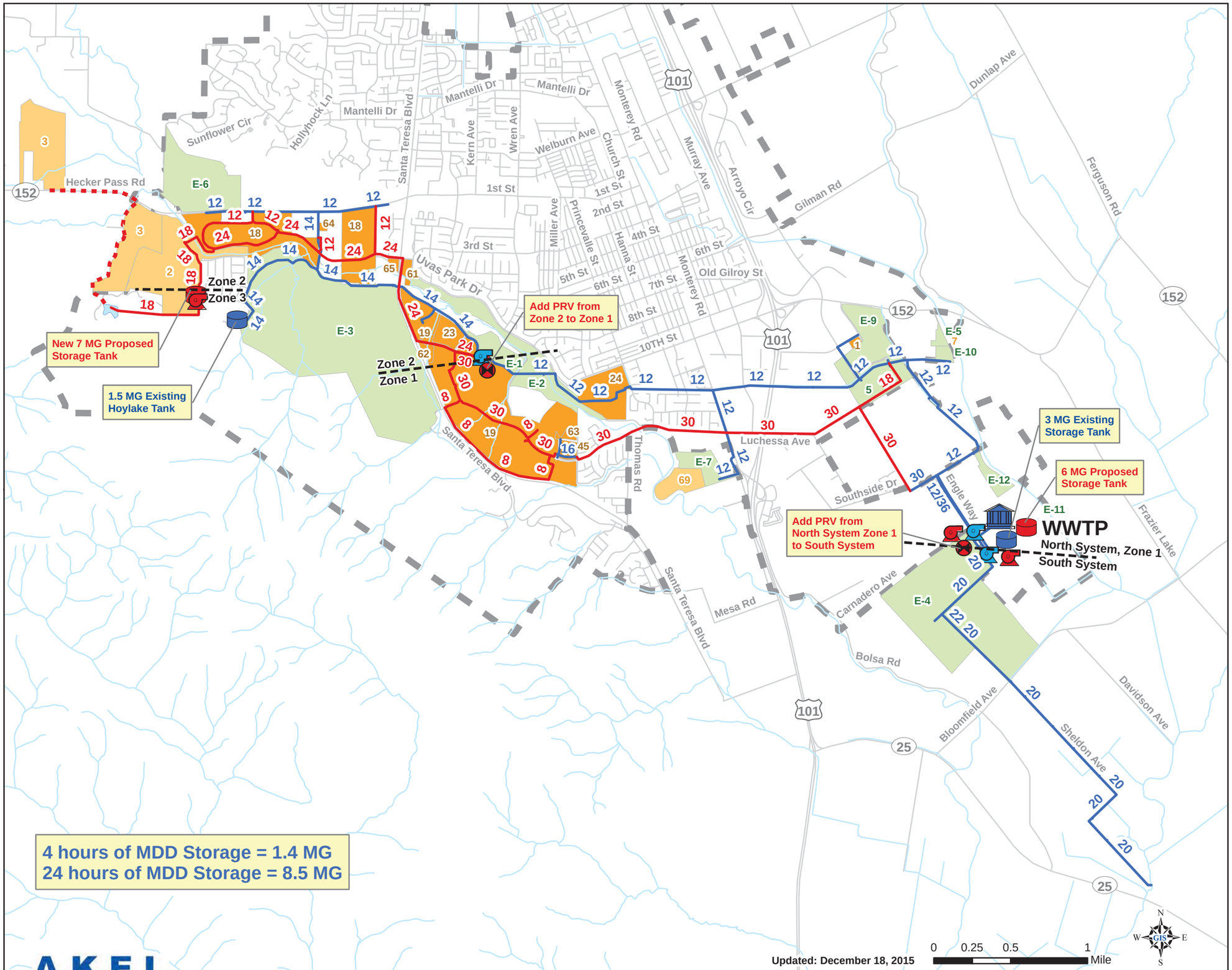
1) Additional six million gallon recycled water storage facility at SCRWA WWTP
2) Interconnection between North System Zone 1 and South System
3) 4 hours of recycled water storage in distribution system
4) 24 hours of recycled water storage in distribution system
5) Connection to potable water supply
6) Requirement for customers to provide their own reliability

These measures could be combined in various ways. The components that are included in each of the reliability measures are presented in sections 3.1 through 3.6. Table 3 presents the Class 5 capital costs estimates or "Order of Magnitude" estimate for each of the reliability measures. The Association for the Advancement of Cost Engineering (AACE International), formerly known as the American Association of Cost Engineers, classifies the "Order of Magnitude" estimate as an "original estimate," "study estimate," or "preliminary estimate," and is generally intended for master plans and studies. This estimate is not supported with detailed engineering data about the specific project, and its accuracy is dependent on historical data and cost indexes. It is generally expected that this estimate would be accurate within -30 percent to +50 percent. The costs developed in this study should be considered "Order of Magnitude" estimates.

The 24 hour storage alternative includes all of the elements from alternatives 2 and 3 plus an additional storage facility. The proposed alignment for this alternative is presented in Figure 3, and a breakdown of the capital cost is given in Table 4.

Table 3: Estimated Capital Costs of Reliability Measures

Reliability Measure	Estimated Capital Cost (Millions $)
6 MG Storage at SCRWA WWTP	$6.0
North and South Pipeline Interconnect	$0.4
4 Hours Storage	$0.6
24 Hours Storage	$12.5
Connection to Potable Supply	$0.2
Customers Provide Reliability	$0



Legend

Proposed

- Storage Tanks
- Booster Stations
- PRVs
- Long-Term Proposed Pipe
- Existing User Infrastructure

Existing

- WWTP
- Storage Tanks
- Booster Stations
- Recycled Water Pipelines
- Pressure Zone Line
- Existing Users
- In-Progress Users
- Baseline Users
- City Limits
- Roads
- Creeks
- Lake

Figure 3
System Reliability Storage Requirements
South County Recycled Water System

Santa Clara Valley Water District /
South County Regional Wastewater Authority

Santa Clara Valley Water District

AKEL ENGINEERING GROUP, INC.

File Name & Location: P:\xGIS\GIS_Projects\SCVWD\MWH\SysReliability\SCVWD_SystemReliability_121815.mxd

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Table 4: Cost Estimate for 24 Hour Storage Option

PRELIMINARY

Cost Estimates

Item No.	Description	Size/Length	Unit	Unit Price		Total
Recommended Improvements						
1	**Storage Reservoir**					
	Zone 2: 7 MG Tank	7,000,000	gallon	$0.86	$	6,020,000
	Sub-Total				$	6,020,000
2	**Pressure Reducing Stations**					
	10" PRV from North System Zone 2 to Zone 1	1	each	$100,000	$	100,000
	10" PRV from North System Zone 1 to South System	1	each	$100,000	$	100,000
	Sub-Total				$	200,000
3	**Pipelines**					
	On-site pipes for PRV Connections	600	feet	$230	$	138,000
	Sub-Total				$	138,000
4	**Land Acquisition**					
	Storage Reservoir Site	21,780	sq. ft.	$15	$	327,000
	Sub-Total				$	327,000
	Total				$	6,685,000
			Contingencies			
			Estimating	20%	$	1,337,000
			Construction	20%	$	1,604,000
			Administration	30%	$	2,888,000
			Total Project Cost		$	12,514,000

AKEL ENGINEERING GROUP, INC.

11/24/2015

3.1 Six Million Gallon Recycled Water Storage Facility at SCRWA WWTP

The addition of a six million gallon recycled water storage facility on the SCRWA WWTP would provide a total of nine million gallons of recycled water storage on the treatment plant site. Given a maximum day demand of 8.5 MGD this would provide a full day of recycled water storage in the event of a shutdown of the tertiary treatment facilities. The recycled water storage facilities on the SCRWA WWTP are upstream of the recycled water distribution pump stations and therefore would not provide redundancy in the event of a loss of pump station production.

The recycled water reservoir is used to meet peak recycled water demands during times when the demand for recycled water exceeds the tertiary treatment capacity or the plant secondary effluent. This operational strategy is necessary to continue meeting the needs of the current recycled water customers. The result of this operational strategy is that the onsite recycled water storage reservoirs could be drawn down during peak periods of recycled water demand. As a result, the full capacity of the reservoir may not be available in the event of a loss of tertiary treatment capacity.

3.2 North and South Pipeline Interconnect

Currently, the North Pipeline and the South Pipeline operate as independent systems with their own dedicated pump stations. Pump Station 93 supplies recycled water to the North Pipeline and the Area 94 pump station supplies recycled water to the South Pipeline. If either pump station could not operate, the respective distribution system would begin to fail. An interconnection between the North and South Pipeline would enable Pump Station 93 and Pump Station 94 to supply recycled water both the North and South Pipelines.

Pump Station 93 and 94 are both on the SCRWA WWTP grounds and are located approximately 600 feet apart. An interconnection pipe would require a pressure reducing valve as the North Pipeline has significantly higher head than the South Pipeline. Supplying recycled water to the North Pipeline using the Area 94 Pump Station would result in reduced flows due to the smaller capacity of the Area 94 Pump Station as compared to the Area 93 Pump Station.

3.3 Four Hours Recycled Water Storage

This alternative would provide four hours of recycled water storage in the distribution system, in addition to the recycled water storage provided at the SCRWA WWTP. The 1.4 million gallon Hoylake Tank already provides sufficient recycled water storage to provide four hours of supply. Therefore, this alternative does not include provisions for any additional storage. The elements of this alternative include:

- A pressure reducing valve between the North System Zone 2 and Zone 1
- A connection with pressure reducing valve between the North System Zone 1 and the South System
- Approximately 5,250 ft of 24-inch pipe from the Hoylake Tank replacing the existing 12 and 14-inch mains.

These three elements would allow recycled water to flow from the storage tank in the North System Zone 2 to users throughout the recycled water distribution system.

3.4 24 Hours Recycled Water Storage

This alternative would provide 24 hours of recycled water storage in the distribution system, in addition to the recycled water storage provided at the SCRWA WWTP. This alternative includes the following elements:

- New 7 million gallon storage reservoir in the North System Zone 2
- A pressure reducing valve between the North System Zone 2 and Zone 1
- A connection with pressure reducing valve between the North System Zone 1 and the South System

Similar to the four hours storage alternative, the pressure reducing valve between Zone 2 and Zone 1 and the connection between the North and South System allow recycled water to flow from storage in Zone 2 to users throughout the distribution system. The 7 million gallon storage tank, combined with the existing 1.5 million gallon storage tank would meet the maximum day demand of 8.5 MGD for 24 hours.

3.5 Connection to Potable Water Supply

Connecting a pressurized recycled water distribution system to a potable water supply pipe introduces the risk of cross connections. Backflow prevention devices and/or air gaps must be provided to guarantee that recycled water does not enter the potable water distribution system. Title 17 of the California Code of Regulations establishes the cross connection prevention actions that are required for recycled water distribution systems in California. Table 1 of that code presents the required type of backflow prevention device for various use applications. From that table, any premises with wastewater treatment or pumping facilities requires an air gap separation to the potable supply. A reduced pressure type backflow prevention device could be used if it is approved by the local health agency and the water supplier.

Potable water could be supplied to the existing 1.5 million gallon Hoylake tank utilizing an air gap. This alternative would require upsizing the existing 12 and 14-inch transmission mains (approximately 5,250 feet) from Hoylake tank to 24-inch. The pressure reducing valve and the North and South System interconnect, if installed, would allow this potable water to supply the entire distribution system. Alternatively, potable water connections could be introduced in other locations in the distribution system, which could potentially mitigate the need for the pressure reducing valves, the North and South System connection, and the new transmission main from Hoylake Tank.

3.6 Customers Provide Reliability

This alternative proposes shifting the burden of guaranteeing reliability of recycled water service from the SCVWD to the recycled water customer. As presented in Section 2, some recycled water customers have opted to provide their own recycled water system reliability with either backup supplies or onsite storage. This alternative would require that all recycled water

customers provide reliability in some way, or accept the possibility of temporary losses in recycled water service. This alternative would not have any costs for the District; however, it may result in the loss of existing or potential customers.

4 RECOMMENDED ALTERNATIVE

Based on feedback from recycled water customer and from other utilities, and considering the level of service requirements developed in this report, alternative 6 is recommended. This alternative does not require the SCVWD to do anything beyond the improvements currently underway at the SCRWA WWTP. If recycled water customers require additional reliability, they can provide it themselves with onsite storage or backup supplies. Even the users that require a high level of reliability, like the agricultural user without a backup supply, can likely work around interruptions in service lasting up to 24 hours. If new users require a higher degree of reliability, it would likely be more economical for them to provide it themselves.

APPENDIX G

SCREENING LEVEL ASSESSMENT OF INDIRECT POTABLE REUSE IN THE LLAGAS SUBBASIN

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Santa Clara Valley Water District

Screening Level Assessment of Indirect Potable Reuse in the Llagas Subbasin

September 2015

Prepared for:

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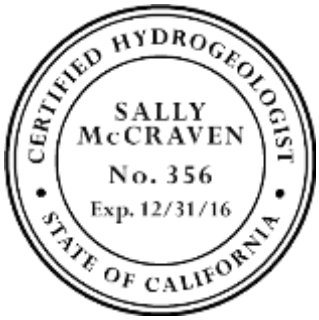

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List of Acronyms

AF	acre-feet
AFY	acre-feet per year
AOP	advanced oxidation process
Ave.	Avenue
AWT	Advanced Water Treatment
Basin Plan	Regional Water Quality Control Board Water Quality Control Plan for the Central Coastal Basin
bgs	below ground surface
CCRWQCB	Central Coast Regional Water Quality Control Board
CDPH	California Department of Public Health
CVP	Central Valley Project
CPT	cone penetrometer
DDW	State Water Resources Control Board Division of Drinking Water
District	Santa Clara Valley Water District
FAT	fully advanced treated
ft-bgs	feet below ground surface
ft/d	feet per day
FY	fiscal year
gpm	gallons per minute
GWR	groundwater recharge
IPR	indirect potable reuse
LLNL	Lawrence Livermore National Laboratory
LUST	leaking underground storage tank
MAR	managed aquifer recharge
MCL	Maximum Contaminant Level
MF	microfiltration
mgd	millions of gallons per day
MTBE	methyl-tert butyl ether
msl	mean sea level
mg/L	milligrams per liter
OCWD	Orange County Water District
PRT	pathogen reduction time
RO	reverse osmosis
RRT	response retention time
RWC	recycled water contribution
RWQCB	Regional Water Quality Control Board
SCRWA	South County Regional Wastewater Authority
SCVWD	Santa Clara Valley Water District

SLIC	Spills, Leaks, Investigation and Cleanup
SWRCB	State Water Resources Control Board
TDS	total dissolved solids
TOC	total organic carbon
TMDL	total maximum daily load
ton/yr	tons per year
ug/L	micrograms per liter
UIC	Underground Injection Control
WDRs	Waste Discharge Requirements
VOC	volatile organic compound
WQO	Basin Plan Water Quality Objectives
WRRs	water recycling requirements
WTRF	Wastewater Treatment and Recycling Facility
WY	water year

Executive Summary

This report provides a screening-level assessment of the feasibility of recharging 8.5 million gallons per day (mgd) or 9,500 acre-feet per year (AFY) of purified water (fully advanced treated recycled water) in the Llagas Groundwater Subbasin. Recharge by both surface spreading and subsurface injection is considered. The assessment is based on hydrogeologic and regulatory considerations. The State Water Resources Control Board (SWRCB) Division of Drinking Water (DDW) Groundwater Recharge Reuse Regulations (May 2014) established the conditions that must be met for recycled water recharge projects.

Hydrogeologic and regulatory considerations include:

- Depth to groundwater and available storage capacity,
- Permeability of soils and aquifer materials,
- Percolation capacity of existing spreading grounds,
- Recovery of recharged purified water in the Llagas Subbasin, i.e., significant production downgradient of recharge,
- Projected future groundwater demand,
- Groundwater quality and potential impacts on contaminant plumes,
- Dilution water requirements,
- Response Retention Time (RRT) requirement and impacts on nearby production wells,
- Pathogen Reduction Time (PRT) requirements and impacts on nearby potable production wells.

From a hydrogeologic perspective, the Llagas Subbasin in suitable for recharge of purified water as demonstrated by the significant historical and ongoing managed aquifer recharge (MAR) with local and imported water conducted by the Santa Clara Valley Water District (District). Groundwater provides almost 100 percent of the water supply in the Llagas Subbasin and groundwater pumping far exceeds natural recharge. District planning studies for the South County area have long recognized the need for additional MAR in the Subbasin.

From a regulatory perspective, the most significant impediment to purified water recharge is the large number and density of potable water supply wells in the Subbasin. There are more than 3,400 domestic, irrigation, industrial, and municipal water supply wells in the Subbasin (District, 2014). The DDW requirements (May 2014) that indirect potable reuse (IPR) projects provide sufficient RRT and PRT between IPR projects and potable supply wells limits locations where IPR facilities can be sited in the Subbasin to that extent that such projects are infeasible in the Subbasin based on a screening-level assessment.

IPR projects may be feasible if strategies can be developed to connect domestic wells to municipal supplies, provide alternative water supplies to replace these domestic wells, and prevent new wells from being drilled near IPR projects. Groundwater modeling may also be conducted to reduce the uncertainty and associated regulatory correction required for travel time predictions for IPR project planning.

1 Introduction

To help meet long-term water supply needs and improve water supply reliability, the Santa Clara Valley Water District (District or SCVWD) and South County Regional Wastewater Authority (SCRWA) have implemented a program to reuse tertiary-treated recycled water from the SCRWA's Wastewater Treatment and Recycling Facility (WTRF) for irrigation and industrial purposes. To date, water supply planning documents have focused on increasing use of recycled water for non-potable uses. Recent drought conditions in California and associated reduced availability of imported and local water supplies for groundwater recharge have prompted an examination of the feasibility of producing purified water (advanced treated recycled water) for recharge and indirect potable reuse (IPR) in the Llagas Subbasin.

1.1 Purpose and Scope

The purpose of this report is to provide a high-level assessment of the feasibility of IPR in the Llagas Subbasin based on hydrogeologic and regulatory considerations. Factors considered in this assessment and previously conducted studies of indirect potable reuse include:

Hydrogeologic and regulatory considerations include:

- Depth to groundwater and available storage capacity,
- Permeability of soils and aquifer materials,
- Percolation capacity of existing spreading grounds,
- Recovery of recharged purified water in the Llagas Subbasin,
- Projected future groundwater demand,
- Groundwater quality and potential impacts on contaminant plumes,
- Dilution water requirements,
- Response Retention Time (RRT) requirement and impacts on nearby production wells,
- Pathogen Reduction Time (PRT) requirements and impacts on nearby potable production wells.

The assessment is preliminary in nature and relies on existing, readily-available groundwater and related data within the South County Study Area (Llagas Subbasin and surrounding area). This assessment provides a summary of the Subbasin groundwater characteristics and the regulatory requirements for groundwater recharge, and identifies potential groundwater recharge areas using both surface spreading and injection of purified water. This assessment recommends the next steps to implement potential indirect potable water reuse projects. Potential challenges and limitations to IPR in the South County Area are identified.

2 Hydrogeologic Setting

2.1 Study Area

Figure 1 shows the Llagas Subbasin boundary as defined by the California Department of Water Resources (DWR Bulletin 118, 2003) and as currently used by the District. The Llagas Subbasin is located within the southern part of Santa Clara County. **Figure 2** shows the Subbasin boundary as previously defined by the District for modeling purposes.

2.2 Physical Setting

The Llagas Subbasin is a northwest-trending depression approximately 15 miles long and 3 to 6 miles wide, covering an area of about 88 square miles. It is bounded by the Diablo Range on the east and the Santa Cruz Mountains on the west (Figure 2). At the northern boundary of the Subbasin, an elevated area forms a topographic and hydrologic divide between groundwater flowing north toward the San Francisco Bay in the adjacent Coyote Valley Subarea and south toward the Pajaro River in the Llagas Subbasin. The ground surface within the Llagas Subbasin slopes gently from northeast to southwest. Along the valley axis, elevations at the north end of the Subbasin are approximately 400 feet mean sea level (msl) and decrease steadily to about 140 feet msl at the south end.

2.3 Land Use

Residential and commercial development in the Llagas Subbasin is focused in the City of Morgan Hill in the north and the City of Gilroy (Figure 2) in the southwest, where water is supplied through large municipal wells. Wastewater is handled at the South County Regional Wastewater Authority (SCRWA) Water Treatment and Recycling Facility (WTRF) located along Southside Drive approximately 2 miles southeast of downtown Gilroy (Figure 2). In contrast, in the central portion of the Subbasin, the unincorporated community of San Martin is comprised predominantly of rural residential and agricultural development on large (five to ten acre) parcels relying on individual wells and on-site septic systems. The area south and east of the City of Gilroy is also predominantly agricultural.

2.4 Water Sources

Groundwater is the major source of water supply in the Llagas Subbasin. Between 2002 and 2011, an average of about 42,000 acre-feet per year (AFY) of groundwater was extracted from the Study Area. In addition, during that period, a small amount of recycled water (about 650 AFY) was used for irrigation and industrial uses and a small amount (about 1,400 AFY) of imported surface water was used for irrigation (Todd 2014, Table 22).

Groundwater is used for agricultural, municipal, industrial, and domestic purposes. The cities of Morgan Hill and Gilroy are the largest municipal users in the Subbasin. Smaller municipal users include West San Martin Water Works and San Martin County Water District, among others. There are more than 2,300 domestic wells throughout the Subbasin (District, 2014). Overall,

agriculture is the largest groundwater use in the Subbasin (52 percent), followed by municipal/industrial[1] (44 percent), and domestic (4 percent).

As part of its core mission, the District implements various operations to recharge groundwater with local and imported surface water to increase long-term water supply reliability. **Figure 3** shows the location of managed recharge facilities that have been constructed and are operated by the District to enhance recharge in the Subbasin and augment local supplies. Both local and imported surface water are recharged in the Subbasin. Between 2002 and 2011, the District's managed aquifer recharge (MAR) accounted for an average of 24,000 AFY (Todd, 2014).

Groundwater is also recharged naturally through percolation of rainfall, irrigation and septic system return flows, natural stream recharge, and mountain front recharge accounting for about 21,500 AFY between 2002 and 2011 (District, October 2012).

2.4.1 Domestic Pumping

More than 2,300 small domestic wells exist in the Subbasin, representing about 82 percent of the total number of wells (District, 2014). Annual groundwater extraction from domestic wells is generally less than 10 AFY per well. In total, domestic wells pump an average of about 1,700 AFY from the Subbasin (2002 to 2011) (Todd, 2014). Domestic well production in 2013 was about 1,400 AFY (District, 2014).

2.4.2 Agricultural Pumping

There are more than 500 agricultural irrigation wells in the Subbasin (District, 2014). Annual groundwater production from agricultural wells generally ranges from less than about 10 to 100 AFY per well. The average annual production from agricultural wells from 2002 to 2011 was approximately 22,000 AFY (Todd, 2014). Agricultural groundwater use in 2013 was approximately 23,000 AFY (District, 2014).

2.4.3 Municipal and Industrial Pumping

Municipal and industrial wells are combined in the District production databases. There are more than 250 wells in this category (District, 2013). Annual municipal and industrial production is generally greater than 100 AFY per well and total production averaged approximately 19,000 AFY from 2002 to 2011 (Todd, 2014). Municipal/industrial production in 2013 was approximately 22,300 AFY (District, 2014).

2.4.4 Recycled Water

As part of an effort to meet long-term water supply needs and improve water supply reliability, the District and SCRWA have implemented a program to reuse tertiary-treated recycled water from the SCRWA's WTRF for irrigation and industrial purposes. The WTRF treats wastewater from the cities of Morgan Hill and Gilroy. The WTRF has capacity to treat up to 8.5 million

[1] The District records place municipal and industrial water use in the same category.

gallons per day (mgd) to secondary treatment standards and currently treats approximately 6 mgd or about 7,000 AFY (CH2MHill, January 2012).

The treatment process consists of influent screening, aerated grit removal, nitrification, denitrification, oxidation ditches, and secondary clarification. The WTRF can divert secondary effluent to a tertiary treatment process that meets the recycled water criteria of California's Title 22 unrestricted use classification. The tertiary treatment process consists of coagulation, filtration with sand filters, chlorination, and dechlorination. The tertiary-treated water can be recycled for irrigation and industrial uses. Recycled water use for irrigation averaged about 570 AFY between water years (WYs) 2002 and 2011, with 501 AF of use in 2011. Recycled water is used for landscape, golf course, and agricultural irrigation, as well as industrial uses. Customers in and near the City of Gilroy currently use the recycled water.

SCRWA produced approximately 2,000 acre-feet (AF) of recycled water in calendar year 2014 (Silva, August 2015). Staff estimates that through implementation of the South County Recycled Water Master Plan, non-potable recycled water use could be expanded by another 1,100 AFY (District, January 2014).

2.4.5 Managed Aquifer Recharge (MAR)

A number of recharge facilities have been constructed and are operated by the District to enhance recharge in the Subbasin and augment local supplies. Both local and imported surface water are recharged in the Subbasin. In the vicinity of the Llagas Subbasin, the District owns and manages four local surface water reservoirs: Anderson, Coyote, Chesbro, and Uvas reservoirs (see Figure 3). Imported water delivered to the Llagas Subbasin comes from the Central Valley Project (CVP) through the San Felipe Project (District, May 2011 and October 2012). Imported water is stored in the San Luis Reservoir after being conveyed through the San Joaquin/Sacramento Delta.

The District recharge facilities are divided into the Upper Llagas Recharge System and the Lower Llagas Recharge System. Major recharge facilities in the Upper Llagas Recharge System include in-stream recharge in Llagas Creek and off-stream recharge in Madrone Channel and the San Pedro and Main Avenue ponds (Figure 3). This system recharges predominately imported CVP water. Smaller amounts of local water are supplied from Chesbro Reservoir to the west and Anderson and Coyote Reservoirs to the east, and a minor amount of stormwater runoff drains to the Madrone Channel. The Upper Llagas Recharge System has a recharge capacity of about 19,000 AFY.

Major facilities in the Lower Llagas Recharge System include Uvas and Chesbro Reservoirs, in-stream recharge in Llagas and Uvas Creeks, the Church Avenue off-stream ponds, and the Uvas-Llagas pipeline, which can divert water from Uvas Reservoir to Llagas Creek. This system is entirely dependent on local water from the Uvas and Llagas Watersheds. This system has a recharge capacity of about 21,000 AF per year.

The District facilitates in-stream recharge in local creeks through releases of local reservoir. Historically, spreader dams were operated on Llagas and East Little Llagas creeks to further increase recharge to groundwater.

Average annual MAR in the Llagas Subbasin from 2002 to 2011 is estimated to be about 24,000 AFY. Of the water recharged by the District between 2002 and 2011, imported water accounted for about 42 percent and local water accounted for about 58 percent (Todd, 2014).

Table 1 provides the construction data and average and maximum annual recharge for off-stream recharge facilities.

Table 1 Recharge Facility Construction Dates and Recharge Rates

Recharge Facility	Construction Date	Water Surface Area of Ponds[1] (acres)	Average Annual Recharge Capacity (AF)
Main Avenue Ponds	1955	6	2,700
Madrone Channel	1975	11	10,500
Church Avenue Ponds	1977-1979	34	7,300
San Pedro Ponds	1990 (temporary) 1996 (permanent)	8	4,700
Total		59	25,200

AFY – acre-feet per year
1 – from District, March 31, 2010, 2010 Baseline Groundwater Recharge Facility Capacity by Zone

2.5 Surface Water

The Llagas Subbasin is an inland valley that is drained to the south by tributaries of the Pajaro River, including Llagas Creek, the West Branch Llagas Creek, East Little Llagas Creek, and Uvas Creek. Uvas Creek and Llagas Creek are the main creeks entering the valley from the west. Uvas Creek becomes Carnadero Creek along its lower reaches. Combined, the major creeks drain a 104 square mile portion of the larger Pajaro River Watershed. Many smaller creeks feed into Uvas and Llagas creek in the Santa Cruz Mountains. Many other minor creeks enter the valley from the east and are tributary to Llagas Creek (Figure 2). The Pajaro River flows westerly along the Subbasin's southern boundary and discharges to Monterey Bay. To the north, a drainage divide separates the Llagas Creek from Coyote Creek, which drains to the north and San Francisco Bay.

Local runoff in the adjacent uplands is captured in reservoirs for managed aquifer recharge (MAR). The Chesbro and Uvas reservoirs are located in the Santa Cruz Mountains west of the Subbasin. The Coyote and Anderson reservoirs are located to the east and northeast of the Subbasin in the Diablo Range and drain north into Coyote Valley, which does not recharge the Llagas Subbasin. On an infrequent basis, when imported water is not available due to pipeline

maintenance or other causes, minor amounts of water have been diverted from the Coyote/Anderson reservoir for recharge in the Llagas Subbasin. In addition, a small portion of Coyote Creek overlies the Llagas Subbasin and water released for recharge in Coyote Valley may also recharge the Llagas Subbasin.

2.6 Soil

Figure 4 shows the soil hydrologic groups that define the infiltration rate of soils. Group A soils have high infiltration rates and readily drain, while Group D soils have very slow infiltration rates. Soil infiltration properties are one factor to consider for locating surface spreading facilities.

2.7 Geologic Setting

Geologic materials in the Study Area can be divided into water-bearing and non-water bearing. Non-water bearing formations transmit only limited quantities of water and include the mountainous areas to the east and west of the Subbasin and the bedrock underlying alluvium in the Subbasin (Iwamura, May 1995).

The water-bearing formations that constitute the groundwater Subbasin include the Santa Clara Formation and valley fill materials (alluvium, alluvial fan deposits, and colluvium) composed of semi-consolidated and unconsolidated heterogeneous mixtures of gravel, sand, silt, and clay. The Santa Clara Formation underlies much of the Subbasin overlying deeper non-water bearing bedrock. The Santa Clara Formation consists of fairly well consolidated alluvial sediments composed of interbedded sand, gravel, clayey gravel, silt, and clay (Iwamura, 1995). The Santa Clara Formation is similar in composition to the overlying unconsolidated deposits; however, the formation is more compacted and its water-bearing capacity is much lower than the overlying unconsolidated materials (DWR, May 1981).

The unconsolidated valley-fill material can be separated into 1) coarse grained stream channel deposits that form the primary aquifer intervals; 2) fine grained floodplain deposits, lateral to the stream channel, which form the primary aquitard units; and 3) colluvium and alluvial fan deposits flanking the uplands, which may also represent aquifer intervals. The stream channels have migrated over time through the process of avulsion, whereby a stream breaches its bank, and creates a new channel, or occupies an old channel forming discontinuous paleochannels in the subsurface. In the deeper zones along the axis of the Subbasin there are thick, coarse grained sediments associated with stacked paleochannels from the ancestral Coyote Creek (Mactec, August 2008). Mactec (March 2006) also defined a continuous basin-wide surficial unit of predominately coarse gravel.

The occurrence of fine-grained deposits increases in the central and southern portion of the Subbasin ranging in thickness from 20 to over 100 feet, most commonly encountered between 120 and 180 feet below ground surface (ft-bgs) (District, June 1989). While DWR (May 1981) speculated that the clay deposits in the southern Subbasin may have been associated with lake deposits, Mactec found depositional features inconsistent with lacustrine environments (Mactec, August 2008).

The contact between the base of alluvial materials and underlying bedrock dips inward from the east and west toward the axis of the Subbasin and to the south. Accordingly, the water-bearing materials are thicker along the axis of the Subbasin and thicken to the south reaching their maximum thicknesses at the southern extent of the Subbasin (DWR, May 1981). Depth to bedrock at the Subbasin boundary with the Coyote Valley is over 400 feet, reaching more than 700 feet in the deepest portions of the northern Subbasin. In the southern portion of the Subbasin, the water-bearing formations reach thicknesses over 1,000 feet near the Pajaro River (Abuye, September 2003). These thicknesses include both the unconsolidated alluvial/colluvial deposits and the underlying semi-consolidated Santa Clara Formation.

2.7.1 Geologic Faults

A number of faults have been mapped in the vicinity of the Subbasin including the Calaveras, Coyote Creek, and Chesbro faults. The faults displace older formations but are not thought to affect general groundwater flow within the Subbasin (DWR, May 1981). These faults were formed by regional transverse compressional forces that uplifted bedrock units east and west of the valley floor. Alluvial sediments were subsequently deposited in the structural low of the valley forming the groundwater basin.

2.8 Aquifers

The areal extent and thickness of fine grained materials have been used to subdivide the Llagas Subbasin into a confined zone and unconfined recharge areas (District, 2012) (see Figure 2). The extent and thickness of clay deposits increase toward the south and middle of the valley. As a result, the confined area occupies the south-central part of the Subbasin (Figure 2). Unconfined areas are also shown along the east and west sides of the southern portion of the basin (Figure 2). The boundary between the recharge areas and the confined area is gradual, and not known with precision. The boundary between the recharge and confined areas was originally defined by W. O. Clark on the basis of flowing artesian wells (1924). The recharge areas are located in the northern portion of the Subbasin and predominantly along the western edge of the southern Subbasin.

Others have proposed that a larger portion of the basin exhibits confined conditions. Based on extensive investigations conducted for the perchlorate contamination site in the Llagas Subbasin, AFW (April 2015) has proposed a layered aquifer system comprised of:

- Shallow Unconfined Aquifer (0 to ~60 feet ft-bgs)
- Intermediate Confined Aquifer (80 to ~200 ft-bgs)
- Deep Confined Aquifer (220 to ~450 ft-bgs)

and two main aquitards:

- A/B Aquitard (60 to ~80 ft-bgs) below the Shallow Aquifer
- B/C Aquitard (200 to ~220 ft bgs) below the Intermediate Aquifer

These encompass most of the Llagas Subbasin.

For reporting purposes, the District divides the Subbasin vertically into "Shallow" and "Principal" aquifers; the Shallow Aquifer includes all basin fill materials to a depth of 150 ft-bgs, and the Principal Aquifer includes all unconsolidated and semi-consolidated materials at greater depth.

2.9 Water Levels and Flow

The District monitors water levels in Subbasin wells and periodically prepares water level contour maps to assess changes in groundwater levels. However, because some of the monitored wells are production wells, which may be pumped and screened across more than one water-bearing zone, the maps are general in nature and may not be representative of certain local flow conditions. Nonetheless, they generally illustrate groundwater levels and flow in the Subbasin and changes over time.

Under natural conditions, groundwater in the Subbasin moves southeast toward the Pajaro River, roughly in the same direction as the surface water drainage. Groundwater can flow south beneath the Pajaro River toward pumping depressions in the adjacent Bolsa Groundwater Subbasin (Yates, December 2002) and can discharge to the Pajaro River. Depending on the relative groundwater levels in the Llagas and Bolsa subbasins, groundwater can also flow into the Llagas Subbasin from the Bolsa Subbasin. **Figure 5** shows groundwater elevation contour maps for spring and fall of 2010. The maps show that groundwater movement generally follows surface topography patterns, moving south toward the Bolsa Subbasin of the Gilroy-Hollister Valley Basin in San Benito County. Locally, groundwater also moves toward areas of intense pumping. Groundwater levels are influenced by recharge from off- and on-stream recharge activities in the recharge areas.

Based on Figure 5, the regional horizontal groundwater gradient is approximately 0.001 to 0.004 foot per foot.

A strong downward vertical flow gradient exists in the northern portion of the Subbasin that is generally absent in the southern portion of the Subbasin. The strong downward gradient in the northern Subbasin is due to a combination of MAR operations and municipal pumping (Mactec, January 2009). Several of the District's and City of Gilroy's monitoring wells at the southern end of the Subbasin are flowing artesian, indicating upward vertical gradients in the southern part of the Subbasin. Historically, marshes east of the City of Gilroy and south of what is now Pacheco Highway indicate an area of upward flow and groundwater discharge (Clark, 1924).

2.10 Aquifer Parameters

Various parameters are used to describe the hydraulic properties of an aquifer and well yields. Properties such as saturated thickness, hydraulic conductivity (permeability) and storativity are essential components of the existing Subbasin groundwater flow model. Typically the hydraulic conductivity in the Shallow Aquifer ranges from 100 to >200 feet per day (ft/d) and in the Principal Aquifer ranges from 2 to >600 ft/d.

2.11 Well Yields

The saturated thickness of aquifer material increases from north to south and along the axis of the basin providing greater available drawdown to water supply wells. Review of driller's logs and other references indicate that municipal production wells operated by the City of Morgan Hill in the northern portion of the basin yield between 240 and 1,500 gallons per minute (gpm). Municipal well yields are higher in the southern portion of the basin, where yields from City of Gilroy wells range from about 1,200 to 3,000 gpm (Fugro, February 2004). Well yields are also higher along the axis of the Subbasin where saturated thicknesses are greater (Fugro, February 2004). Review of driller's logs in the central portion of the basin indicates well yields between 100 and 1,400 gpm.

3 Groundwater Quality

3.1.1 General Water Quality

Natural groundwater quality within the Llagas Subbasin is generally good and is acceptable for potable, irrigation, and livestock uses with the exception of areas with elevated nitrate and a few remaining domestic wells in which perchlorate remains present above the MCL. Nitrate and perchlorate represent significant contaminants in the Subbasin, while solvents and petroleum hydrocarbons are rarely detected in the Principal Aquifer above the MCL.

3.1.2 Nitrate

Nitrate is widely detected in the Llagas Subbasin above the maximum contaminant level (MCL) of 45 micrograms per liter (mg/L). Elevated levels of nitrate in the Subbasin are thought to be due primarily to synthetic fertilizer application (LLNL, July 2005). Currently, approximately 30 percent of the Subbasin area is agricultural, which is a potential source of fertilizers and historically, there was more agricultural land in the Subbasin. Other sources of nitrate in the Subbasin include septic systems, greenhouse operations, urban runoff, manure used for fertilizers, historically-operated feedlots, dairies, egg farms, food packaging operations, a cogeneration facility, and treated wastewater disposal.

Nitrate concentrations are consistently higher in shallow monitoring and production wells compared with wells screened at greater depths. Nitrate concentrations are highest east of Highway 101 in the central and southern Subbasin with some of the highest concentrations in the southeast part of the Subbasin (LLNL, July 2005).

3.1.3 Volatile Organic Compounds (VOCs) and Fuel Leak Sites

There are a number of both active and closed fuel leak sites in the Llagas Subbasin; most of the open cases are located in the cities of Morgan Hill and Gilroy and along Highway 101. Based on the District's and Division of Drinking Water (DDW)-required monitoring data, there have been no detections of petroleum hydrocarbons or methyl-tert butyl ether (MTBE) above MCLs in the Principal Aquifer. MTBE is a historically-used gasoline additive that is more mobile in groundwater than petroleum hydrocarbons.

Other contaminant impacts to groundwater including volatile organic compounds (VOCs) are regulated under the Central Coast Regional Water Quality Control Boards (CCRWQCB's) Spills, Leaks, Investigation and Cleanup (SLIC) program. Due to the relatively rural and residential nature of the Subbasin, there are relatively few SLIC sites in the Llagas Subbasin. Based on the available data, there are no vertically and laterally extensive VOC groundwater plumes in the Principal Aquifer (i.e., water supply zones) in the Llagas Subbasin.

3.1.4 Perchlorate

The most significant single environmental release in the Llagas Subbasin is the perchlorate contamination associated with a former flare manufacturing facility. The California MCL for perchlorate is six micrograms per liter (µg/L). Perchlorate concentrations greater than the MCL

currently extend approximately four miles downgradient from the site in the Deep Aquifer (AFW, March 2015). The site has been undergoing remediation since 2004 and the number of domestic supply wells with concentrations above the MCL has declined substantially over time. Contamination in private and municipal water supply wells has been addressed through installation of well head and at-tap water treatment systems and provision of bottled water (MACTEC, March 2006).

4 Regulatory Requirements for Indirect Potable Reuse Projects

4.1 Division of Drinking Water

The State Water Resources Control Board (SWRCB), Division of Drinking Water (DDW - formerly the California Department of Public Health [CDPH]) has developed the Groundwater Replenishment using Recycled Water regulations (GWR Regulations). The final GWR Regulations were adopted and went into effect on June 18, 2014 (SWRCB DDW, May 2014). The GWR Regulations are organized by the type of project, including both 1) surface applications (surface spreading) and 2) subsurface applications (injection or vadose zone wells). A summary of the key provisions in the GWR Regulations for surface and subsurface application is presented in **Table 2**. A copy of the regulations are provided in Appendix A.

4.1.1 Pathogen Reduction Time (PRT) in the Saturated Zone

The GWR regulations require that water used for recharge achieve at least 12-log [2]enteric virus reduction, 10-log Giardia cyst reduction, and 10-log Cryptosporidium oocyst reduction. The treatment train is required to consist of at least three separate treatment barriers. For each pathogen, a separate treatment process can only be credited with up to a 6-log reduction and at least 3 processes must each achieve no less than 1-log reduction. Typically, the final reduction is achieved within the aquifer, after injection or percolation, based on travel time credits of 1-log per each 1-month travel time, up to a maximum of 6-log credits. The needed travel time underground to achieve the required pathogen reduction credit is specific to each project and recycled water facility treatment train. Once the required subsurface Pathogen Reduction Time (PRT) is determined by the treatment facility, it must be demonstrated that this travel time in the subsurface can be met prior to purified recycled water reaching a potable supply well.

Underground travel time can be estimated by analytical calculations such as through use of Darcy's Law or through groundwater modeling. Due to uncertainties in these methods, a correction factor is required by DDW. Estimated travel times with a Darcy calculation are divided by 4 and estimated travel times using a numerical model are divided by two. For example, if a Darcy calculation showed that the nearest potable supply well to a recharge project was 12 months travel time away, for planning purposes, the travel time would be divided by 4 and would be considered to be 3 months for permitting purposes.

[2] "Log" stands for logarithm, which is the exponent of 10. For example, 2-Log represents 10^2 or 10 x 10 or 100. Log reduction stands for a 10-fold (one decimal) or 90 percent reduction in numbers of live bacteria. Another way to look at it is: 1-Log Reduction would reduce the number of bacteria 90 percent. This means, for example, that 100 bacteria would be reduced to 10, or 10 reduced to 1.

The estimated travel time must ultimately be validated by tracer testing conducted under actual recycled water recharge operational conditions, using either an added or intrinsic tracer approved by DDW.

Table 2 DDW Regulations for Surface and Subsurface Recharge of Recycled Water

	Surface Application	Subsurface Application
Treatment	Title 22 definitions of filtered wastewater and disinfected tertiary-treated recycled water	Full advanced treatment including microfiltration, reverse osmosis and advanced oxidation process applied to the full recycled water volume
Total Organic Carbon (TOC)	Recycled water total organic carbon (TOC) = 0.5 milligrams per liter (mg/L)	Recycled water TOC = 0.5 mg/L
Pathogen reduction time (PRT)	Time required for recycled water to be retained underground to meet virus reduction requirement; for each month underground, 1-log virus reduction is credited	Time required for recycled water to be retained underground to meet virus reduction requirement; for each month underground, 1-log virus reduction is credited
Response retention time (RRT)	Minimum time that recycled water will be retained underground to allow the project sponsor to respond to a treatment failure. Minimum allowed RRT is 2 months, but it must be justified by the project sponsor. The RRT must be validated using an added tracer or DDW-approved intrinsic tracer.	Minimum time that recycled water will be retained underground to allow the project sponsor to respond to a treatment failure. Minimum allowed RRT is 2 months, but it must be justified by the project sponsor. The RRT must be validated using an added tracer or DDW-approved intrinsic tracer.
Recycled water contribution (RWC)	The RWC can be defined by volume and TOC. The recycled water applied at the groundwater recharge (GWR) Project ÷ (recycled water + credited dilution water). The Initial RWC_{min} can be = 0.5 mg/L ÷ the maximum TOC concentration in the recycled water (0.5 mg/L).	The RWC can be defined by volume and TOC. The recycled water applied at the GWR Project ÷ (recycled water + credited dilution water). The Initial RWC_{min} can be = 0.5 mg/L ÷ the maximum TOC concentration in the recycled water (0.5 mg/L).
Initial RWC_{max}	Based on DDW review of the Engineering Report and information obtained as a result of the public hearing Can range from 20% up to 100%	Based on DDW review of the Engineering Report and information obtained as a result of the public hearing Can range from 20% up to 100%
Increased RWC_{max}	Up to 100% subject to additional requirements: 1) Updated Engineering Report and Operations Plan 2) Approval by DDW and Regional Water Quality Control Board (RWQCB) and RWQCB permit 3) For the previous 52 weeks, the TOC 20-week running average has not exceeded 0.5 mg/L 4) Monitoring well(s) requirements met	Up to 100% subject to additional requirements: 1) Updated Engineering Report and Operations Plan 2) Approval by DDW and RWQCB and RWQCB permit 3) For the previous 52 weeks, the TOC 20-week running average has not exceeded 0.5 mg/L 4) Monitoring well(s) requirements met
Dilution water compliance calculation	Based on 120-month running average	Based on 120-month running average
Groundwater monitoring	At least two monitoring wells downgradient of the spreading grounds 1. One monitoring well must be located between two weeks to six months travel time and at least 30 days upgradient of the nearest drinking water well; and 2. One monitoring well must be located between the injection well(s) and the nearest downgradient drinking water well. 3. The monitoring wells must allow for samples to be obtained independently from each aquifer and validated as receiving recharge water from the spreading grounds.	At least two monitoring wells downgradient of the injection well(s). 1. One monitoring well must be located between two weeks to six months travel time and at least 30 days upgradient of the nearest drinking water well; and 2. One monitoring well must be located between the injection well(s) and the nearest downgradient drinking water well. 3. The monitoring wells must allow for samples to be obtained independently from each aquifer and validated as receiving recharge water from the injection well(s).
Engineering Report	Proposed recycled water recharge project require submittal of an Engineering Report to DDW.	Proposed recycled water recharge project require submittal of an Engineering Report to DDW.

4.1.2 Response Retention Time (RRT)

The GWR regulations also include provisions for the determination of a Response Retention Time (RRT), which is the time that recycled water must be retained underground between recharge and extraction from a potable supply well. The RRT is intended to allow a project sponsor ample time to identify treatment failures and to implement appropriate actions to protect public health from inadequately treated recycled water or recharge water. The minimum RRT allowed is 2 months, but the proposed RRT must be approved by the DDW. Based on other approved projects, the RRT is often measured in months. For example, the RRT for the Alamitos Gap and Dominguez Gap Seawater Intrusion Barriers, which have been approved to inject 100 percent advanced treated recycled water, have proposed RRTs of five months. Orange County Water District has a two month RRT for their mid-basin injection project.

Under the GWR regulations, and similar to the PRT, the RRT can be demonstrated for planning purposes by analytical analysis such as Darcy's Law calculations or by groundwater flow modeling, with the appropriate corrections due to inherent uncertainties in these methods.

As with the PRT, ultimately, the RRT must be verified with an added or intrinsic tracer test within 6 months after the project is put into operation.

The RRT represents a zone of controlled potable well construction. In addition, DDW requires definition of a secondary boundary representing a zone of potential controlled potable well construction, depicting the zone within which a well may extend the RRT boundary, thereby requiring further study and potential mitigating activities prior to potable well construction. It appears that this refers to the potential that new wells or changes in pumping patterns could enlarge the RRT travel distance.

4.1.3 Recycled Water Contribution (RWC) and Diluent Water

The initial maximum RWC for surface application projects using recycled water treated to levels less than fully advanced treated (FAT) must not exceed 0.20, or an alternative initial RWC approved by DDW. An alternative RWC up to 1.0 may be approved based on, but not limited to, the review of the project's Engineering Report, information obtained as a result of the public hearing(s), and a project sponsor's demonstration that treatment preceding soil aquifer treatment will reliably achieve total organic carbon (TOC) concentrations no greater than 0.5 mg/L when divided by the proposed RWC. A project sponsor can increase the RWC if 1) it is approved by the DDW and RWQCB; 2) for the previous 52 weeks, the total organic carbon (TOC) 20-week running average has not exceeded 0.5 mg/L ÷ $RWC_{proposed\ max}$; and 3) the permit allows the increase. The remainder of the water that replenishes the groundwater basin or subbasin should come from non-recycled water sources, which can include surface water/stormwater, imported water, potable water, or native groundwater flowing through the recharged water zone of influence. These water sources are referred to as "diluent" water. The recycled water divided by the sum of the recycled water and diluent water is referred to as the RWC.

The regulations do not specify the initial maximum RWC to the aquifer for subsurface injection. Only FAT recycled water can be used for subsurface injection projects. Ultimately, a RWC of 100 percent or 1.0 can be achieved for a recharge project utilizing FAT recycled water[3], eliminating the need for diluent water. As examples, the three seawater intrusion barriers in Los Angeles County have received approval to move to 100 percent RWC and the Orange County Water District (OCWD) has received approval to inject recycled water at a 100 percent RWC. A greater initial RWC was allowed for OCWD based on OCWD's demonstrated experience with recycled water recharge projects.

4.1.4 Groundwater Monitoring

Groundwater monitoring wells must be installed near the groundwater recharge project as described in Table 3. Two groundwater samples must be collected and tested for required analytes prior to groundwater recharge operations. While not required by the regulations, it is good practice to collect one to two years of quarterly data to assess seasonal variations in baseline conditions.

4.1.5 Engineering Report

The numerous requirements for the Engineering Report for a recycled water groundwater replenishment reuse project are described in the GWR Regulations (SWRCB DDW, May 2014). It should be noted that this high-level assessment is not intended to fulfill the DDW requirements for an Engineering Report. Rather, it is intended to provide a high-level assessment of potential recharge sites and the suitability of the Subbasin for IPR projects generally. Considerable additional studies and analysis will be required to fulfill the requirements for the project Engineering Report.

4.2 Regional Water Quality Control Board

The CCRWQCB regulates groundwater replenishment projects in the Central Coast Region under numerous state laws and regulations, including the Water Quality Control Plan (Basin Plan) (June 2011) and SWRCB Policies. The Basin Plan requirements include designated uses and groundwater objectives using both numeric and narrative requirements to protect those uses. The Basin Plan also applies the state's Anti-degradation Policy, which is further interpreted pursuant to the SWRCB Recycled Water Policy (January 2013).

Any proposed IPR projects in the Llagas Subbasin will necessitate issuance of Waste Discharge and Water Recycling Requirements (WDRs/WRRs) by the CCRWQCB. The WDRs/WRRs will establish monitoring and reporting requirements.

[3] "FAT" includes microfiltration, reverse osmosis, and advanced oxidation process (MF/RO/AOP).

4.3 Underground Injection Control

Under existing federal regulations for the Underground Injection Control (UIC) program, recycled water injection wells are "authorized by rule," which means they do not require a permit from the United States Environmental Protection Agency (USEPA) if they do not endanger underground sources of drinking water and comply with other UIC program requirements. For California, USEPA Region 9 is the permitting administrator for Class V wells (wells that are used to inject non-hazardous fluids underground). Any injection project planned in California must meet the Sources of Drinking Water Policy[4] which ensures protection of groundwater quality for drinking water supplies; thus, a Federal permit is not necessary. However, all Class V injection well owners in California are required to submit information to USEPA Region 9 on the well for USEPA's inventory.

[4] State Water Resources Control Board Resolution No. 88-63, as amended by Resolution No. 2006-0008.

5 Recycled Water Recharge Assessment

5.1 Previous Supply and Recharge Assessments

Maple and San Pedro Recharge Facilities Planning Study, Volume 1 Engineer's Report, October 1992, Kennedy Jenks Consultants

This study evaluated recharge at the Maple and San Pedro Avenue Recharge Facilities in the Morgan Hill area. The study documented good surface recharge potential at the San Pedro Avenue Site, which was subsequently developed into the San Pedro Ponds. The study documented unfavorable geologic conditions at two Maple Avenue sites for surface spreading.

This study points to the need for detailed site investigations to assess site-specific conditions relative to surface spreading with recycled water. Recharge in a location in the areas designated as a regional recharge or unconfined is not a guarantee of acceptable percolation rates.

South County Additional Off-Stream Recharge Feasibility Analysis, January 2004, District

This analysis notes that the Integrated Resources Planning Study (District, 2003) identified a need to develop an additional 11,000 AFY of recharge in South County (Llagas Subbasin and Coyote Valley) and that an additional 3,000 AFY is needed to replace recharge lost because the use of in-stream dams has been discontinued in South County.

This Feasibility Analysis identified three general areas where off-stream recharge areas might be sited in the central and northern portion of the Subbasin overlying the unconfined aquifer along the axis of the Subbasin (**Figure 6**). Areas of good recharge were identified based on an analysis of historic or abandoned stream channels and drainage ways, soils with high infiltration rates, stream levees, alluvial fan deposits, deeper groundwater, and steeper groundwater gradients from groundwater contour maps. **Figures 7**, **8**, and **9** show areas of good recharge potential based on the analysis of these key factors in Areas 1, 2, and 3, respectively (see Figure 6).

The report noted that the Main Ave., San Pedro Ave. and Church Ave. ponds had an average recharge from 1990 to 1998 of 7,062 AFY from 68 acres of ponds. It was estimated that an additional 135 acres of ponds would be necessary to recharge an additional 14,000 AFY of water.

South County In-Stream Recharge Feasibility Analysis, undated, SCVWD

This study assessed the potential for in-steam recharge along four stretches of Llagas and East Little Llagas creeks (**Figure 10**). The four proposed in-stream recharge sites are all within the areas identified as having significant potential for recharge in the previously described Off-Stream Recharge Feasibility Analysis. It was estimated that controlled recharge through use of spreader dams could account for between about 2,500 and 3,700 AFY of additional recharge.

South County Recycled Water Master Plan, October 2004, Carollo Engineers

This plan describes alternatives for increased use of recycled water in the Llagas Subbasin. The Plan focused on increased use of recycled water for non-potable uses such as irrigation and industrial applications and associated facilities, pipelines, storage, and pump stations necessary to supply new customers. The plan considered a small wastewater scalping plant in Morgan Hill, which could provide recycled water for non-potable uses in the vicinity of Morgan Hill. The plan also considered a pipeline routed north from the SCRWA facility parallel to the existing wastewater collection pipelines.

Church Avenue Ponds Groundwater Analysis Report, Santa Clara County, California, June 2007, Todd Engineers, included in Engineering Report for Perchlorate Recharge Mitigation Feasibility Study, prepared for the Santa Clara Valley Water District, June 2007, Kennedy/Jenks Consultants,

The Todd Engineers study assessed the water quality impacts of the District's recharge operations in the Church Avenue Ponds. The District's artificial recharge operations provide almost half of the recharge water to the Llagas Subbasin. Groundwater modeling conducted for the study demonstrated that recharge in the Church Avenue Ponds has provided dilution and associated remediation for a perchlorate plume originating from the former Olin flare manufacturing facility located on Tennant Avenue.

The study found that the District's artificial recharge of local and imported water has increased groundwater levels and storage and provided a relatively consistent source of dilution water to the Subbasin.

South County Water Supply Planning Project, Project Report, July 2010, SCVWD

District planning studies for the South County area have long recognized the need for additional MAR in the Llagas Subbasin. This Planning Report anticipated that groundwater demands in the Llagas Subbasin would increase by about 7,000 AFY by 2030 and between 4,000 and 16,000 AFY of additional water supplies would be needed to meet groundwater management objectives and provide a reliable water supply in the future.

One alternative evaluated in this report was advanced water treatment in Gilroy with delivery to Morgan Hill, including improvements to the Madrone pipeline and recharge in the Butterfield Channel, and/or recharge in the northernmost part of the Madrone Channel. The study also found that water shortfalls are more pronounced in the Morgan Hill area compared with the central and southern Subbasin areas.

The City of Morgan Hill owns and operates Butterfield Channel for stormwater management and City staff reports that the channel has good recharge capacity. This project identified the need for additional water supplies and the cities and County expressed their preference that those additional water supplies consist of recharge and recycling. The system and groundwater modeling performed for this project indicated that extending the Madrone Pipeline to Butterfield Channel and using the channel for recharge during the summer would be sufficient to meet future water supply needs in the Morgan Hill area. It is noted that the Olin perchlorate

cleanup site located on Tenant Avenue has discharged treated remedial groundwater to the Butterfield Channel.

Under existing DPH recycled water recharge regulations at the time of this assessment, either six months travel time or a 500 foot distance was required between recharge and the nearest water supply well. This assessment determined that there were no locations within the Llagas Subbasin in which there was sufficient distance between existing recharge facilities and the nearest water supply wells.

5.2 Project Assumptions

This evaluation assumes that 8.5 million gallons per day (mgd), or 9,500 AFY of purified recycled water would be available for IPR. The purified recycled water could be recharged through surface spreading or injection wells.

For planning purposes, it is assumed that any Llagas IPR project would be approved at an initial 100 percent RWC and there would be no need to identify dilution water. It is noted that DDW has approved initial 100 percent RWCs for other purified IPR projects.

The minimum DDW-required RRT is two months; however, most projects have RRTs and PRTs on the order of five to six months. For planning purposes, it is assumed that the RRT and PRT would be six months. This evaluation does not consider the larger, secondary zone of controlled potable well construction, which could potentially be greater than the six-month travel distance.

5.3 Travel Time to Nearest Potable Water Supply Wells

Figure 11 shows identified active, inactive, and standby potable supply wells. The District does not have location information for many driller's logs in the District files in the Llagas Subbasin (District, January 2004). Therefore, there could be additional, unrecorded potable supply wells not shown on the figure. The Llagas Subbasin is entirely reliant on groundwater for potable supply and outside of the cities of Morgan Hill and Gilroy, groundwater is provided by thousands of individual domestic wells. In addition some wells that have a designated use as agricultural may provide potable water to field laborers. Due to the large number of wells in the Llagas Subbasin and the fact that many property owners do not have access to any other source of potable water supply, water supply wells are a major limiting factor in siting IPR surface spreading or injection well facilities. While the District is the well permitting agency for the Subbasin, new potable supply wells could be constructed in the future, unless some new mechanism was put in place to restrict drilling of potable supply wells near IPR projects.

Investigations for the Olin perchlorate cleanup site have included estimates of groundwater velocity based on well specific capacity data from driller's logs and aquifer tests performed in monitoring wells. Estimated shallow zone groundwater velocities from these studies range from 0.8 to 4.7 feet per day (ft/d); intermediate zone velocities range from 0.2 to 21 ft/d; and deep zone velocities range from 0.03 to 0.7 ft/d (Mactec, January 2009). In addition, Lawrence Livermore National Laboratory (LLNL, July 2005) conducted an independent and scientific study

of groundwater in the Llagas Subbasin. Based on tritium concentrations and tritium-helium groundwater age data, LLNL estimated shallow groundwater velocities between 3.5 and 16 ft/d (LLNL, July 2005).

Assuming a groundwater velocity of 10 ft/d and a six-month RRT and PRT, a buffer area of 1,800 feet is shown around each well in **Figure 12.** Further, when applying a simple Darcy calculation such as this to estimate travel distances, there is a penalty applied by the DDW. The Darcy distance would be multiplied by 4 for a buffer distance of 7,300 feet (**Figure 13**). Assuming a 6 month RRT and PRT and Darcy-calculated buffer areas, IPR would be precluded by travel time limitations to nearby water supply wells in the entire Subbasin due to the density of potable water supply wells.

A more accurate estimation of RRT and PRT can be achieved using a calibrated groundwater flow model to reduce the buffer area around the wells and to take into account the groundwater flow direction, which will result in a narrower area cross-gradient to the groundwater flow direction. There is also a DDW-required correction for groundwater modeling estimates whereby the estimated travel distance would be multiplied by 2.

Based on the smaller 1,800 foot buffer areas shown in Figure 12 and assuming that groundwater flow modeling would result in smaller buffer areas, limited areas in the far northwest and northeast corners of the basin near Morgan Hill and areas in the southern portion of the Subbasin could be suitable sites for IPR. As described in the 2010 South County Water Supply Planning Report, the Morgan Hill area is more affected by water shortfalls and recharge facilities in this area would provide the greatest water supply benefit.

5.4 Spreading Facilities

Using the highest recharge observed in the existing Llagas Subbasin recharge facilities between 1988 and 2011 (Todd, 2014), the maximum recharge of 20,100 AFY or 300 AFY per acre over 59 acres of ponds results in an average recharge rate of 340 AF per acre per year. Assuming that 8.5 mgd or 9,500 AFY of purified recycled water is available for recharge, 28 acres of new spreading grounds would be required to recharge this volume outside of the existing spreading grounds. Based on Figure 12, all of the existing spreading facilities are within the assumed RRT of existing water supply wells. Also, because the purified water would be available year-round, and the existing spreading grounds could, at times, be filled to capacity with local and/or imported water, spreading grounds dedicated to recharge of purified water offer the best assurance of consistent available capacity to recharge purified water.

Based on Figure 12 (assuming modeling would result in smaller buffer areas than Darcy-estimated buffers), spreading grounds could be located in the far northeast and northwest corners of the Subbasin and at two sites along the eastern edge of the northern edge of the Subbasin. These areas were not evaluated in previous off-stream recharge evaluation (District, January 2004), but they are located in the recharge area above unconfined groundwater. The sites are located in or near the City of Morgan Hill. Locations near the city offer the benefit of having a municipal supply of potable water; such availability might justify prohibition of new

potable supply wells in the vicinity of IPR projects or replacing the water supply for existing domestic potable supply wells.

The District has identified areas in the central and northern portion of the Llagas Subbasin (January 2004) where good recharge potential for surface spreading exists. Recycled water recharge in these areas appears to be precluded due to the existence of potable supply wells and associated buffer zones.

The District has also determined that there are areas in the central and northern Llagas Subbasin that are favorable for in-stream recharge. Nonetheless, based on previous District research and information available from other agencies, the District has determined that in-stream recharge for IPR has several levels of complexities that will require additional studies and evaluations. Therefore, in-stream recharge is considered not as feasible as off-stream surface spreading or injection. In addition, the in-stream recharge areas identified as good for recharge are precluded by existing potable well buffer areas.

Based on Figure 12, there are larger areas in the southern portion of the Subbasin with adequate distance/travel time to existing potable supply wells. However, most of the southern portion of the basin is confined, preventing recharge with spreading facilities. Areas of recharge on the west of the Subbasin may be suitable for spreading facilities. Proposed recharge sites should be located as far north as possible to ensure that recharged purified water benefits the Subbasin and does not flow south into San Benito County. Therefore the recharge area in the southwest corner of the Subbasin not eliminated by well buffers is not a desirable area for spreading facilities.

Site-specific studies would be required to assess the suitability of the available areas for surface spreading of purified recycled water. Groundwater flow modeling could also be used to potentially reduce the buffer area around existing potable supply wells and enlarge the areas available for recharge of recycled water.

5.5 Injection Wells

A similar evaluation for injection wells assumes an injection rate of 500 gpm in the northern and central portion of the Subbasin and 1,000 gpm in the southern Subbasin. Injection rates are typically assumed to be about 50 to 80 percent of the pumping rate. Assuming injection in the central and northern Subbasin, a minimum of 19 wells would be needed to accommodate 9,500 AFY of recycled water. In the southern portion of the Subbasin, a minimum of 10 injection wells would be required to accommodate 9,500 AFY of recycled water. The City of Gilroy is one of the major water purveyors in the Subbasin. Accordingly, injection wells would be optimally sited north of Gilroy supply wells. Additional injection wells may be needed to accommodate well maintenance and assurance of injection capacity in the event of a well needing to be down for maintenance or repairs.

5.6 Analysis Summary

Surface spreading would be the preferred method of recharge in any of the unconfined recharge areas based on costs. Based on Figure 12, there are areas in the southern confined Llagas Subbasin where injection wells could be sited. More northern areas (within the southern Subbasin) are more desirable so that recharge water would be more likely to benefit the pumpers in the Subbasin. As with spreading grounds, facilities in or near the City of Gilroy are desirable because the city may be able to provide water supply to property owners in the vicinity of the IPR projects who might otherwise have or plan to drill a potable supply well.

Figure 14 shows a depth to groundwater chart for Well 11S04E10D004. The well location is shown on Figure 12 and is located in the vicinity of Gilroy. As shown on the figure, depths to groundwater fluctuate seasonally with greater depths to water in the summer months when agricultural pumping in the area is greater. It is noted that winter depths to water have varied between 6.5 and 20 feet below ground surface over the past 10 years. This indicates that at some times the available storage capacity in the area is low. In extended wet years, water levels in the Subbasin can be artesian. Injection wells in the area would be screened in the confined aquifer, and while the injection wells could be pressurized to push groundwater levels well above the ground surface to increase storage capacity, overly pressurizing an injection well can result in fracturing of the overlying confining layers and is not recommended. Therefore, installation of injection wells in the confined zone of the Llagas Subbasin should consider the available storage capacity in wet years. Even in the recent drought years, the depth to groundwater in the winter in this well has been around 20 ft-bgs, which does not represent a significant volume of available storage. Injection wells can be expected to result in groundwater mounding and reduced available storage capacity.

6 Next Steps

6.1 Assess Methods to Restrict New Potable Supply Wells

The biggest constraint to IPR in the Llagas Subbasin is the large number and density of potable supply wells. As groundwater is currently the only source of potable water supply, property owners outside of the water service areas of the cities of Gilroy and Morgan Hill and other water companies have no alternative source of water to an individual domestic well. Work is required to assess mechanisms to prevent drilling of new potable supply wells within the RRT, PRT and secondary zone of controlled potable well construction.

Additionally, it may be possible to switch some existing private domestic well owners to municipal water supplies, thus opening up greater areas to potential IPR sites. The District (January 2004) has identified desirable areas for surface recharge in the vicinity of Morgan Hill. If existing domestic water supply wells within the service area of the City of Morgan Hill could be connected to the Morgan Hill's municipal supply and the wells could be destroyed and taken out of service, it might be possible to site a surface spreading project in the northern Subbasin where water shortages are most pronounced. In addition to destroying existing domestic wells, a mechanism to prevent drilling of new potable supply wells in the vicinity of the IPR sites would be required.

6.2 Groundwater Modeling

The assessment presented above indicates that existing potable supply wells and the necessary buffer zones around the well are a significant factor limiting the siting of surface spreading and injection of recycled water. Therefore, the starting point for assessment of spreading and injection is the assessment of adequate separation from potable water supply wells.

Groundwater flow modeling is recommended to provide a more technically-rigorous and less conservative estimate of travel time to nearby water supply wells.

6.3 Site-Specific Studies

Site-specific studies such as the investigation of the Maple Avenue sites clearly indicate the need for substantial field work prior to a final decision about recharge pond siting. This applies to injection wells as well.

Depth to groundwater and degree of stratification of the sediments are important factors controlling the amount and rate of surface recharge possible as well as the potential for causing adverse shallow groundwater conditions.

As described in the off-stream recharge evaluation (District, January 2004), field investigations should be performed that allow a decision after each phase of work whether to continue or to begin with a different parcel if the site appears unsuitable. The field investigation for surface spreading should include drilling and sampling through the unsaturated zone at several locations and one deeper borehole, to 75 feet or so, depending on site conditions. Surface

geophysical methods, such as electro-magnetic and resistivity surveys (several types), can be used to identify coarse materials to a depth of 50 or 60 feet. Based upon the drilling results and the geophysical results, one or two trenches at least 15 feet deep and 30 to 50 feet long could be excavated, shored, logged, and sampled to provide a clear picture of subsurface conditions. Trench logging would allow verification of the geophysical surveys to interpret and define the continuity of sand and gravel deposits. Soil testing (ASTM D-422) may be performed to determine the precise amount of gravel, sand, silt, and clay present at critical depths from the investigation. Infiltrometer tests may be performed in the bottom of the trenches to get a rough idea of percolation rates. If the site meets recharge criteria, then test ponds should be installed. A series of shallow monitoring wells should accompany the test ponds to determine whether there is substantial horizontal migration of water from the test ponds.

In addition to the studies suggested by the District, Cone Penetrometer (CPT) logs are economical and a good technique to evaluate subsurface geologic conditions. Borings and collection of soil samples for hydraulic conductivity testing may also be useful. Multiple day percolation testing of multiple trenches in lieu of infiltrometer tests may be considered.

Site-specific studies should also include a survey of nearby water supply wells that may not be reflected in the District's database of wells or whose use may not be accurately listed. This might begin with a Google Earth™ search for well head facilities. Questionnaire mailings to all property owners within the estimated RRT and PRT of the proposed site are recommended followed with telephone or direct contact. The DDW requires that all well owners within 10 miles travel distance from the IPR project be notified of the project.

6.4 Environmental Contamination Sites

Another consideration in the siting of IPR sites is the potential to mobilize contaminants from environmental release sites. Reports and records for all nearby open and closed LUST, SLIC, and other contaminant release sites should be reviewed to assess this potential. The potential for mobilization of nitrate in the unsaturated zone or nitrate and perchlorate within clay lenses should be assessed. This can be accomplished through dissolution studies discussed in the next section.

6.5 Dissolution Studies

The compatibility of purified recycled water and groundwater should be evaluated for potential chemical reactions. Combining the two types of water might cause some minerals to precipitate out of solution and clog the pores of the aquifer. Precipitation typically involves common minerals composed of relatively abundant ions, such as carbonates and hydrous silicates. Biofouling of injection well screens and adjacent aquifer by iron bacteria may also occur. Finally, the injected water might cause naturally-occurring trace elements to dissolve or desorb from mineral surfaces in the aquifer. Examples include arsenic, chromium, lead, manganese and mercury. Similarly, rising groundwater due to mounding may dissolve solutes that may have accumulated in the unsaturated zone, such as nitrate, or remobilize legacy contamination.

A solid core, extraction, and core leaching test program is recommended to assess the potential for anthropogenic and naturally-occurring constituents to be leached or dissolved from the unsaturated or saturated zones as a result of proposed IPR Project recharge.

7 References

Abuye, C.W., September 2003, Llagas Subbasin Conceptual Hydrogeologic Model, Draft Summary.

Amec Foster Wheeler Environment and Infrastructure, Inc. (AFW), March 31, 2015, 2014 Annual Cleanup Progress Status and Fourth Quarter 2014 Groundwater Monitoring Report, prepared for Olin Corporation.

Amec Foster Wheeler Environment and Infrastructure, Inc. (AFW), April 29, 2015, Llagas Subbasin Hydrogeology, Santa Clara Valley Water District – Lync Webinar.

California Department of Water Resources (DWR), May 1981, Evaluation of Ground Water Resources South San Francisco Bay Volume IV: South Santa Clara County Area, Bulletin 118-1.

California Department of Water Resources (DWR), October 2003, California's Groundwater, Bulletin 118, 2003 Update.

Carollo Engineers (Carollo), October 2004 (2004b), Final South County Recycled Water Master Plan, prepared for Santa Clara Valley Water District and South County Regional Wastewater Authority.

Central Coast Regional Water Quality Control Board (CCRWQCB), June 2011, Water Quality Control Plan for the Central Coastal Basin.

CH2MHill, January 26, 2012, South County Regional Wastewater Authority Municipal Wastewater Treatment Facilities, 2011 Annual Report.

Clark, William O., 1924, Ground Water in Santa Clara Valley, California, USGS Water-Supply Paper 519, 1924.

Fugro West, Inc., February 2004, *Municipal Well Siting Study,* prepared for City of Gilroy.

Iwamura, 1995, Hydrogeology of the Santa Clara and Coyote Valleys Groundwater Basins, California; *in* Sangines, E. M., Andersen, D.W., and Buising, A.B., eds. Recent Geologic Studies in the San Francisco Bay Area; Pacific section SEPM, Vol. 76, p. 173-192.

Kennedy/Jenks Consultants, October 1992, Maple and San Pedro Ave Recharge Facilities Planning Study, Volume 1 Engineer's Report.

Kennedy/Jenks Consultants, Engineering Report for Perchlorate Recharge Mitigation Feasibility Study, prepared for the Santa Clara Valley Water District, June 2007.

Lawrence Livermore National Laboratory (LLNL), July 2005, California GAMA Program: Sources and transport of nitrate in shallow groundwater in the Llagas Basin of Santa Clara County, California, Contract No. W-7405-ENG-48.

Mactec, March 29, 2006, Llagas Subbasin Characterization, Santa Clara County, Olin/Standard Fusee, Morgan Hill California, prepared for Olin Corporation.

Mactec, August 3, 2007, Llagas Subbasin Groundwater Model Development, Santa Clara County, Olin/Standard Fusee, Morgan Hill California, prepared for Olin Corporation.

Mactec, January 30, 2009, Llagas Subbasin Characterization - 2008, Santa Clara County, Olin/Standard Fusee, Morgan Hill California, prepared for Olin Corporation.

Santa Clara Valley Water District (District), June 1989, Standards for the Construction and Destruction of Wells and Other Deep Excavations in Santa Clara County.

Santa Clara Valley Water District (District), January 20, 2004, South County Additional Off-Stream Recharge Feasibility Analysis.

Santa Clara Valley Water District (District), Undated, South County Additional Instream Recharge Feasibility Analysis.

Santa Clara Valley Water District (District), July 2010, South County Water Supply Planning Project, Project Report.

Santa Clara Valley Water District (District), OPAU Unit Manager, March 31, 2010, 2010Baseline Groundwater Recharge Facility Capacity by Zone.

Santa Clara Valley Water District (District), 2014, Annual Groundwater Report for Calendar Year 2013.

Santa Clara Valley Water District (District), January 14, 2014, January 14, 2014 Board Agenda Memo, item 4.2. Santa Clara Valley Water District (District), January 14, 2014, January 14, 2014 Board Agenda Memo, item 4.2.

Silva, Miguel, Santa Clara Valley Water District, Recycled Water Unit, August 24, 2015, verbal communication.

State Water Resources Control Board (SWRCB), May 2009 Draft, amended September 2012, October 2012, and January 2013, approved January 2013, Recycled Water Policy.

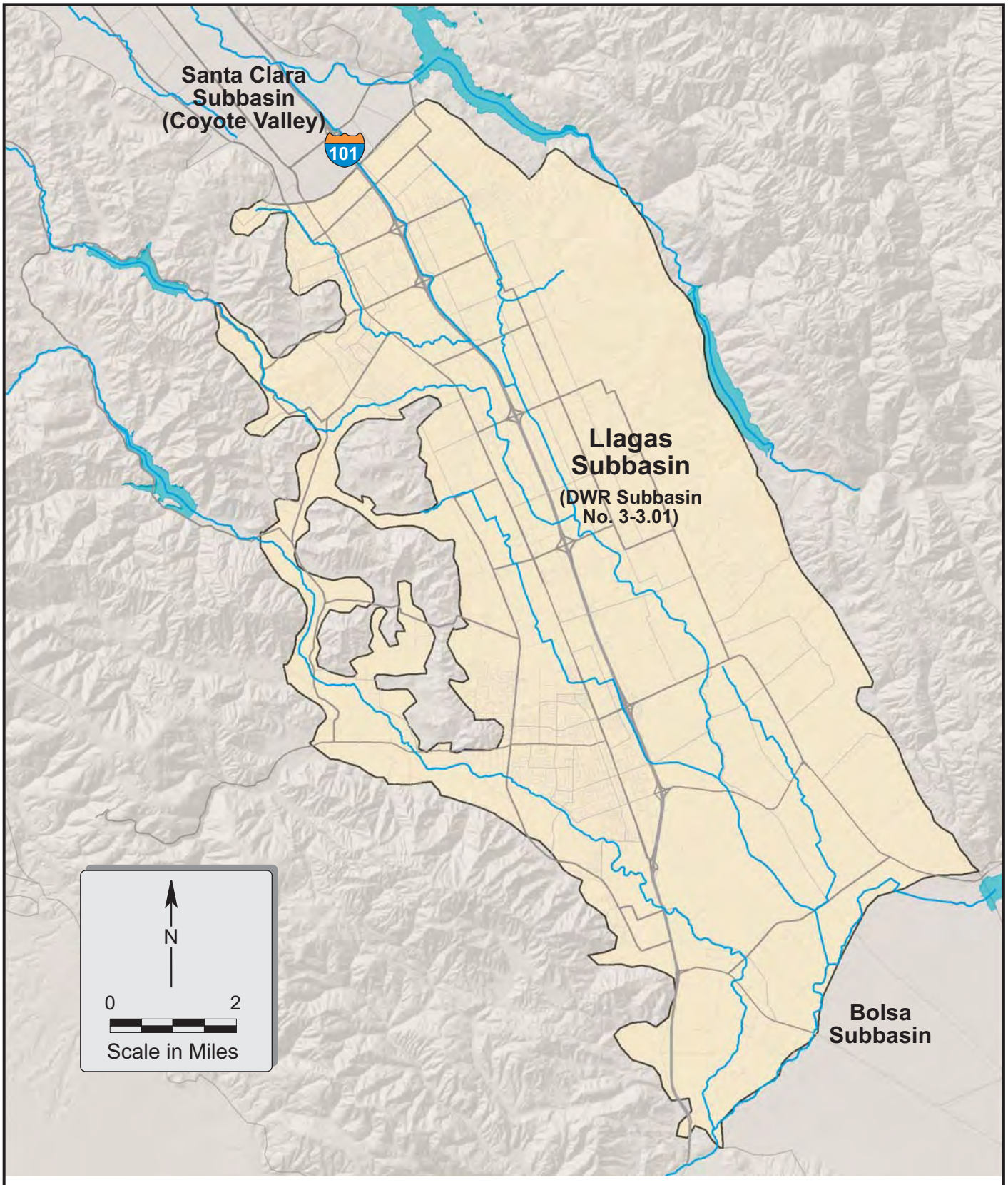
State Water Resources Control Board (SWRCB) Division of Drinking Water (DDW), May 30, 2014, Groundwater Replenishment using Recycled Water Regulations.

Todd Engineers, Church Avenue Ponds Groundwater Analysis Report, Santa Clara County, California, June 2007.

Todd Groundwater (Todd), December 2014, Final Salt and Nutrient Management Plan.

Yates, Gus, December 16, 2002, Consulting Hydrologist, Final Annual Groundwater Report for Water Year 2002, prepared for San Benito County Water District.

Figures



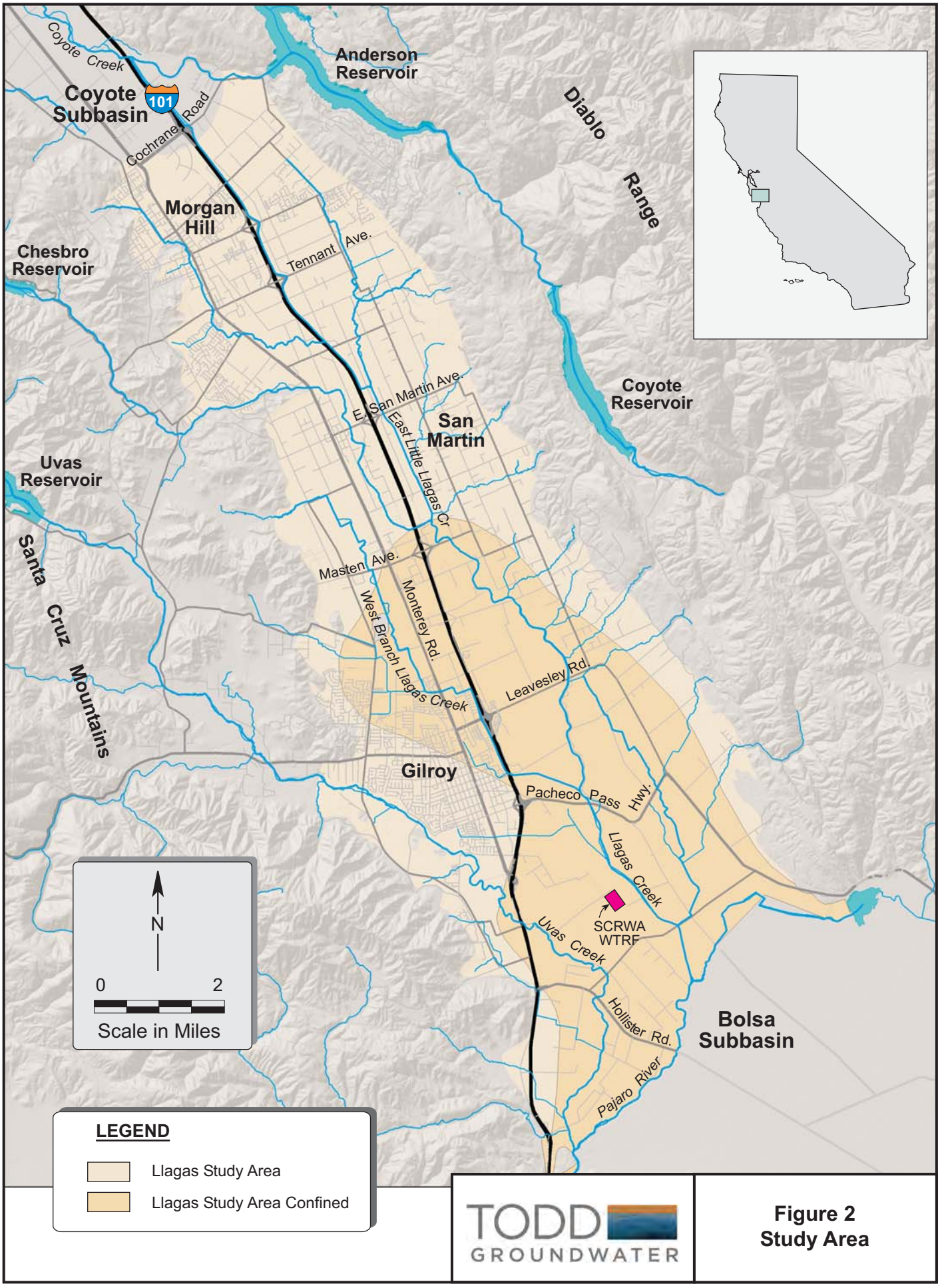
LEGEND

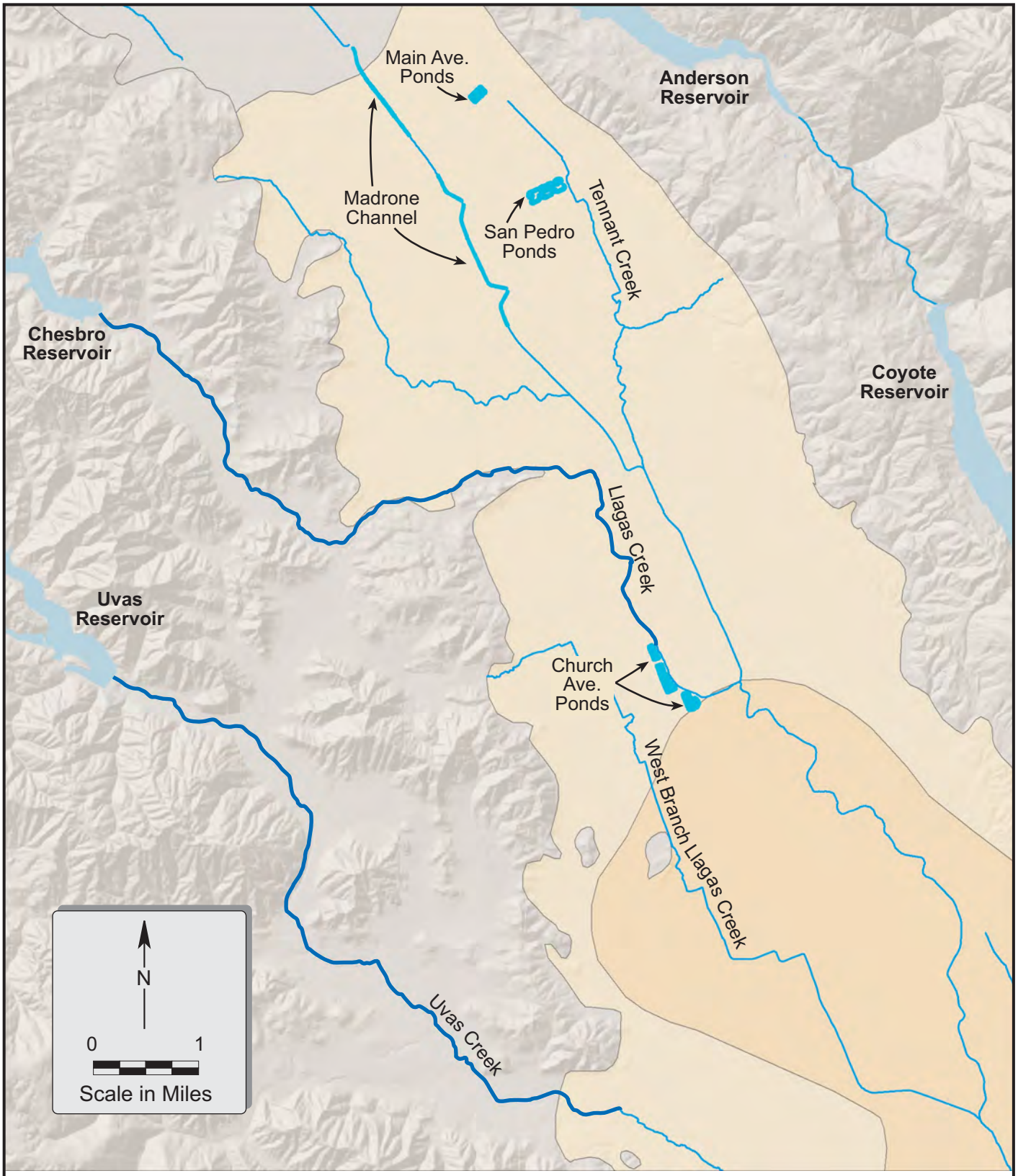
DWR-Designated Llagas Subbasin

DWR California Department of Water Resources

TODD GROUNDWATER

Figure 1
DWR-Designated Llagas Subbasin Boundary


Coyote Creek
Coyote Subbasin
101
Cochrane Road
Anderson Reservoir
Diablo Range
Morgan Hill
Chesbro Reservoir
Tennant Ave.
E. San Martin Ave.
East Little Llagas Cr.
San Martin
Coyote Reservoir
Uvas Reservoir
Santa Cruz Mountains
Masten Ave.
Monterey Rd.
West Branch Llagas Creek
Leavesley Rd.
Gilroy
Pacheco Pass Hwy.
Llagas Creek
SCRWA WTRF
Uvas Creek
Hollister Rd.
Bolsa Subbasin
Pajaro River
N
0
2
Scale in Miles
LEGEND
Llagas Study Area
Llagas Study Area Confined
TODD GROUNDWATER
Figure 2
Study Area

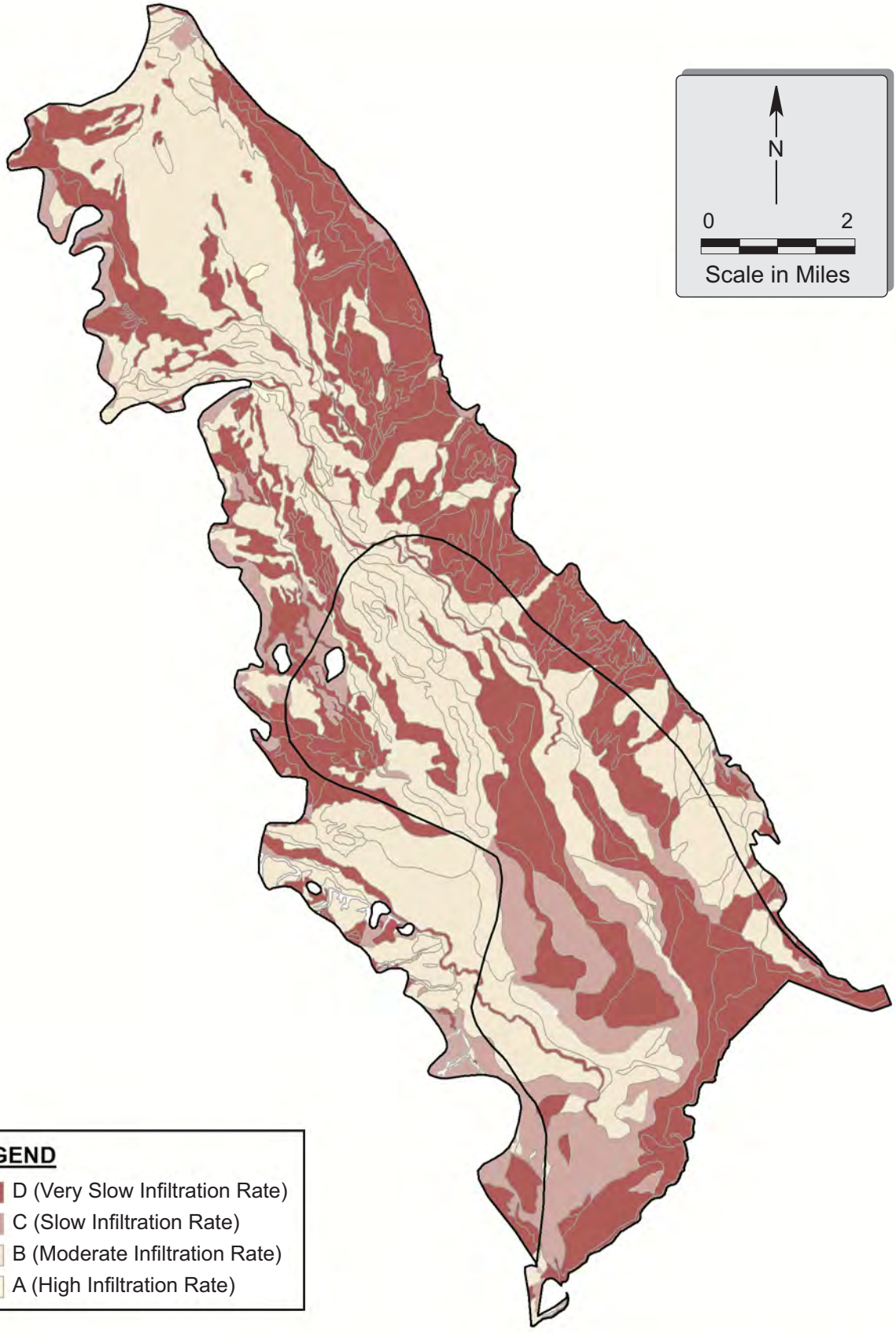


LEGEND

- Llagas Study Area Recharge
- Llagas Study Area Confined
- Recharge Pond or Facilities
- Instream Recharge

TODD GROUNDWATER

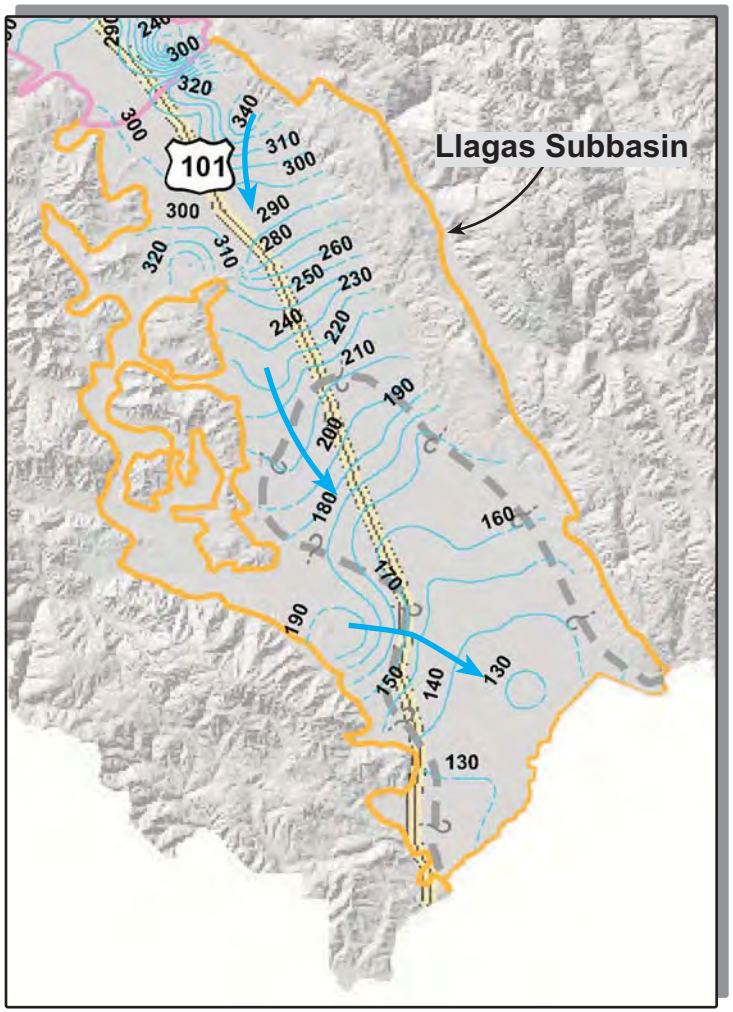
Figure 3
Recharge Facilities



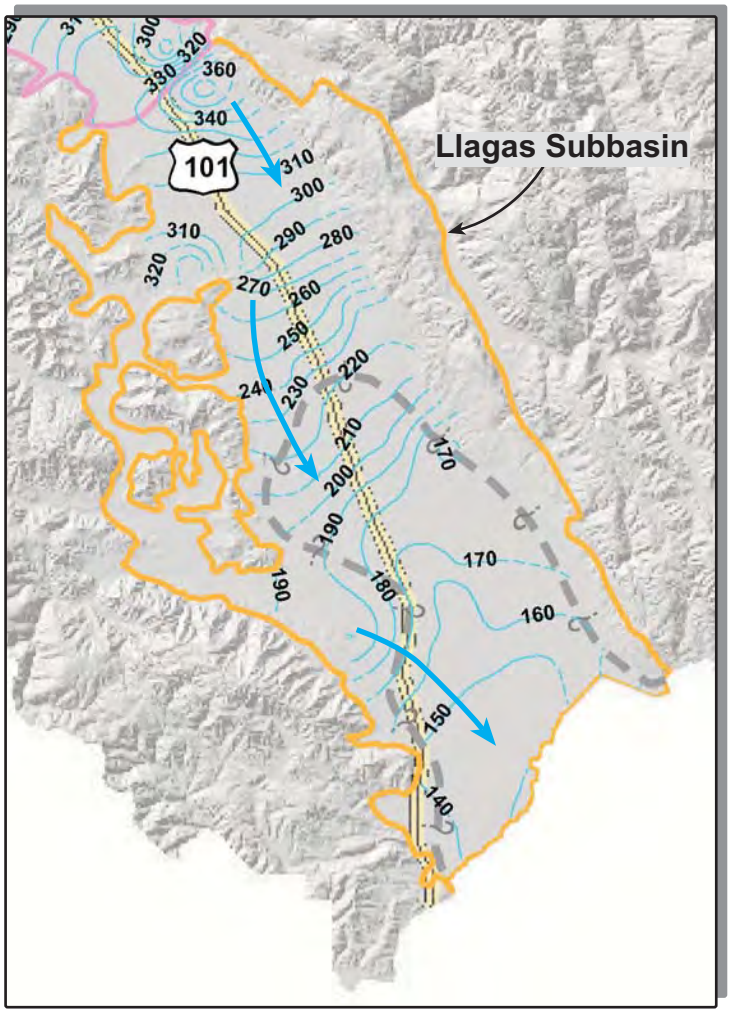
Source: USDA, 2010

TODD GROUNDWATER

Figure 4
Hydrologic Soil Groups



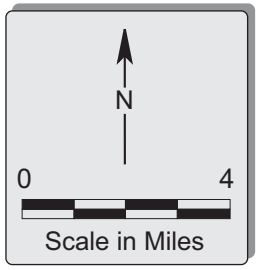
Spring 2010



Fall 2010

LEGEND

- Groundwater Elevation Contour (feet above MSL), dashed where less confident
- Approximate Extent of Confined Zone
- Groundwater Flow Direction



TODD GROUNDWATER

Figure 5
2010 Groundwater Elevation Maps

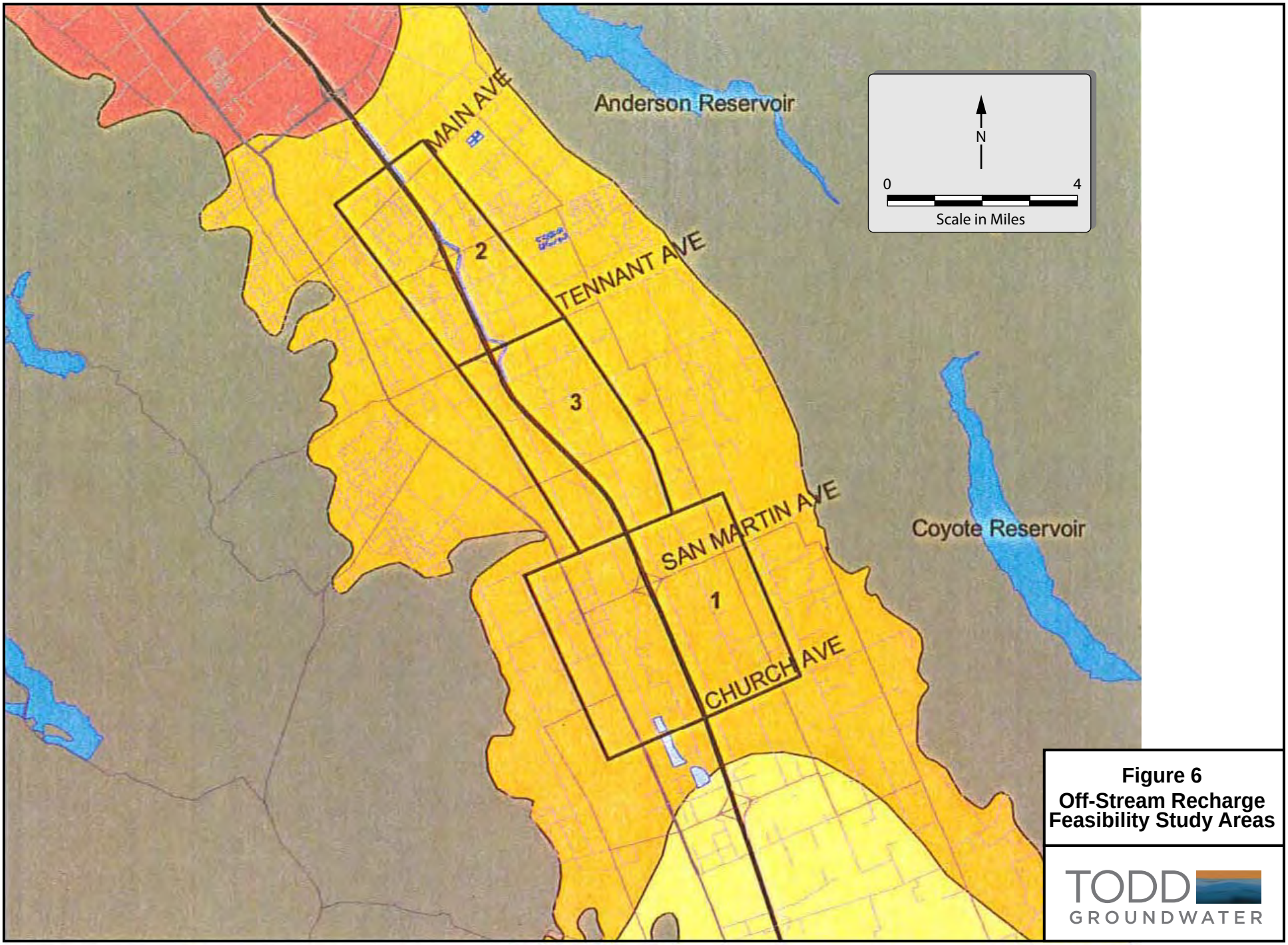


Figure 6
Off-Stream Recharge Feasibility Study Areas

TODD GROUNDWATER

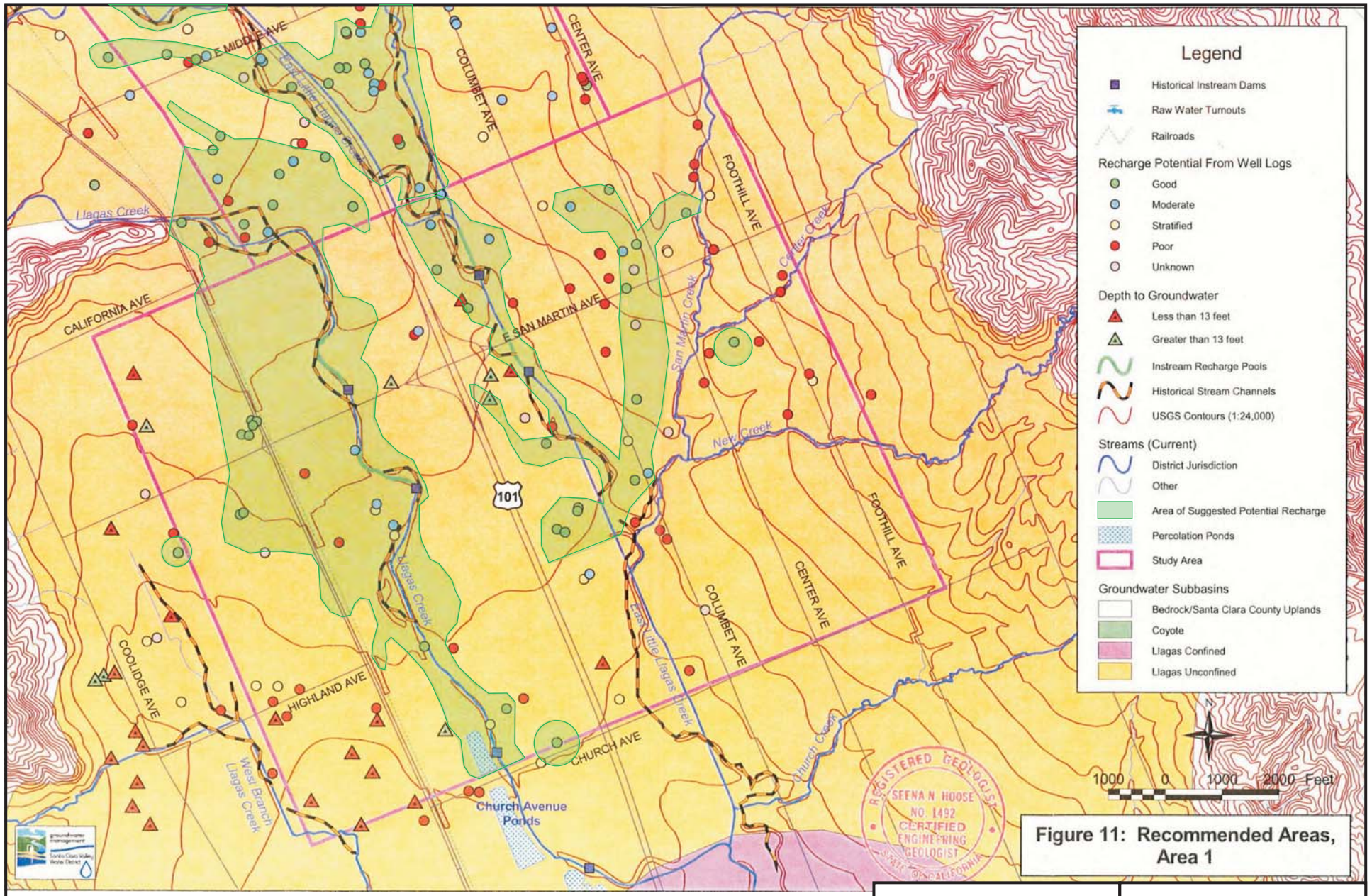


Figure 11: Recommended Areas, Area 1

From: District, January 2004, South County off-stream Recharge Feasibility Analysis

TODD GROUNDWATER

Figure 7
Recommended Off-Stream Recharge Areas in Area 1

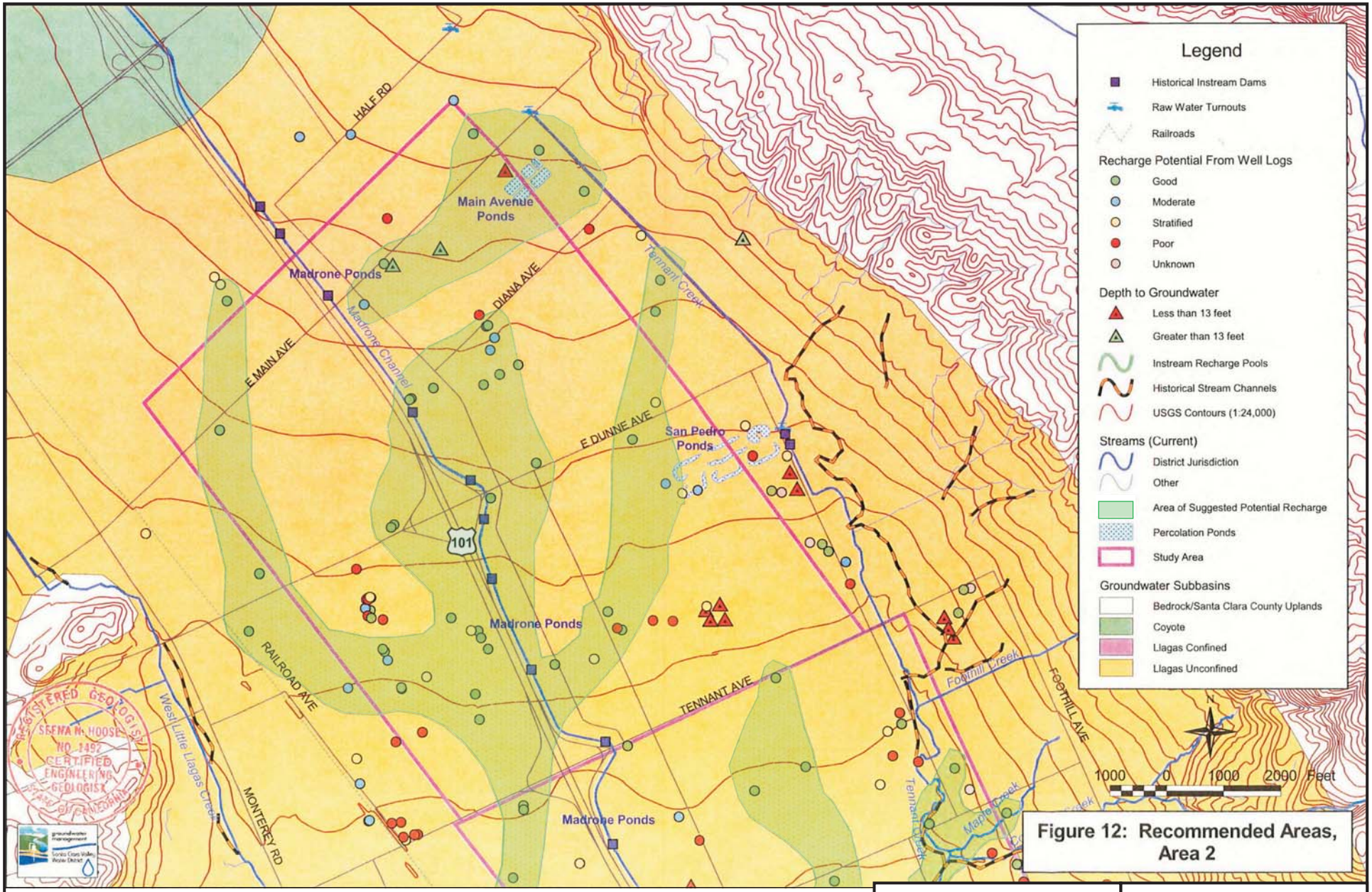


Figure 12: Recommended Areas, Area 2

From: District, January 2004, South County off-stream Recharge Feasibility Analysis

TODD GROUNDWATER

Figure 8
Recommended Off-Stream Recharge Areas in Area 2

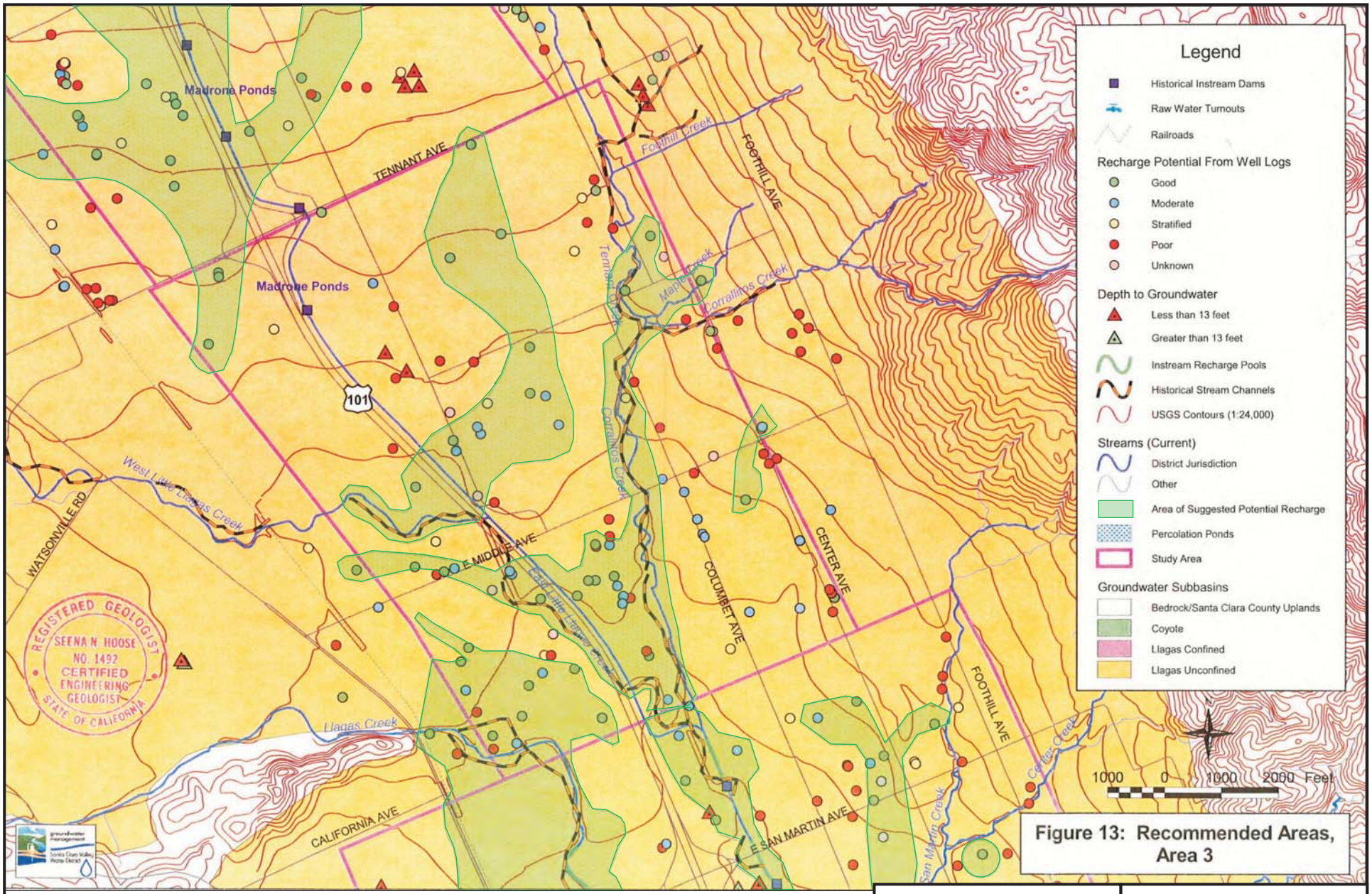
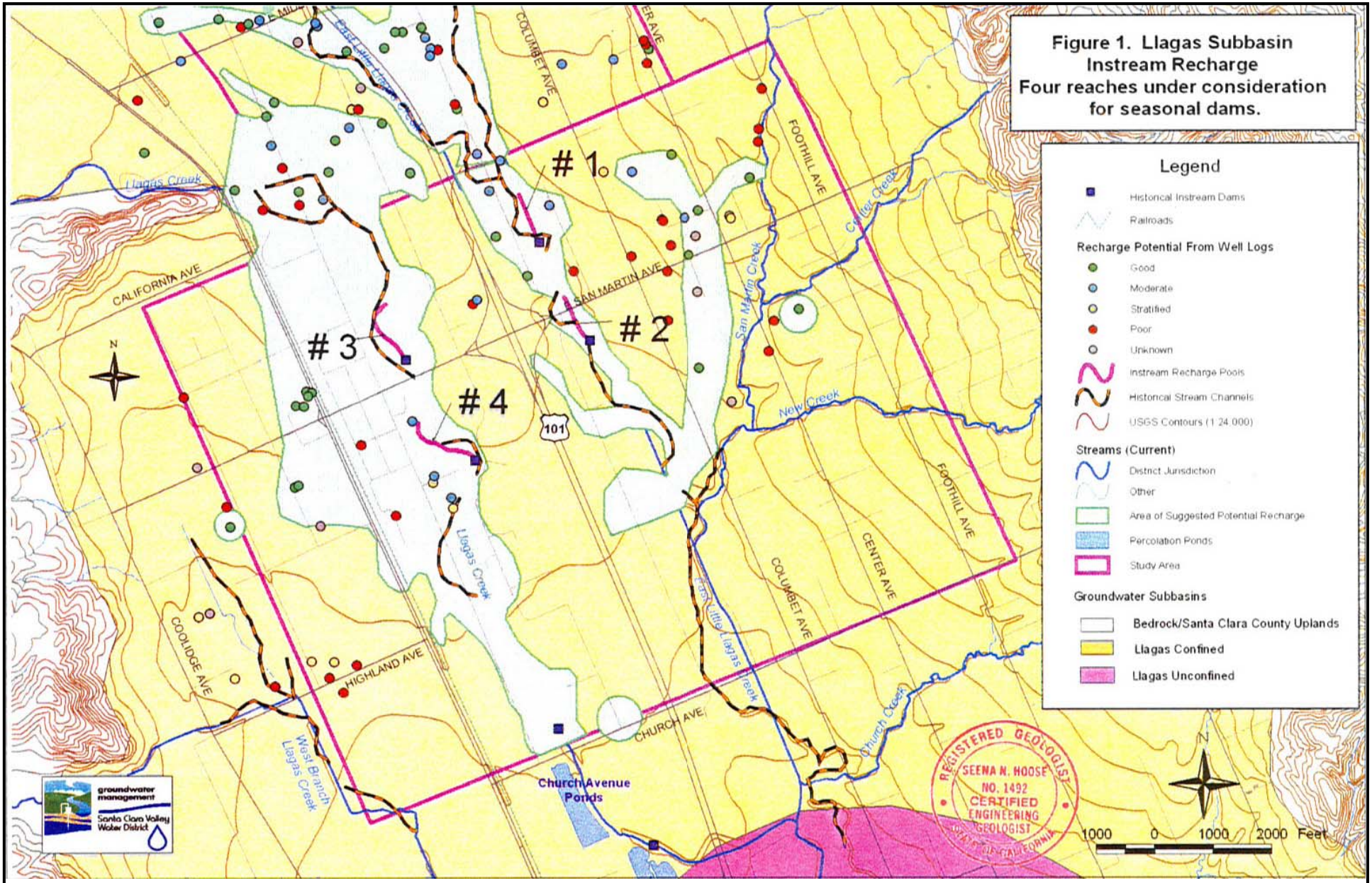


Figure 13: Recommended Areas, Area 3

From: District, January 2004, South County off-stream Recharge Feasibility Analysis

TODD GROUNDWATER

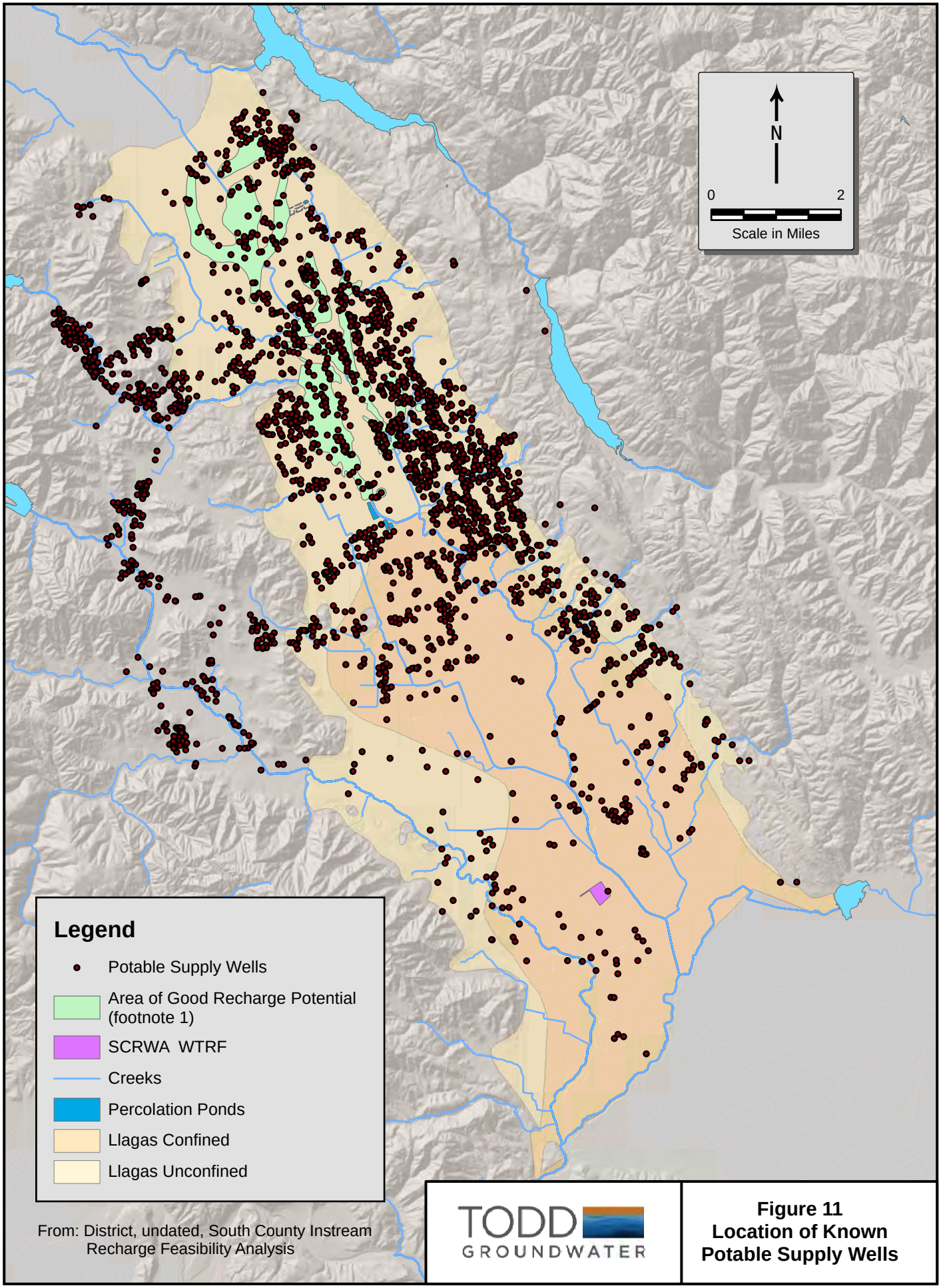
Figure 9
Recommended Off-Stream Recharge Areas in Area 3



From: District, Undated, South County Instream Recharge Feasibility Analysis

TODD GROUNDWATER

Figure 10
Areas of Good In-Stream Recharge Potential



From: District, undated, South County Instream Recharge Feasibility Analysis

TODD GROUNDWATER

Figure 11
Location of Known Potable Supply Wells

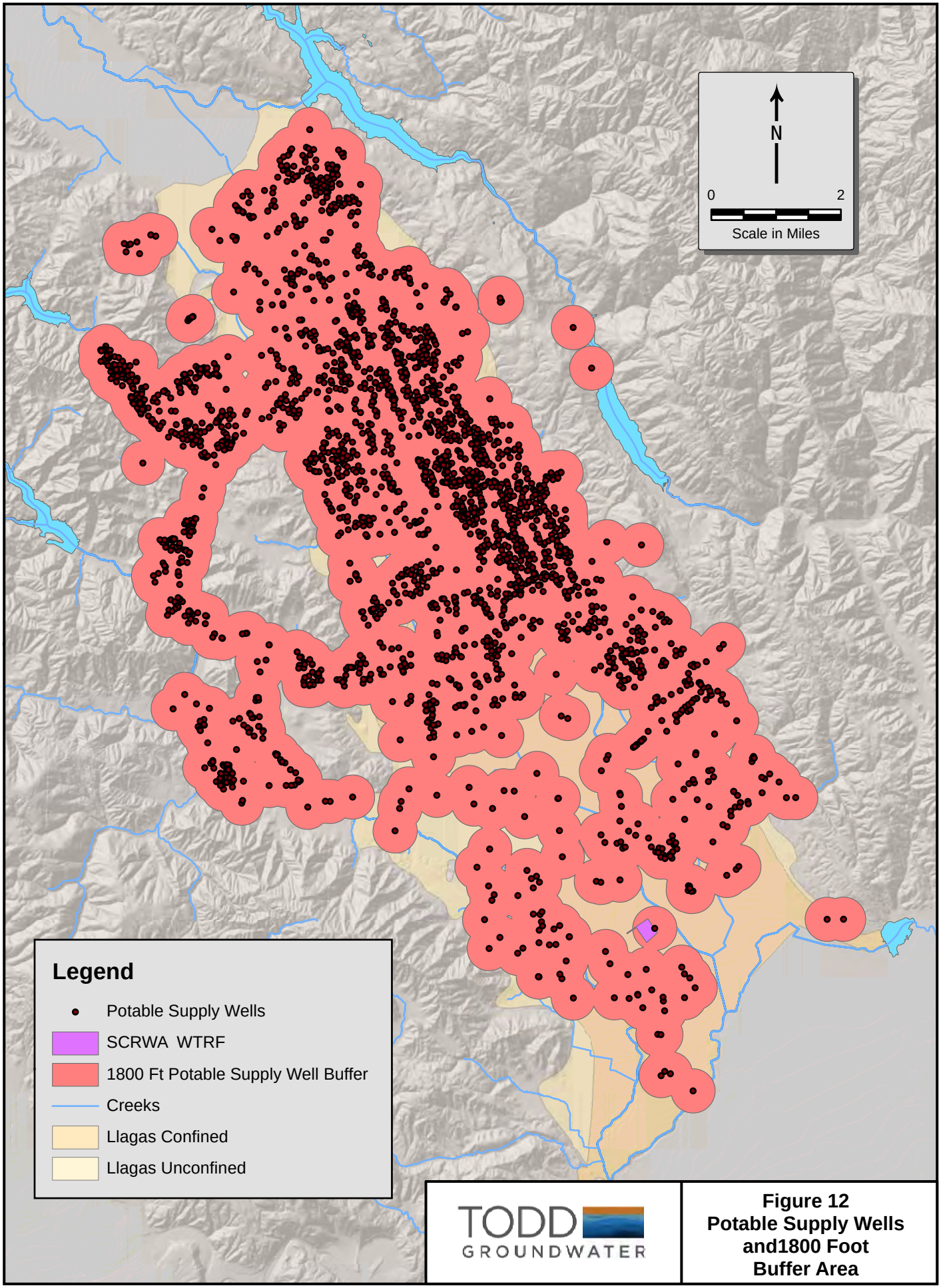


Figure 12
Potable Supply Wells and1800 Foot Buffer Area

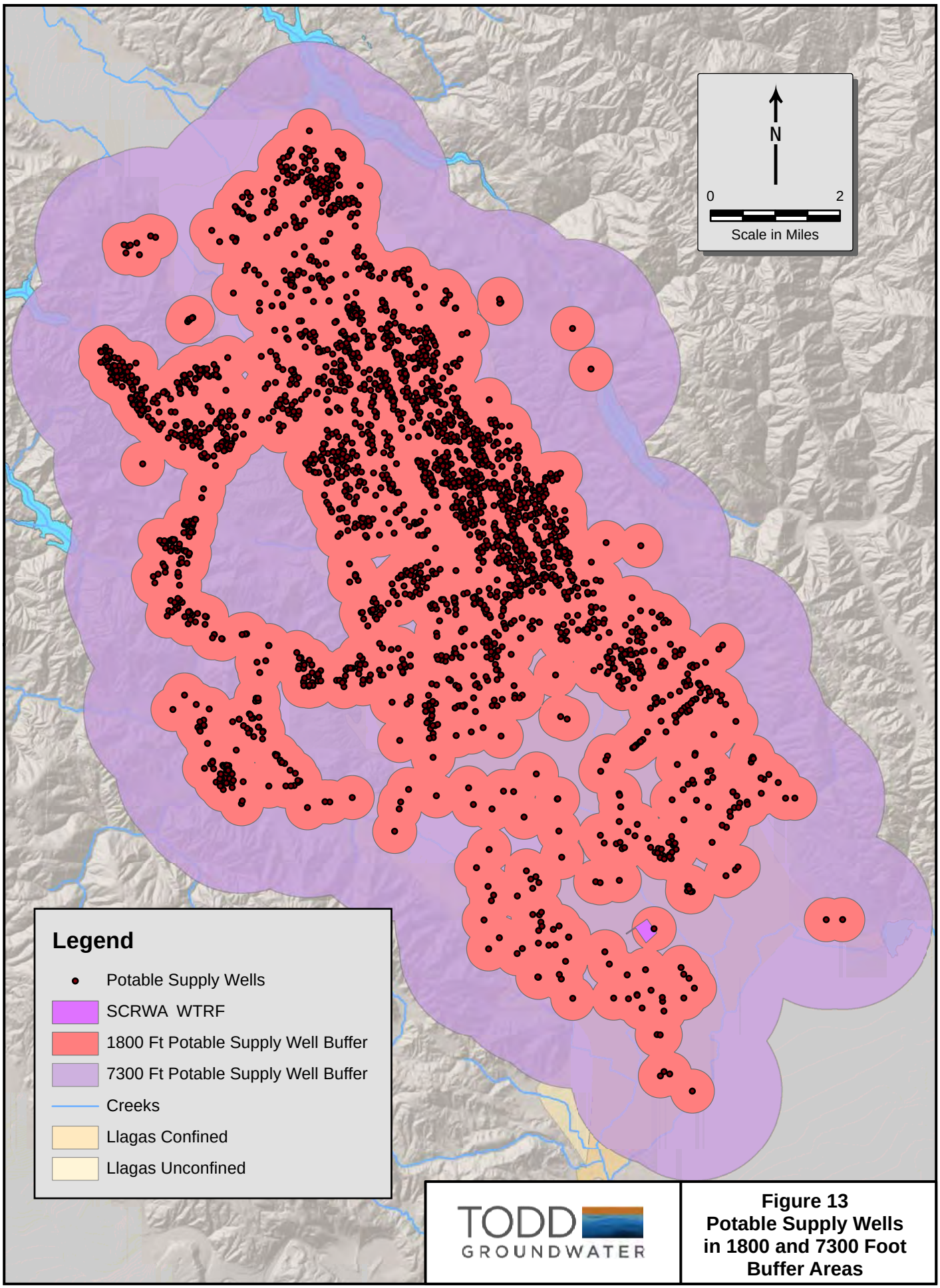
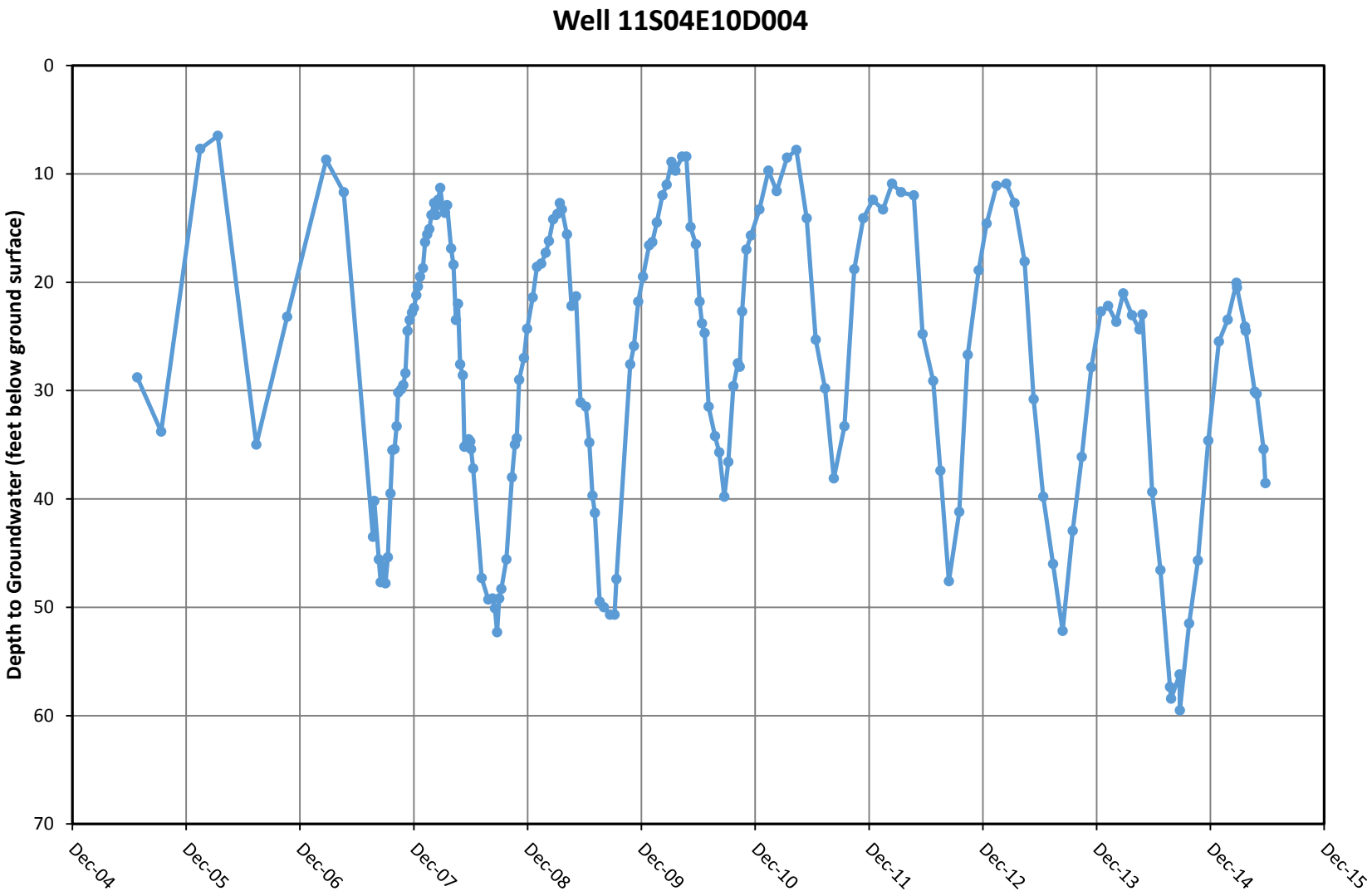


Figure 13
Potable Supply Wells in 1800 and 7300 Foot Buffer Areas



TODD GROUNDWATER

Figure 14
Depth to Groundwater
Well 11S04E10D004

APPENDIX H

COST ESTIMATE DETAILS

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Existing System: Operations and Maintenance

South County Recycled Water System Master Plan

Santa Clara Valley Water District/ South County Regional Wastewater Authority

Operation and Maintenance

Item No.	Description	Quantity	Unit	Unit Price		Total
1	**Purchased Power (Pumping Costs)**					
	Area 93 (North) Pump Station	432,000	kWh	$0.20	$	86,000
	Area 94 (South) Pump Station	65,000	kWh	$0.20	$	13,000
	Zone 2 (Christmas Hill) Pump Station	151,000	kWh	$0.20	$	30,000
	Sub-Total	648,000			$	129,000
2	**Maintenance of Distribution System**	14.5	Miles	3,500	$	51,000
3	**General Administration**	14.5	Miles	1,900	$	28,000
			Sub-Total		$	208,000
			Estimating Contingency	20%	$	42,000
			Total		**$**	**250,000**

Dollar per Arce Foot

Total Project Costs (Present Worth)	$	-
Annual Capital Project Costs for Distribution System Projects (5.5% interest over 30 years)	$	-
O&M Costs	$	250,000
Total Annual Costs	$	250,000
Average Flow (MGD)		1.20
Total Annual Flow (afy)		1,344
Dollar per Arce Foot - Annual Basis	**$**	**186**

Pump Power

	Area 93 (North) Pump Station	Zone 2 (Christmas Hill) Pump Station	Area 94 (South) Pump Station	Total kWh
Average Flow (MGD)	1.0	0.6	0.2	
Average Flow (gpm)	694	410	139	
TDH (psi)	106	63	80	
THD (ft)	245	145	185	
Pump Efficiency	0.65	0.65	0.65	
Horse Power	66	23	10	
Kilowatts	49	17	7	
Kilowatt Hours	432,000	151,000	65,000	**648,000**

Immediate Term: Preliminary Cost Estimate

South County Recycled Water System Master Plan

Santa Clara Valley Water District/ South County Regional Wastewater Authority

Item No.	Description	Size/Length	Unit	Unit Price		Total
1	**Distribution System Pipelines**					
	30-inches in Diameter	14,840	ft	$352	$	5,224,000
	24-inches in Diameter	4,130	ft	$261	$	1,078,000
	18-inches in Diameter	2,430	ft	$215	$	522,000
	12-inches in Diameter	3,650	ft	$174	$	635,000
	8-inches in Diameter	1,550	ft	$132	$	205,000
	Sub-Total				$	7,664,000
2	**Planned SCRWA Pump Station Upgrades[2]**					
	Area 94 (South) Recycled Water Pump Station Upgrade	2,100	gpm		$	945,000
	Sub-Total				$	945,000
3	**Other Planned Improvements at the SCRWA WWTP[2]**					
	UV Treatment Facility (9 MGD)		EA		$	3,500,000
	Sub-Total				$	3,500,000
	Sub-Total (Excluding Planned Pump Station and Treatment Plant Upgrades)				$	7,664,000
	Contingencies					
	Estimating			20%	$	1,533,000
	Construction			20%	$	1,840,000
	Administration			30%	$	3,311,000
	Planned SCRWA Projects Costs[2]				$	4,445,000
	Total Project Cost, Immediate Term CIP				**$**	**18,793,000**

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12/18/2015

Notes:

1. ENRCCI for July 2015: 10037
2. The planned SCRWA projects already include a 35% contingency

Immediate Term: Operations and Maintenance

South County Recycled Water System Master Plan

Santa Clara Valley Water District/ South County Regional Wastewater Authority

Operation and Maintenance

Item No.	Description	Quantity	Unit	Unit Price		Total
1	**Purchased Power (Pumping Costs)**					
	Area 93 (North) Pump Station	604,000	kWh	$0.20	$	121,000
	Area 94 (South) Pump Station	131,000	kWh	$0.20	$	26,000
	Zone 2 (Christmas Hill) Pump Station	42,000	kWh	$0.20	$	8,000
	Sub-Total	777,000			$	155,000
2	**Maintenance of Distribution System**	20	Miles	3,500	$	70,000
3	**General Administration**	20	Miles	1,900	$	38,000
			Sub-Total		$	263,000
			Estimating Contingency	20%	$	53,000
			Total		**$**	**316,000**

Dollar per Arce Foot

Total Project Costs (Present Worth)	$	18,793,000
Annual Capital Project Costs for Distribution System Projects (5.5% interest over 30 years)	$	1,293,000
O&M Costs	$	316,000
Total Annual Costs	$	1,609,000
Average Flow (MGD)		1.8
Total Annual Flow (afy)		2,016
Dollar per Arce Foot - Annual Basis	**$**	**798**

Pump Power

	Area 93 (North) Pump Station	Zone 2 (Christmas Hill) Pump Station	Area 94 (South) Pump Station	Total kWh
Average Flow (MGD)	1.4	0.6	0.4	
Average Flow (gpm)	972	410	278	
TDH (psi)	106	17	80	
THD (ft)	245	40	185	
Pump Efficiency	0.65	0.65	0.65	
Horse Power	93	6	20	
Kilowatts	69	5	15	
Kilowatt Hours	604,000	42,000	131,000	**777,000**

Short Term: Preliminary Cost Estimate

South County Recycled Water System Master Plan

Santa Clara Valley Water District/ South County Regional Wastewater Authority

Item No.	Description	Size/Length	Unit	Unit Price		Total
1	**Distribution System Pipelines**					
	30-inches in Diameter	5,810	ft	$352	$	2,045,000
	24-inches in Diameter	8,150	ft	$261	$	2,127,000
	12-inches in Diameter	2,630	ft	$174	$	458,000
	8-inches in Diameter	5,270	ft	$132	$	696,000
	Sub-Total				$	5,326,000
2	**Pump Station Upgrades**[2]					
	Area 93 (North) Recycled Water Pump Station Upgrade	2 x 1,600	gpm		$	1,500,000
	Sub-Total				$	1,500,000
3	**Storage Reservoir**[2]					
	Reservoir Expansion (additional 6 MG)		EA		$	5,953,500
	Sub-Total				$	5,953,500
4	**Other Planned Improvements at the SCRWA WWTP**[2]					
	Chlorine Contact Basin and Reservoir Retrun Pump Station Upgrade		EA		$	661,500
	Sub-Total				$	661,500
5	**Proposed Wholesaler/Retailer Improvement**[2]					
	Automated Flow Measurement and Smart Meter Conversion		EA		$	300,000
	Sub-Total				$	300,000
	Sub-Total (Excluding Planned Treatment Plant Upgrades)				$	5,326,000
	Contingencies					
	Estimating			20%	$	1,065,000
	Construction			20%	$	1,278,000
	Administration			30%	$	2,301,000
	Planned SCRWA Projects Costs/Wholesaler Improvements				$	8,415,000
	Total Project Cost, Short Term CIP				**$**	**18,385,000**

AKEL ENGINEERING GROUP, INC.

12/18/2015

Notes:

1. ENRCCI for July 2015: 10037
2. These projects already include a 35% contingency

Short Term: Operations and Maintenance

South County Recycled Water System Master Plan

Santa Clara Valley Water District/ South County Regional Wastewater Authority

Operation and Maintenance

Item No.	Description	Quantity	Unit	Unit Price		Total
1	**Purchased Power (Pumping Costs)**					
	Area 93 (North) Pump Station	648,000	kWh	$0.20	$	130,000
	Area 94 (South) Pump Station	130,000	kWh	$0.20	$	26,000
	Zone 2 (Christmas Hill) Pump Station	19,000	kWh	$0.20	$	4,000
	Sub-Total	797,000			$	160,000
2	**Maintenance of Distribution System**	24.1	Miles	3,500	$	84,000
3	**General Administration**	24.1	Miles	1,900	$	46,000
			Sub-Total		$	290,000
			Estimating Contingency	20%	$	58,000
			Total		**$**	**348,000**

Dollar per Arce Foot

Total Project Costs (Present Worth)	$	18,385,000
Annual Capital Project Costs for Distribution System Projects (5.5% interest over 30 years)	$	1,265,000
O&M Costs	$	348,000
Total Annual Costs	$	1,613,000
Average Flow (MGD)		2.0
Total Annual Flow (afy)		2,240
Dollar per Arce Foot - Annual Basis	**$**	**720**

Pump Power

	Area 93 (North) Pump Station	Zone 2 (Christmas Hill) Pump Station	Area 94 (South) Pump Station	Total kWh
Average Flow (MGD)	1.6	0.7	0.4	
Average Flow (gpm)	1111	493	278	
TDH (psi)	100	6	80	
THD (ft)	230	15	185	
Pump Efficiency	0.65	0.65	0.65	
Horse Power	99	3	20	
Kilowatts	74	2	15	
Kilowatt Hours	648,000	19,000	130,000	**797,000**

Long Term: Preliminary Cost Estimate

South County Recycled Water System Master Plan

Santa Clara Valley Water District/ South County Regional Wastewater Authority

Item No.	Description	Size/Length	Unit	Unit Price		Total
1	**Distribution System Pipelines**					
	18-inches in Diameter	7,010	ft	$215	$	1,507,000
	Sub-Total				$	1,507,000
2	**New Tank**					
	New 1.5 MG Zone 2 Tank	1,500,000	Gallons	$1.60	$	2,400,000
	Sub-Total				$	2,400,000
3	**New Pump Stations**					
	New 1,500 gpm Firm Capacity Zone 3 Pump Station	3 x 750	gpm		$	1,108,000
	Sub-Total				$	1,108,000
4	**Land Acquisition**					
	Land for new Tank and Zone 3 Pump Station	21,780	sqft	$15.00	$	327,000
	Sub-Total				$	327,000
5	**Other Planned Improvements at the SCRWA WWTP[2]**					
	SCRWA WWTP MBR Expansion Project		EA		$	50,000,000
	Recycled Water Fill Station		EA		$	850,500
	Sub-Total				$	50,850,500
	Sub-Total (Excluding Planned Treatment Plant Upgrades)				$	5,342,000
	Contingencies					
	Estimating Contingency			20%	$	1,069,000
	Construction Contingency			20%	$	1,282,000
	Administration Contingency			30%	$	2,308,000
	Planned SCRWA Projects Costs (Already Includes 35% Contingency per SCRWA Staff)				$	50,850,500
	Total Project Cost, Long Term CIP				**$**	**60,851,500**

AKEL ENGINEERING GROUP, INC.

12/18/2015

Notes:

1. ENRCCI for July 2015: 10037
2. The planned SCRWA projects already include a 35% contingency

Long Term: Operations and Maintenance

Project: South County Recycled Water Master Plan Update

Client: Santa Clara Valley Water District/ South County Regional Wastewater Authority

Operation and Maintenance

Item No.	Description	Quantity	Unit	Unit Price		Total
1	**Purchased Power (Pumping Costs)**					
	Area 93 (North) Pump Station	811,000	kWh	$0.20	$	162,000
	Area 94 (South) Pump Station	65,000	kWh	$0.20	$	13,000
	Zone 2 (Christmas Hill) Pump Station	35,000	kWh	$0.20	$	7,000
	Zone 3 Pump Station	91,000	kWh	$0.20	$	18,000
	Sub-Total	1,002,000			$	200,000
2	**Maintenance of Distribution System**	25.4	Miles	3,500	$	89,000
3	**General Administration**	25.4	Miles	1,900	$	48,000
			Sub-Total		$	337,000
			Estimating Contingency	20%	$	67,000
			Total		**$**	**404,000**

Dollar per Arce Foot

Total Project Costs (Present Worth)	$	60,851,500
Annual Capital Project Costs for Distribution System Projects (5.5% interest over 30 years)	$	4,187,000
O&M Costs	$	404,000
Total Annual Costs	$	4,591,000
Average Flow (MGD)		2.2
Total Annual Flow (afy)		2,464
Dollar per Arce Foot - Annual Basis	**$**	**1,863**

Pump Power

	Area 93 (North) Pump Station	Zone 2 (Christmas Hill) Pump Station	Area 94 (South) Pump Station	Zone 3 Pump Station	Total kWh
Average Flow (MGD)	2.0	1.3	0.2	0.7	
Average Flow (gpm)	1389	917	139	479	
TDH (psi)	100	6	80	32	
THD (ft)	230	15	185	75	
Pump Efficiency	0.65	0.65	0.65	0.65	
Horse Power	124	5	10	14	
Kilowatts	93	4	7	10	
Kilowatt Hours	811,000	35,000	65,000	91,000	**1,002,000**

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STANDARD SPECIFICATIONS AND DETAILS

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PART 1 – STANDARD SPECIFICATIONS

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SPECIFICATIONS FOR LARGE POLYETHYLENE PRESSURE PIPE FOR RECYCLED WATER

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide high density polyethylene (HDPE) pressure pipe, complete and in place, in accordance with the Contract Documents.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Commercial Standards

AWWA C906	Polyethylene (PE) Pressure Pipe and Fittings, 4 In Through 63 In, for Water Distribution and Transmission
ASTM D 3350	Polyethylene Plastics Pipe and Fittings Materials

1.3 CONTRACTOR SUBMITTALS

A. Furnish Shop Drawings of pipe, fittings, and appurtenances.

B. **Certifications:** Furnish a certified affidavit of compliance for pipe and other products or materials furnished under this Section:

1. Hydrostatic proof test reports.

2. Sustained pressure test reports.

3. Burst strength test reports.

C. A hydrostatic testing plan and schedule, including method for water conveyance, control, and disposal, shall be submitted in writing for approval by ENGINEER.

D. Expenses incurred in making samples for certification of tests shall be borne by the CONTRACTOR as part of the WORK.

1.4 QUALITY ASSURANCE

A. Each manufacturer shall have an approved in-house QA/QC program for compliance to the testing specifications and requirements of AWWA C906 for both pipe and fittings.

B. **Inspection:** Pipe shall be subject to inspection at the place of manufacture in accordance with the City standards as supplemented by the requirements herein. The CONTRACTOR shall notify the ENGINEER in writing of the manufacturing start date not less than 14 calendar days prior to the start of any phase of manufacture.

C. During manufacture of the pipe, the ENGINEER shall be given access to areas where manufacturing is in process confirm compliance with the Specifications.

D. **Tests:** Except as modified herein, materials used in the manufacture of the pipe shall be tested in accordance with the requirements of this Specification and in the referenced standards, as applicable.

E. The CONTRACTOR shall perform said material tests in accordance with the requirements of the Contract Documents. The ENGINEER shall have the right to witness testing conducted by the CONTRACTOR, provided that the CONTRACTOR'S schedule will not be delayed for the convenience of the ENGINEER.

F. In addition to those tests specifically required, the ENGINEER may request additional samples of any material for testing by the OWNER. The additional samples shall be furnished as part of the WORK.

PART 2 -- PRODUCTS

2.1 GENERAL

A. **Scope:** The pipe diameter shall be [[[ ]]] inch nominal and shall meet the specifications and requirements of AWWA C 906. Pipe shall be in [[[iron pipe sizes (IPS)]]] [[[ductile iron pipe sizes (DIPS)]]].

B. **Materials:** Pipe and fittings shall be made from prime virgin resins exhibiting a cell classification of PE 334434C as defined in ASTM D 3350, with an established hydrostatic-design basis of 1600 psi for water at 73 degrees F. The resin shall be listed by the PPI (Plastic Pipe Institute) in its pipe-grade registry Technical Report (TR) 4, "Listing of Plastic Pipe Compounds.

C. **Pipe and Fittings:** The pressure rating shall be [[[160 psi, DR 11.0]]]. Laying lengths shall be 40-ft standard. Both pipe and fittings shall be listed as compliant with NSF Standard 61 and shall bear the "NSF-pw" logo or mark. Pressure rating for all HDPE fittings shall be DR 9.

D. **Joints:** Pipe sections shall be joined by heat fusion.

E. **Marking:** Pipe and fittings shall be marked as prescribed by AWWA C906. Pipe markings shall include nominal size, OD base (ie: 12-inch ductile iron pipe sizing, DIPS), dimension ratio, pressure class, AWWA C906, manufacturer's name, manufacturer's production code including day, month, and year extruded, manufacturer's plant and extrusion line, and NSF - pw logo.

2.2 PLASTIC MARKING TAPE

A. The pipeline shall be marked with a purple marking tape labeled “Caution Recycled Water Below.” The tape shall be placed along the trench centerline at 6 inches above the pipe.

PART 3 -- EXECUTION

3.1 GENERAL

A. Laying, jointing, and testing for defects and for leakage shall be performed in the presence of the ENGINEER and shall be subject to approval before acceptance. All material found to be defective will be rejected and the CONTRACTOR shall promptly remove such materials from the Site.

B. Installation shall conform to AWWA M23, instructions furnished by the pipe manufacturer, and to the supplementary requirements or modifications herein. Wherever

the provisions of this Specification and the aforementioned requirements are in conflict, the more stringent provision shall apply.

3.2 HANDLING AND STORAGE

A. **Handling:** Pipe, fittings, and accessories shall be carefully inspected before and after installation and those found defective will be rejected. Pipe and fittings shall be free from fins and burrs. Before placing in position, clean pipe, fittings, and accessories, and maintain them in a clean condition. Proper methods shall be used for lowering sections of pipe into trenches. Under no circumstances shall pipe, fittings, or any other material be dropped or dumped into trenches.

B. **Storage:** Pipe shall be stored, if possible, at the Site in unit packages provided by the manufacturer. Caution should be exercised to avoid compression damage or deformation to the pipe. Pipe shall be stored in such a way as to prevent sagging or bending, and it shall be protected from exposure to direct sunlight by covering with an opaque material that allows adequate air circulation above and around the pipe. Gaskets shall be stored in a cool, dark place out of the direct rays of the sun, preferably in original cartons.

3.3 TRENCHING AND BACKFILL

A. Trench excavation and backfill shall conform to City standards.

3.4 JOINING

A. Prior to installation of any pipe, the manufacturer shall provide training in the recommended butt fusion and saddle fusion procedures, testing procedures, and any other installation methods required by the WORK. Training shall include the CONTRACTOR'S installation personnel, an OWNER'S representative, the ENGINEER'S representative, and any other personnel chosen by the OWNER. The CONTRACTOR shall record the names of trained personnel.

B. On every day that butt fusion joints are to be made, the first fusion of the day shall be a test. The test fusion shall be allowed to cool completely, then fusion test straps shall be cut out. Test strap length shall be 12-inches (min) or 30 times the wall thickness with the fused area in the center and width shall be 1-inch (min) or 1.5 times the wall thickness. The CONTRACTOR shall bend the test strap until the ends of the strap touch. If the test strap fails at the joint, the CONTRACTOR shall perform a new test to be cooled completely and bent as before. The CONTRACTOR shall not commence installation of pipe until a test fusion has passed the bent strap test.

C. The fusion machine used in the joining of the pipe shall incorporate a data logging device that records information related to each individual joint for the construction of the entire pipeline. The recorded information shall include at least the date and time of the fusion, the employee ID of the machine operator, the machine ID, the machine model, the piston area, pipe material, pipe size, the interfacial pressures (including heat, soak, fuse, cool), recommended gauge pressures (including heat, soak, fuse, cool), drag pressure, data logger probe temperature, and the external probe temperature.

3.5 INSTALLATION

A. Trench shall be graded in straight lines, taking care to avoid formation of any dips or low points. Pipe shall not be laid when the conditions of trench or weather are unsuitable. At

the end of each day's work, open ends of pipe shall be closed temporarily with wood blocks or bulkheads.

B. Pipe shall be cut by means of saws, power driven abrasive wheels, pipe cutters, or other manufacturer recommended methods that will produce a clean, square cut.

C. Pipe shall be supported uniformly and firmly at its proper elevation. Wood support blocking will not be permitted. The full length of each section of pipe and fittings shall rest solidly on the soil, with recesses to accommodate joints and couplings. Anchors and supports shall be provided where necessary and where indicated for fastening WORK into place. Fittings shall be independently supported.

D. Short lengths of pipe shall be used in and out of each rigid joint or rigid structure. Piping that does not allow sufficient space for proper installation of jointing shall be replaced.

E. Joints shall be installed according to manufacturer's recommendations. Trenches shall be kept free of water until joints have been properly made. The maximum combined deflection at any coupling shall be in accordance with the manufacturer's recommendations.

3.6 INSTALLATION OF COPPER WIRE

A. HPDE pipelines shall be provided with No. 10 AWG bare copper wire laid along the top of the pipe and held in place with ties or hitches of the same kind of wire spaced not more than 13-feet apart. Terminate the wire in a precast concrete box either adjacent to or part of the valve box, vault, turnout, or other structure into which the non-metallic pipe enters or at the end of the non-metallic pipeline. The termination boxes shall be covered with a cast iron lid. The boxes shall be located at grade in paved areas or 6-inches above grade in unpaved areas.

3.7 HYDROSTATIC TESTING OF PIPELINES

A. Pipeline 30-inches diameter and larger shall be visually inspected that all debris has been removed prior to flushing.

B. Prior to hydrostatic testing, pipelines shall be flushed or blown out as appropriate. The CONTRACTOR shall test pipelines in sections. Sections to be tested shall be defined by isolation valves in the pipeline. Where such valves are not present, the CONTRACTOR shall install temporary bulkheads or plugs for the purpose of testing. Sections that do not have isolation valves shall be tested in approximate one-mile segments. Sections that have a zero leakage allowance may be tested as a unit. No section of the pipeline shall be tested until field-placed concrete or mortar has attained an age of 14 Days. The test shall be made by closing valves when available or by placing bulkheads and filling the line slowly with water. The CONTRACTOR shall be responsible for ascertaining that test bulkheads are suitably restrained to resist the thrust of the test pressure without damage to or movement of the adjacent pipe. Unharnessed sleeve-type couplings, expansion joints, or other sliding joints shall be restrained or suitably anchored prior to the test to avoid movement and damage to piping and equipment. Remove or protect any pipeline-mounted devices that may be damaged by the test pressure. The CONTRACTOR shall provide sufficient temporary tappings in the pipelines to allow for trapped air to exit. After completion of the tests, such taps shall be permanently plugged. Care shall be taken that air relief valves are open during filling.

C. The pipeline shall be filled at a rate which will not cause any surges or exceed the rate at which the air can be released through the release valves at a reasonable velocity. The air within the pipeline shall be allowed to escape completely. The differential pressure across the orifices in the air release valves shall not be allowed to exceed 5 psi at any time during filling. After the pipeline or section thereof has been filled, it shall be allowed to stand under a slight pressure for at least 24 hours to allow the concrete or mortar lining, as applicable, to absorb water and to allow the escape of air from air pockets. During this period, bulkheads, valves, and connections shall be examined for leaks. If leaks are found, corrective measures satisfactory to the ENGINEER shall be taken.

D. The hydrostatic test shall consist of holding the indicated test pressure on the pipeline segment for a period of 4 hours. The test pressure for yard piping shall be as indicated on the Piping Schedule measured at the lowest point of the pipeline section being tested. No pressure test will be required for a reservoir overflow line. Visible leaks that appear during testing shall be repaired in a manner acceptable to the ENGINEER. Add water to restore the test pressure if the pressure decreases 5 psi below test pressure during the test period.

E. Pipe with welded joints shall have no leakage. Exposed piping shall show no visible leaks and no pressure loss during the test. In the case of pipelines that fail to pass the leakage test, the CONTRACTOR shall determine the cause of the leakage, shall take corrective measures necessary to repair the leaks, and shall again test the pipeline, repeating as necessary until the pipeline passes.

- END OF SECTION -

SPECIFICATIONS FOR MISCELLANEOUS VALVES

PART 1 -- GENERAL

1.1 THE SUMMARY

A. The CONTRACTOR shall provide miscellaneous valves and appurtenances, complete and operable, in accordance with the Contract Documents.

1.2 CONTRACTOR SUBMITTALS

A. Furnish the following information on Shop Drawings:

1. valve name, size, Cv factor, pressure rating, identification number (if any), and specification section number;

2. complete information on the valve actuator, hydraulic power units (HPU), pneumatic air supply system including size, manufacturer, model number, limit switches, and mounting;

3. cavitation limits for control valves;

4. assembly drawings showing part nomenclature, materials, dimensions, weights, and relationships of valve handles, hand wheels, position indicators, limit switches, integral control systems, needle valves, and control systems;

5. data in accordance with Electric Motors Specification, for electric motor-actuated valves;

6. complete wiring diagrams and control system schematics; and,

7. A valve-labeling schedule, listing the valves to be furnished with stainless steel tags, indicating in each case the valve location and the proposed wording for the label.

B. Furnish a technical manual containing the required information for each valve, as indicated.

C. Furnish a spare parts list, containing the required information for each valve assembly, as indicated.

D. Factory Test Data

1. Where indicated, submit signed, dated, and certified factory test data for each valve requiring certification, before shipping the valve.

2. Furnish a certification of quality and test results for factory-applied coatings.

E. Field Test Data

1. Submit signed, dated, and certified field test data for each valve.

PART 2 -- PRODUCTS

2.1 AIR-VACUUM AND AIR-RELEASE VALVES

A. Air and Vacuum Valves: Air and vacuum valves shall be capable of venting large quantities of air while pipelines are being filled, and allowing air to re-enter while pipelines are being drained. They shall be of the size indicated, with flanged or screwed ends to match piping. Bodies shall be of high-strength cast iron. The float, seat, and moving parts shall be constructed of Type 316 stainless steel. Seat washers and gaskets shall be of a material insuring water tightness with a minimum of maintenance. Valves shall be designed for minimum 150 psi water-working pressure, unless otherwise indicated.

B. Air-Release Valves: Air-release valves shall vent accumulating air while system is in service under pressure and be of the size indicated. Valves shall meet the same general requirements as indicated for air and vacuum valves except that the vacuum feature will not be required. Valves shall be designed for a minimum water-working pressure of 150 psi, unless otherwise indicated.

C. Combination Air Valves: Combination air valves shall combine the characteristics of air and vacuum valves and air release valves by exhausting accumulated air in systems under pressure and releasing or re-admitting large quantities of air while a system is being filled or drained, respectively. Valves shall have the same general requirements as indicated for air and vacuum valves.

D. Sewage Air Release Valves: Sewage air release valves shall vent accumulating gases during system operation. Valves shall have long float stems and bodies to minimize clogging. The same general requirements shall apply as indicated for air and vacuum valves. Each sewage air release valve shall be furnished with the following backwash accessories, fully assembled on the valve:

1. Inlet shut-off valve.

2. Blow-off valve.

3. Clear water inlet valve.

4. Rubber supply hose.

5. Quick disconnect couplings.

E. Manufacturers, or Equal

1. **APCO (Valve and Primer Corporation)**

2. **Crispin - Multiplex Manufacturing Company**

3. **GA Industries**

4. **Val-Matic (Valve and Manufacturing Corporation)**

2.2 VACUUM RELIEF/AIR INLET VALVE FOR SURGE TANK

A. A vacuum relief/air inlet valve shall be installed on the surge tank. The vacuum relief/air inlet valve shall be normally closed, capable of admitting large quantities of air into the

system immediately should the system pressure become negative and preventing a vacuum from forming during draining, pipeline rupture, or water column separation. The valve shall be of the size indicated, with flanged ends to match piping connections. Bodies shall be of high-strength cast iron with a steel hood. The float, seat, spring, and moving parts shall be constructed of Type 316 stainless steel. The internal valve-plug and seat shall be heavy cast brass. The plug shall be normally closed by means of a stainless steel spring and shall open when a vacuum/pressure differential exceeds 0.25 psi or less. Seat seal shall be of Buna-N providing a drip-tight seal. Valves shall be designed for minimum [[[150 psi]]] water-working pressure, unless otherwise indicated.

B. Manufacturers, or Equal

1. **APCO (Valve and Primer Corporation)**

2. **Val-Matic (Valve and Manufacturing Corporation)**

2.3 BACKFLOW PREVENTER VALVES

A. General

1. Provide backflow preventers that work on the reduced pressure principle.

2. Provide drain lines with air gaps.

3. The backflow preventer valves shall be in accordance with AWWA C511 – Reduced-Pressure Principle Backflow Prevention Assembly.

B. Construction

1. The preventers shall consist of 2 spring-loaded check valves, an automatic differential pressure relief valve, drain valves, and shut-off valves.

2. The body material shall be bronze or cast iron, for a working pressure of not less than 150 psig, with bronze or stainless steel trim.

C. Maintenance Access

1. Provide separate access covers for the check valves and the relief valve.

2. Provide top-entry access to check valve components.

D. Manufacturers, or Equal

1. **Cla-Val Company**

2. **Febco (CMB Industries)**

3. **Watts, ACV**

4. **Wilkins Regulator Division (Zurn Industries)**

2.4 CORPORATION STOPS

A. Unless otherwise indicated, corporation stops shall be made of solid brass for key operation, with screwed ends with corporation thread or iron pipe thread, as required.

B. Manufacturer, or Equal

1. **Ford Meter Box Company, Inc.**

2. **James Jones Company (Watts, ACV)**

3. **Mueller Company**

2.5 MUD VALVES

A. Mud valves shall be flanged, non-rising stem type, with threaded stem, seat ring, and gate ring of bronze. Valves shall be provided with coupling nut, extension stem, stem guides, and operating stand, and wheel or wrench nut as indicated. Mud valve shall be installed with valve seats level.

B. Manufacturers or Equal

1. **Clow**

2. **Mueller**

2.6 SOLENOID VALVES

A. Solenoid valves shall be of the size, type, and class indicated and shall be designed for not less than 150 psi water-working pressure. Valves for water, air, or gas service shall have brass or bronze body with screwed ends, stainless steel trim and spring, Teflon or other resilient seals with material best suited for the temperature and fluid handled. Unless otherwise indicated, for chemicals and corrosive fluids, solenoid valves with PVC, CPVC, polypropylene (PP), polyvinylidene fluoride (PVDF), or Teflon materials of construction, suitable for the specific application shall be provided. Enclosures shall be NEMA rated in accordance with area designations. Coil ratings shall be for continuous duty. For electrical characteristics see the electrical Drawings or Specifications.

B. Manufacturers, or Equal

1. For general duty

   a. Automatic Switch Co. (ASCO), Model RED HAT

   b. Skinner Valve (Parker Hannifin Corporation)

   c. Magnatrol Valve Corporation

   d. **J. D. Gould Co.**

2. Metallic valves for corrosive fluids

   a. Valcor Engineering Corporation

3. Plastic valves for corrosive fluids

   a. +GF+ Plastic Systems, Inc.

   b. Spears Mfg. Co.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Backflow preventers shall be installed in potable water lines where required by applicable codes or regulations, wherever there is any danger of contamination, and where indicated.

B. Valves shall be installed in accordance with the manufacturer's printed recommendations.

C. Backflow preventers, as well as air and vacuum release valves, shall have piped outlets to the nearest acceptable drain, firmly-supported, and installed in such a way as to avoid splashing and wetting of floors and obstruction of traffic.

END OF SECTION

PART 2 – STANDARD DETAILS

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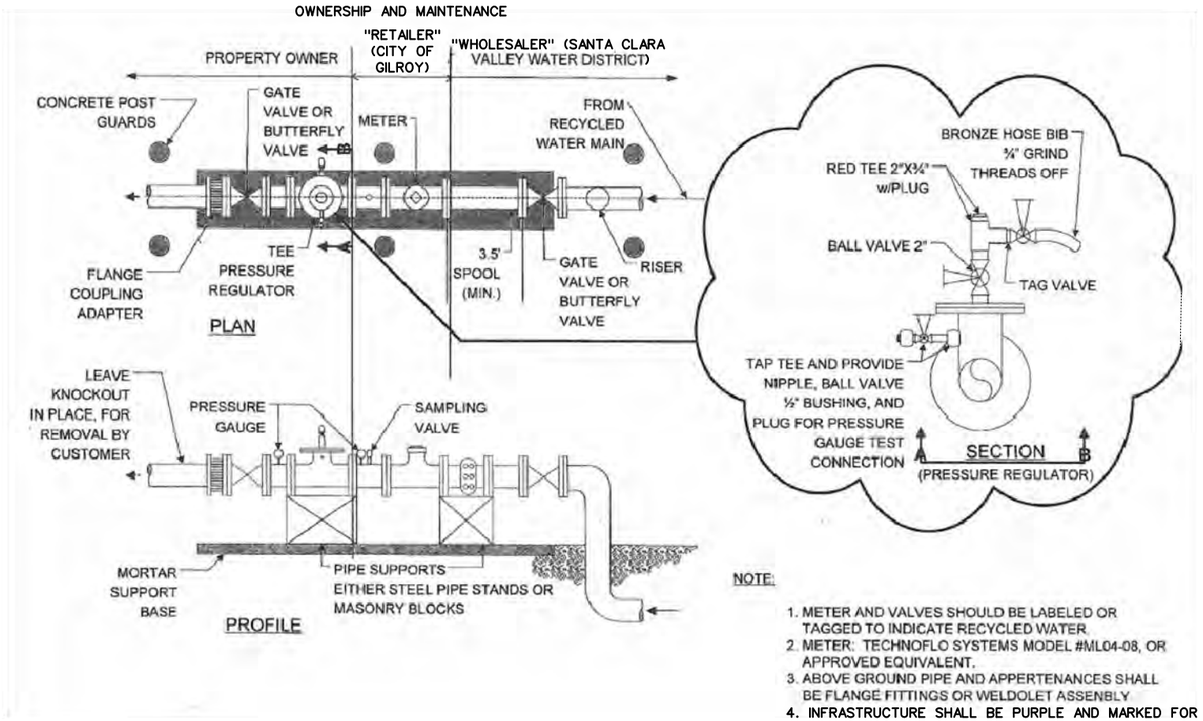
Plot Date: $$$$$DATE$$$$$

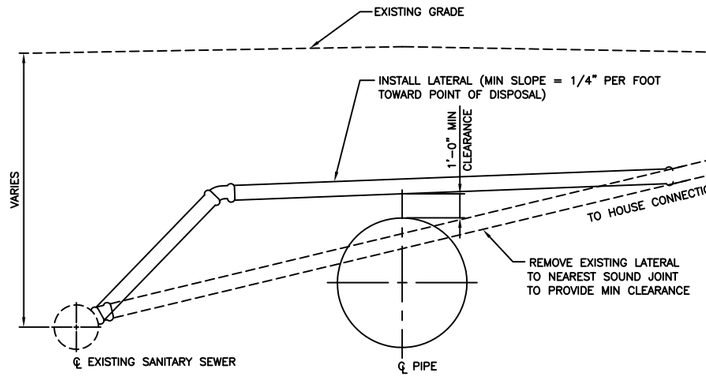


NOTE:

1. METER AND VALVES SHOULD BE LABELED OR TAGGED TO INDICATE RECYCLED WATER.
2. METER: TECHNOFLO SYSTEMS MODEL #ML04-08, OR APPROVED EQUIVALENT.
3. ABOVE GROUND PIPE AND APPERTENANCES SHALL BE FLANGE FITTINGS OR WELDOLET ASSEMBLY.
4. INFRASTRUCTURE SHALL BE PURPLE AND MARKED FOR RECYCLED WATER USE ONLY
5. SIGNAGE SHALL COMPLY WITH RECYCLED WATER PERMIT TO BE OBTAINED FROM THE SCRWA.

DETAIL 1/– RECYCLED WATER TURNOUT

SCALE: NTS



DETAIL 2/– SANITARY SEWER LATERAL RELOCATION

SCALE: NTS

REV	DATE	BY	DESCRIPTION

SCALE: NO SCALE

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DRAFT - NOT FOR CONSTRUCTION

DETAILS 1 THROUGH 12 TAKEN FROM THE SOUTH COUNTY RECYCLED WATER PIPELINE, PHASE 1B PROJECT 60% PRELIMINARY DESIGN. DETAILS 13 THROUGH 15 PROVIDED BY MWH.

SOUTH COUNTY RECYCLED WATER MASTER PLAN, 2015 UPDATE

MWH AKEL ENGINEERING GROUP, INC.

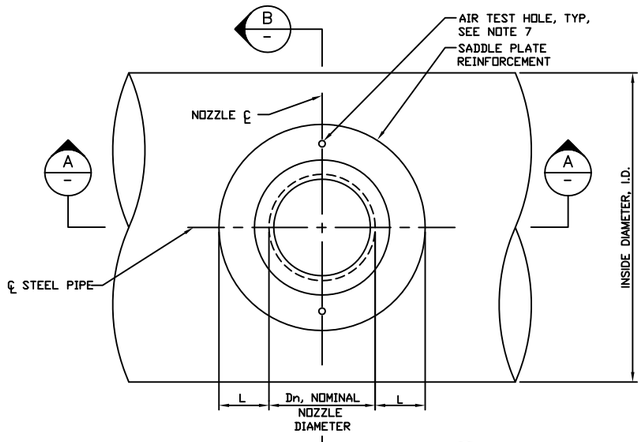
Santa Clara Valley Water District

South County Regional Wastewater Authority

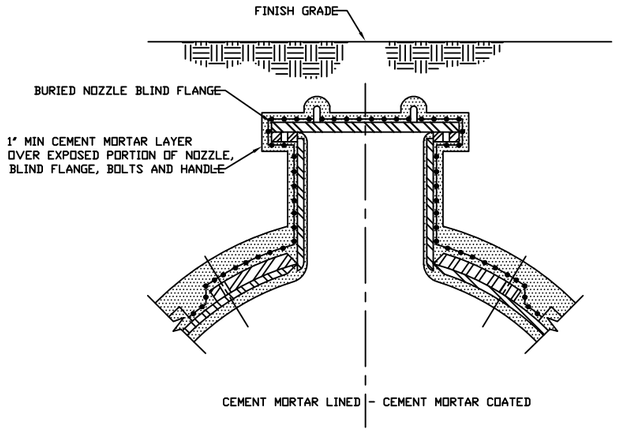
SOUTH COUNTY RECYCLED WATER MASTER PLAN, 2015 UPDATE

STANDARD DETAILS - 1

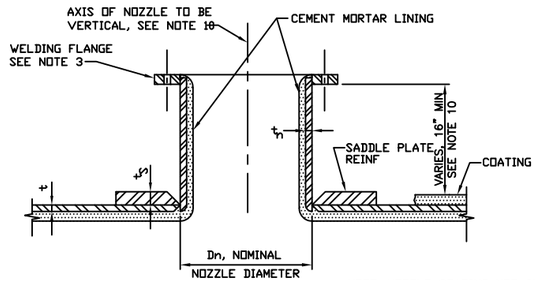
Sheet G-01



DETAIL 3 — TYPICAL NOZZLE OUTLET
SCALE: NTS

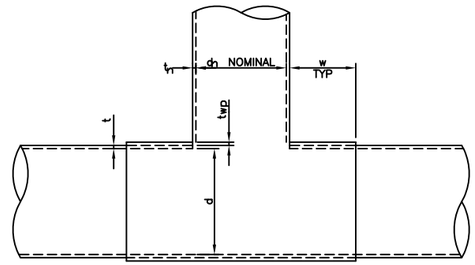


DETAIL 4 — TYPICAL BURIED NOZZLE
SCALE: NTS



NOTE: NOZZLE COATING NOT SHOWN. FOR NOZZLE DIMENSIONS, SEE TABLE 1.

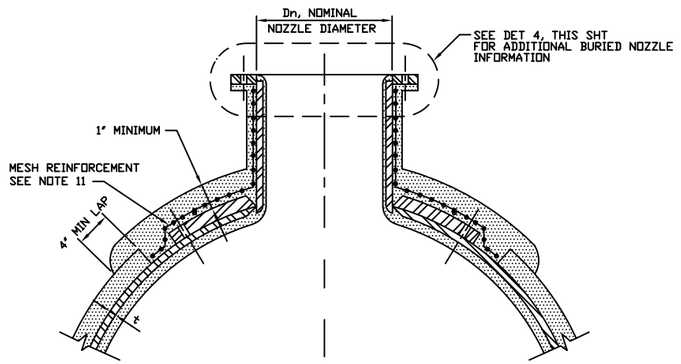
SECTION A
SCALE: NTS



NOTE:

NOZZLE COATING AND LINING NOT SHOWN. FOR NOZZLE DIMENSIONS, SEE TABLE 2, FOR WELDING OF WRAPPER AT NOZZLE AND OUTSIDE END

DETAIL 5 — NOZZLE WITH WRAPPED REINFORCEMENT
SCALE: NTS



SECTION B
SCALE: NTS

GENERAL NOTES:

1. SEE SPECIFICATIONS FOR MATERIAL, INSTALLATION, COATING, AND LINING REQUIREMENTS.
2. ALL NOZZLES AND PLATES ARE TO BE MANUFACTURED FROM STEEL, CONFORMING TO THE REQUIREMENTS OF ASTM A1011 GRADE 36 STEEL SHEET, OR ASTM 572 GRADE 36, ASTM A36 OR EQUAL STEEL PLATE. FOR NOZZLE 24" OR LESS NOMINAL DIAMETER, ASTM A53 GRADE B STANDARD SCHEDULE STEEL PIPE MAY BE USED.
3. WELDING FLANGES SHALL BE SLIP-ON WELDING FLANGES, RING TYPE, FLAT-FACE, SEE SPECIFICATIONS. BLIND FLANGES SHALL BE STEEL, SEE SPECIFICATIONS.
4. FLANGE FACES SHALL BE SHOP COATED WITH A REMOVABLE RUST-PREVENTING COMPOUND TO PROVIDE PROTECTION DURING TRANSPORT AND PRIOR TO INSTALLATION.
5. FLANGE GASKETS SHALL BE 1/8" THICK, FULL-FACE GASKETS.
6. FLANGE BOLTS SHALL STRADDLE CENTERLINE OF PIPE OR CENTERLINE OF FLANGE UNLESS REQUIRED OTHERWISE ON DRAWINGS.
7. DRILL AND TAP TEST HOLES FOR AIR TEST BEFORE WELDING MEMBERS AS SHOWN ON DETAILS. PLUG WELD AFTER AIR TEST IS COMPLETED. SEE SHT C-28.
8. SHOP COAT ALL METAL SURFACES EXCEPT FLANGE FACES AND SURFACES RECEIVING FIELD APPLIED COATINGS.
9. COAT ALL EXPOSED METAL SURFACES WITH THE SAME COATING AS WAS USED ON THE MAIN PIPE, EXCEPT AS NOTED OTHERWISE.
10. FOR SLOPING PIPE: INSTALL NOZZLE VERTICALLY, MAINTAIN A MINIMUM CLEARANCE TO THE NOZZLE FLANGE AS SHOWN.
11. MESH REINFORCING SHALL BE SELF-FURRING GALVANIZED WIRE MESH 2" x 4" x 13 GAUGE. SECURE WITH CLIPS AT 24" CENTERS AND WELD TO SADDLE, PIPE CYLINDER, OR NOZZLE.
12. FOR t_s ,t_n ,D_n , AND L, SEE TABLE 1 & 2.

TABLE 1

PIPE DIAMETER ID (IN)	PIPE CYLINDER* t (IN)	● D_n	NOZZLE THICKNESS t_n (IN)	INTERNAL DESIGN PRESSURE, FEET 360	X	X	X	X	L(IN)
SADDLE PLATE THICKNESS (ts)									
36	0.25	24"	0.375	0.1875	X	X	X	X	12
30	0.1875	12"	0.375	0.1875	X	X	X	X	6

TABLE 2 – NOZZLE WITH WRAPPER REINFORCEMENT

MAIN d (INCHES)	NOZZLE d_n (INCHES)	NOZZLE THICKNESS t_n (INCHES)	MAIN CYLINDER THICKNESS t (INCHES)	WRAPPER THICKNESS t_{wp} (INCHES)	WRAPPER WIDTH w (INCHES)
36	24	0.375	0.25	0.1875	12
30	24	0.375	0.1875	0.1875	12

Plot Date: $$$$$DATE$$$$$

REV	DATE	BY	DESCRIPTION

SCALE: NO SCALE

WARNING 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DRAFT - NOT FOR CONSTRUCTION

DETAILS 1 THROUGH 12 TAKEN FROM THE SOUTH COUNTY RECYCLED WATER PIPELINE, PHASE 1B PROJECT 60% PRELIMINARY DESIGN. DETAILS 13 THROUGH 15 PROVIDED BY MWH.

SOUTH COUNTY RECYCLED WATER MASTER PLAN, 2015 UPDATE

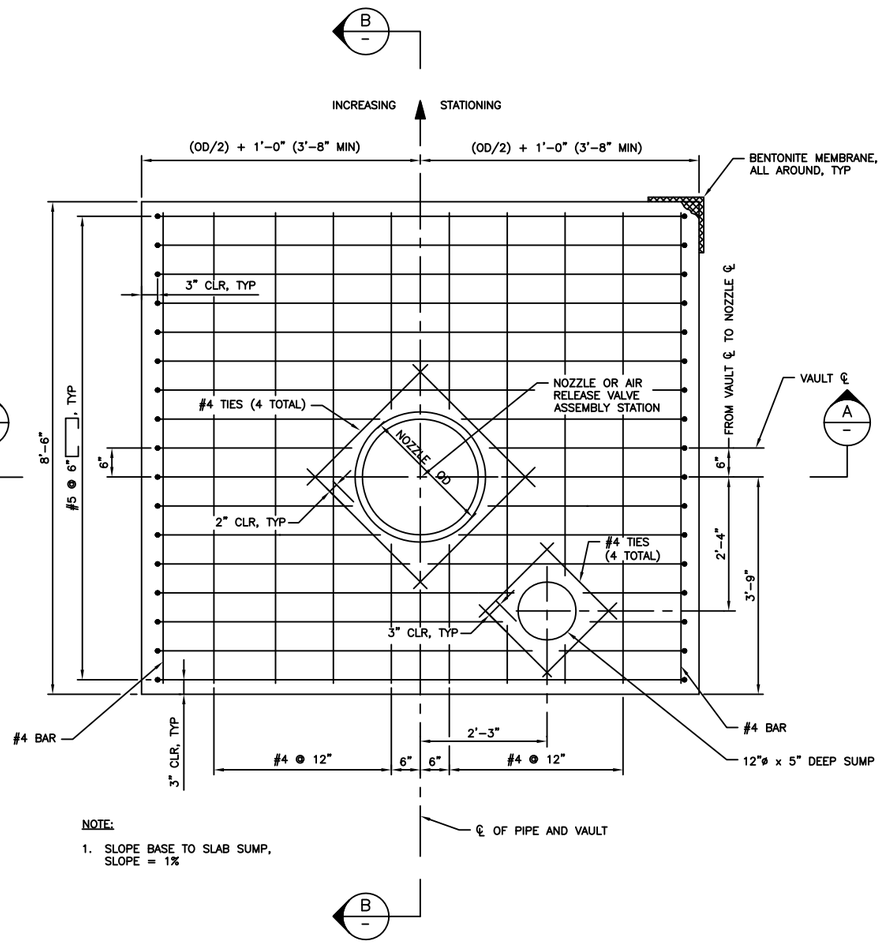
MWH AKEL ENGINEERING GROUP, INC.

Santa Clara Valley Water District — South County Regional Wastewater Authority

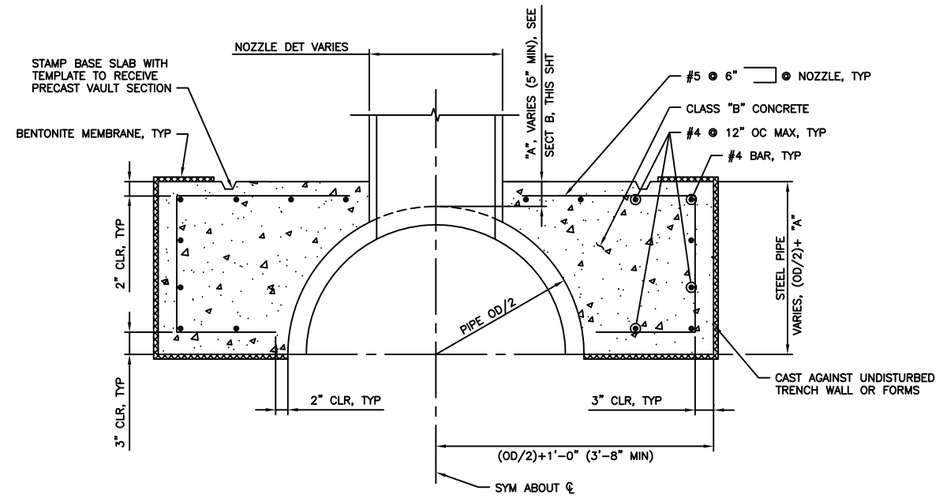
SOUTH COUNTY RECYCLED WATER MASTER PLAN, 2015 UPDATE

STANDARD DETAILS - 2

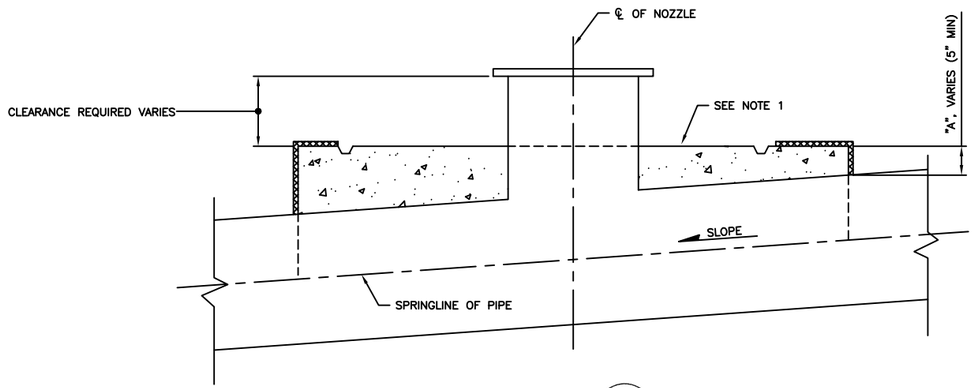
Sheet G-02



DETAIL 6 — PLAN VIEW – BASE SLAB FOR PRECAST VAULT
SCALE: NTS



SECTION A
SCALE: NTS



SECTION B
SCALE: NTS

Plot Date: $$$$$DATE$$$$$

REV	DATE	BY	DESCRIPTION

SCALE: NO SCALE

WARNING: IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE (0, ½, 1)

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SOUTH COUNTY RECYCLED WATER MASTER PLAN, 2015 UPDATE

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SOUTH COUNTY RECYCLED WATER MASTER PLAN, 2015 UPDATE

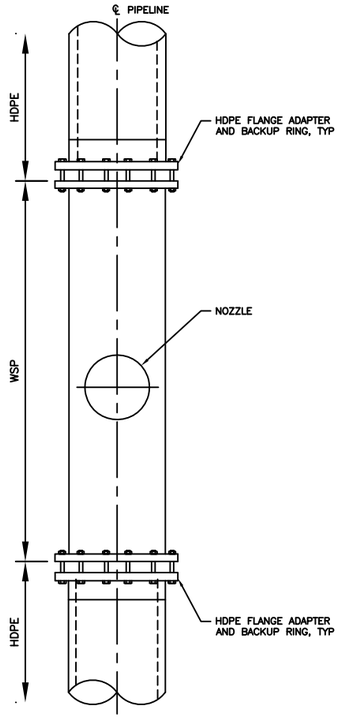
STANDARD DETAILS - 3

Sheet G-03

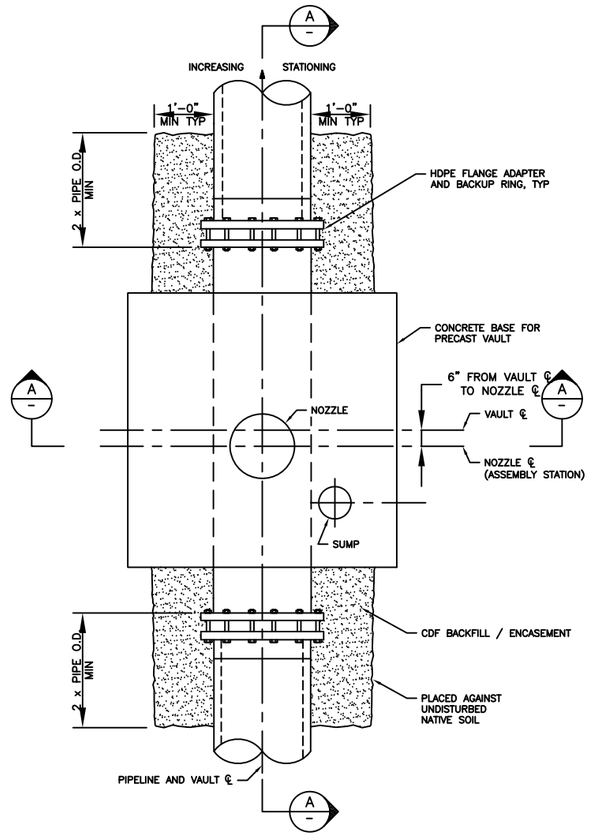
Plot Date: $$$$$DATE$$$$$

GENERAL NOTES:

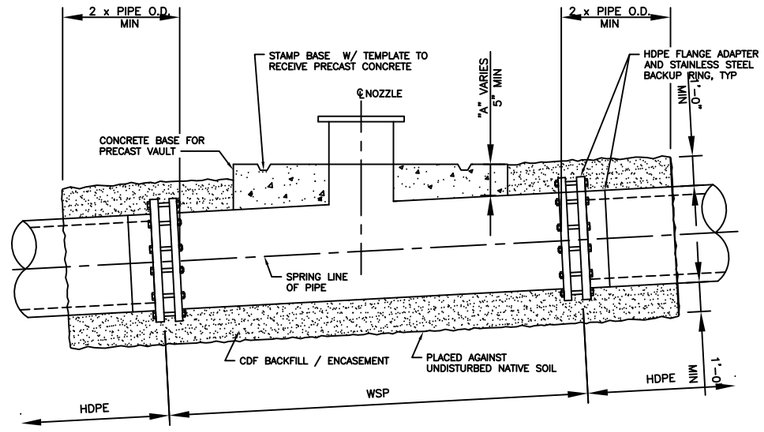
1. FLANGED SPOOL SECTION AT OUTLET NOZZLES SHALL BE CEMENT MORTAR LINED AND COATED WELDED STEEL PIPE. THE INTERNAL DIAMETER OF THE FLANGED SPOOL ASSEMBLIES SHALL MATCH THE INTERNAL DIAMETER OF THE ADJOINING HDPE PIPE.
2. NO BENDING OF HDPE PIPE IS ALLOWED WITHIN 20 FT OF A FLANGE ADAPTER JOINT FOR HORIZONTAL OR VERTICAL CURVES.
3. ALL STEEL PIPE, FITTINGS, VALVES AND ACCESSORIES, INCLUDING HARDWARE, SHALL BE RATED FOR 150 PSI, MINIMUM.



DETAIL 7/– FLANGED WSP SECTION @ APPURTENANCE VAULT
SCALE: NTS



DETAIL 8/– VAULT BASE W/ CDF ENCASEMENT
SCALE: NTS
(PRECAST CONCRETE VAULT NOT SHOWN)



SECTION A/– VAULT BASE W/ CDF ENCASEMENT
SCALE: NTS
(PRECAST CONCRETE VAULT NOT SHOWN)

REV	DATE	BY	DESCRIPTION

SCALE: NO SCALE

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

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SOUTH COUNTY RECYCLED WATER MASTER PLAN, 2015 UPDATE

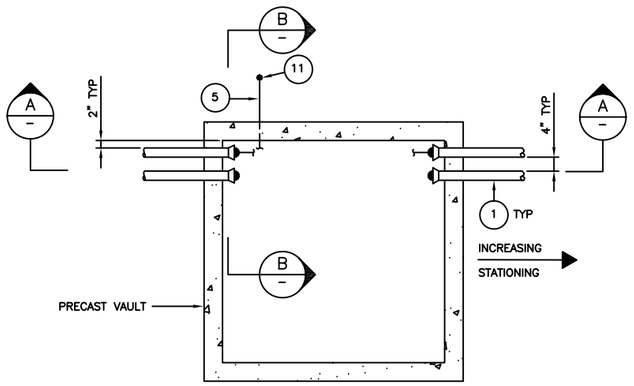
MWH — AKEL ENGINEERING GROUP, INC.

Santa Clara Valley Water District — South County Regional Wastewater Authority

SOUTH COUNTY RECYCLED WATER MASTER PLAN, 2015 UPDATE

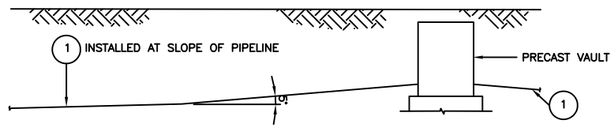
STANDARD DETAILS - 4

Sheet G-04



DETAIL 9 – PLAN VIEW – PRECAST VAULT TELEMETRY CABLE CONDUIT LOCATIONS

SCALE: NTS



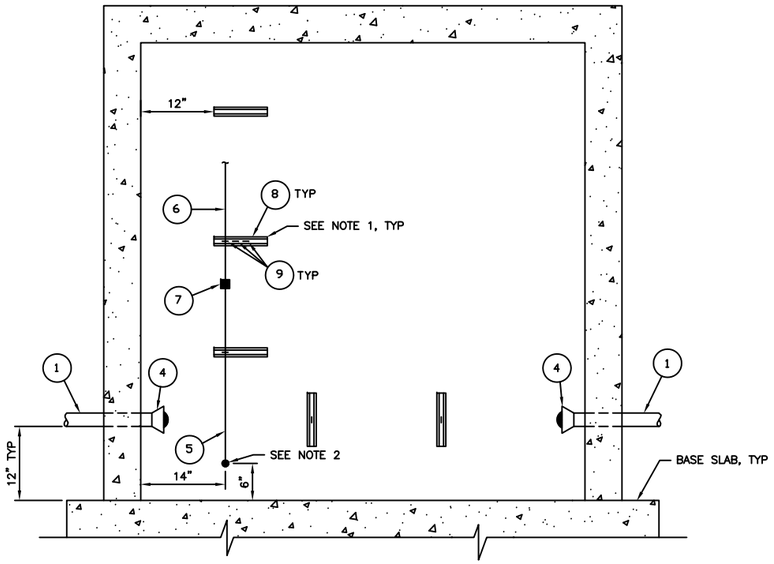
DETAIL 10 – TELEMETRY CABLE CONDUIT ANGLE OF DEPARTURE AT PRECAST VAULT

SCALE: NTS

GENERAL NOTES:

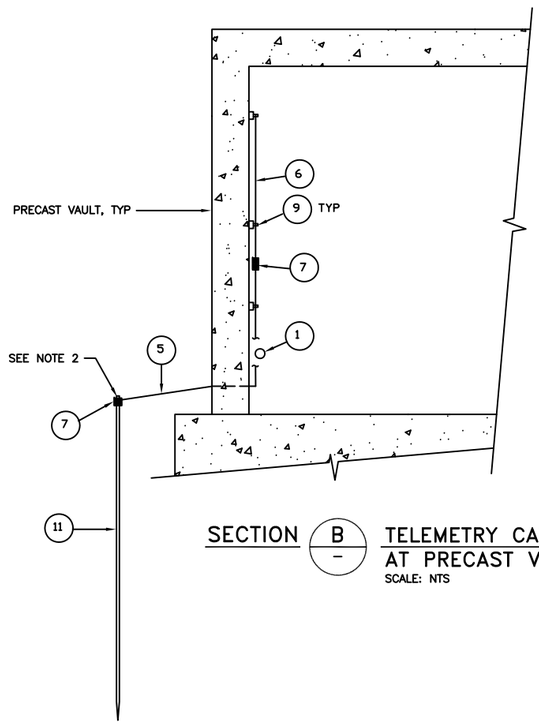
1. FRAMING CHANNELS SHALL BE 6 - 8 INCHES LONG. MOUNTING HARDWARE, INCLUDING MACHINE SCREWS AND WASHERS, SHALL BE HOT-DIPPED GALVANIZED. ANCHORS SHALL BE DIE-CAST, RUSTPROOF ALLOY EXPANSION SHIELDS OR RUSTPROOF CAST FLUSH TYPE.
2. RUN GROUNDING CONDUCTOR TO GROUNDING ROD OUTSIDE VAULT AND SEAL WALL OPENING. TOP OF GROUNDING ROD SHALL BE BELOW VAULT GROUNDING CONDUCTOR EXIT AND BELOW TELEMETRY CABLE SPLICE CLOSURE.

MATERIALS LIST	
1	TELEMETRY CABLE CONDUIT
2	TELEMETRY CABLE
3	WATERPROOF RE-ENTERABLE SPLICE CLOSURE.
4	BELL END
5	GROUNDING CONDUCTOR
6	GROUNDING CONDUCTOR
7	COPPER COMPRESSION CONNECTOR
8	FRAMING CHANNEL
9	FRAMING CHANNEL CABLE CLAMP
10	FRAMING CHANNEL CABLE CLAMP
11	GROUNDING ROD



SECTION A – TELEMETRY CABLE SPLICE – TRAINING AT PRECAST VAULT LOCATIONS

SCALE: NTS



SECTION B – TELEMETRY CABLE GROUNDING AT PRECAST VAULTS

SCALE: NTS

Plot Date: $$$$$DATE$$$$$

REV	DATE	BY	DESCRIPTION

SCALE: NO SCALE

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

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DETAILS 1 THROUGH 12 TAKEN FROM THE SOUTH COUNTY RECYCLED WATER PIPELINE, PHASE 1B PROJECT 60% PRELIMINARY DESIGN. DETAILS 13 THROUGH 15 PROVIDED BY MWH.

SOUTH COUNTY RECYCLED WATER MASTER PLAN, 2015 UPDATE

MWH AKEL ENGINEERING GROUP, INC.

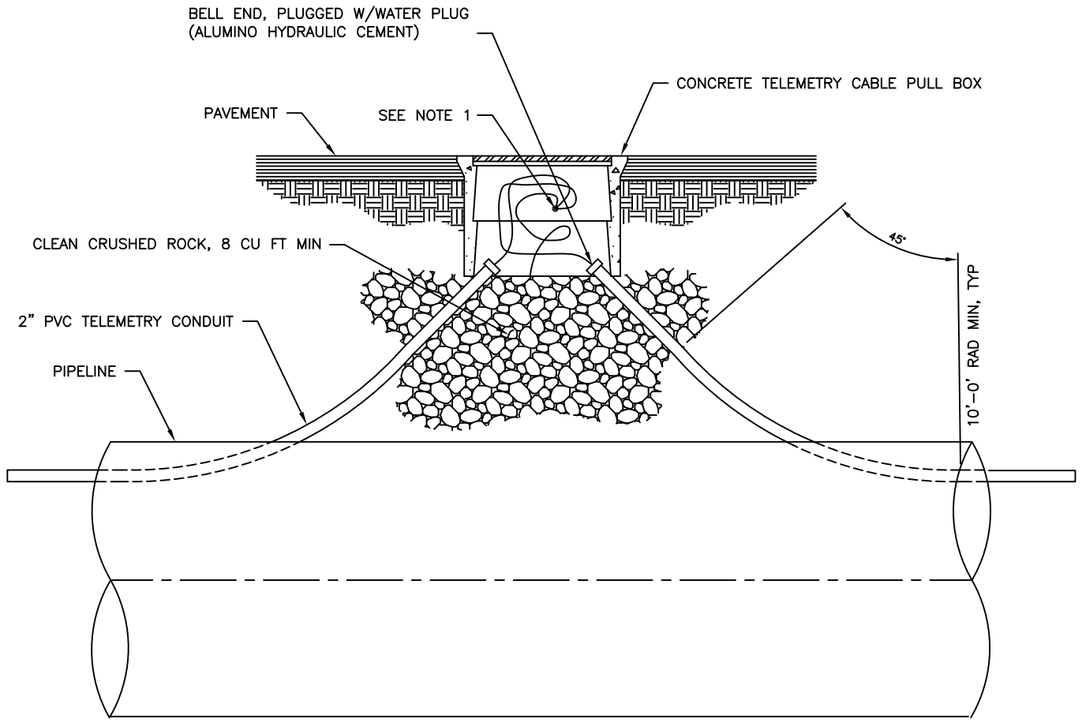
Santa Clara Valley Water District

South County Regional Wastewater Authority

SOUTH COUNTY RECYCLED WATER MASTER PLAN, 2015 UPDATE

STANDARD DETAILS - 5

Sheet G-05

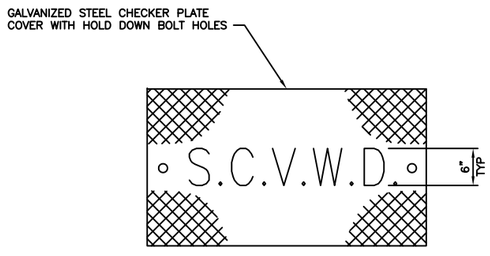


DETAIL 11 – SURFACE TELEMETRY CABLE PULL BOX AT SPLICE LOCATIONS FOR FUTURE TELEMETRY CABLE–CONDUIT SYSTEM

SCALE: NTS

GENERAL NOTES:

1. INSTALL CAPS ON CONDUIT AND PULL ROPES THROUGH CAPS TO TEMPORARILY TIE ROPES FOR FUTURE USE.
2. SURFACE INSTALLED TELEMETRY PULL BOXES SHALL BE RATED FOR HS–20 TRAFFIC LOADING.



DETAIL 12 – SURFACE TELEMETRY CABLE PULL BOX COVER

SCALE: NTS

Plot Date: $$$$$DATE$$$$$

REV	DATE	BY	DESCRIPTION

SCALE: NO SCALE

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DRAFT - NOT FOR CONSTRUCTION

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SOUTH COUNTY RECYCLED WATER MASTER PLAN, 2015 UPDATE

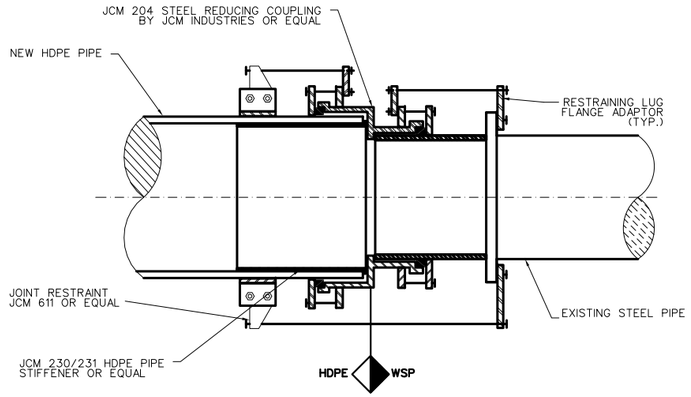
MWH — AKEL ENGINEERING GROUP, INC.

Santa Clara Valley Water District — South County Regional Wastewater Authority

SOUTH COUNTY RECYCLED WATER MASTER PLAN, 2015 UPDATE

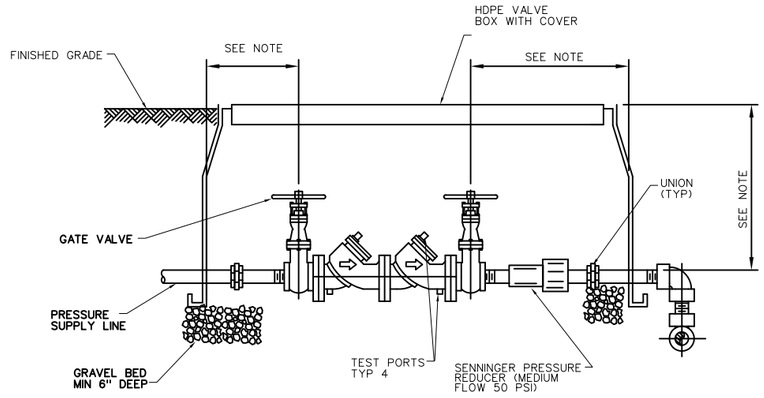
STANDARD DETAILS - 6

Sheet G-06



DETAIL 13 – TRANSITION COUPLING

SCALE: NTS

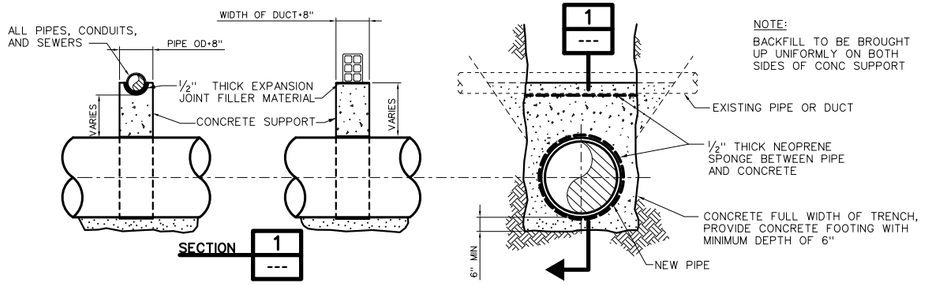


NOTE:

1. UP TO 2" LINE, PROVIDE 6" SIDE AND GROUND CLEARANCE;
   2½" AND LARGER, PROVIDE 12" SIDE AND GROUND CLEARANCE.

DETAIL 15 – BACKFLOW PREVENTER (BELOW GRADE ASSEMBLY)

SCALE: NTS (SEE NOTE 1 FOR SIZE REQUIREMENTS)



NOTES:

1. UNDERGROUND UTILITY SUPPORTS ARE TO BE PROVIDED WHEN MINIMUM CLEARANCE OF 12 INCHES CANNOT BE PROVIDED.
2. EXISTING PIPE OR DUCT SHALL BE FIRMLY SUPPORTED DURING INSTALLATION OF NEW PIPE AND SUPPORT.

DETAIL 14 – UNDERGROUND UTILITY SUPPORT

SCALE: NTS

Plot Date: $$$$$DATE$$$$$

REV	DATE	BY	DESCRIPTION

SCALE: NO SCALE

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DRAFT - NOT FOR CONSTRUCTION

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SOUTH COUNTY RECYCLED WATER MASTER PLAN, 2015 UPDATE

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Santa Clara Valley Water District — South County Regional Wastewater Authority

SOUTH COUNTY RECYCLED WATER MASTER PLAN, 2015 UPDATE
STANDARD DETAILS - 7

Sheet G-07

10% DESIGN OF SELECTED NPR ALTERNATIVE

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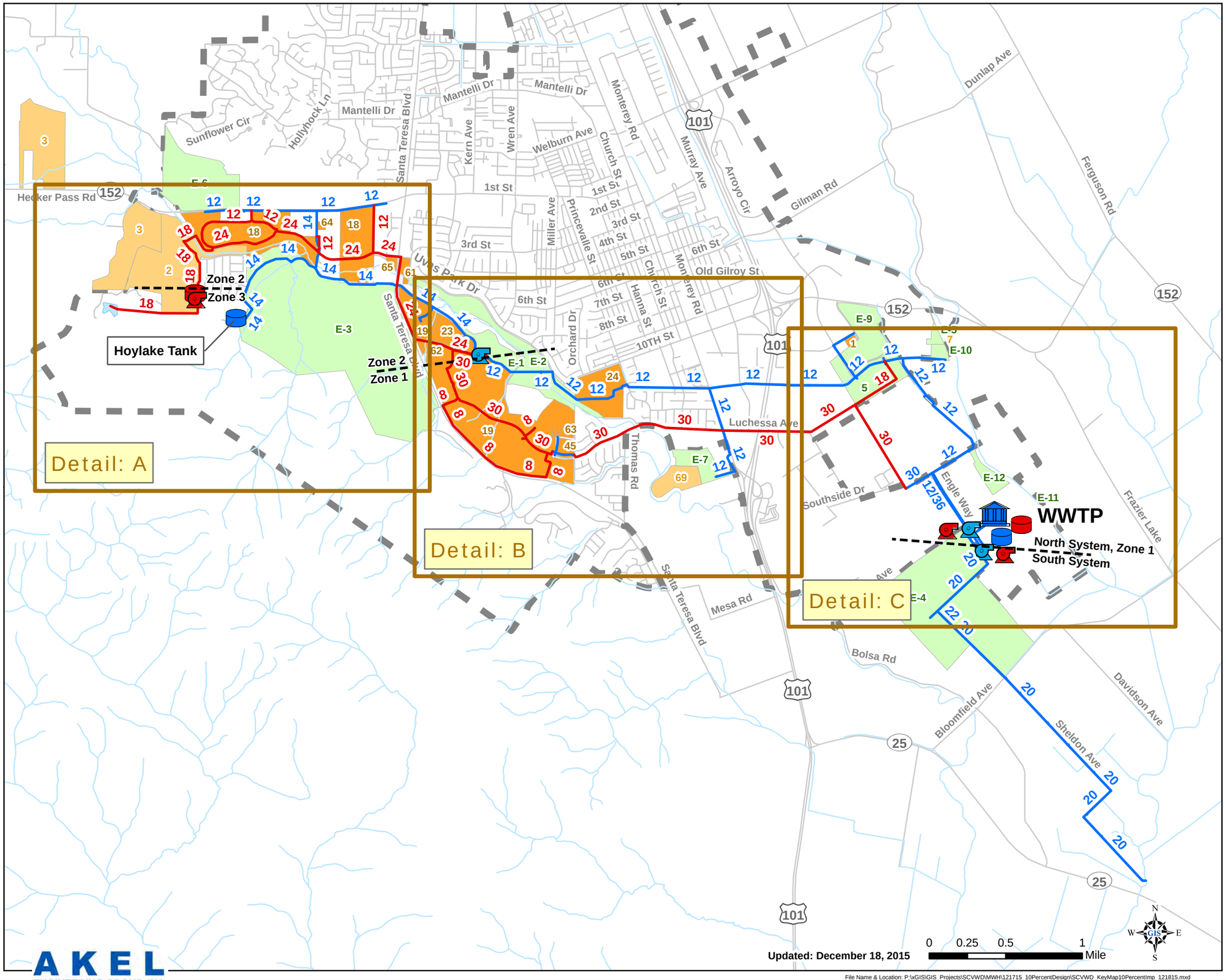


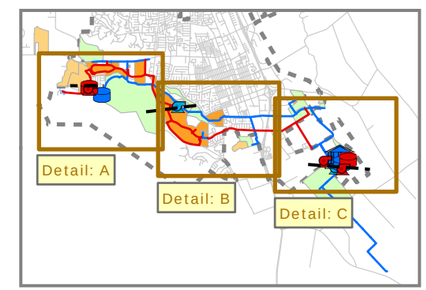
Legend

Proposed

- Storage Tanks
- Booster Stations
- Proposed Pipe

Existing

- WWTP
- Storage Tanks
- Booster Stations
- Recycled Water Pipelines
- Pressure Zone Line
- Existing Users
- In-Progress Users
- Baseline Users
- City Limits
- Roads
- Lake
- Creeks



Key Map
Baseline Improvements
10% Design

South County Recycled Water System

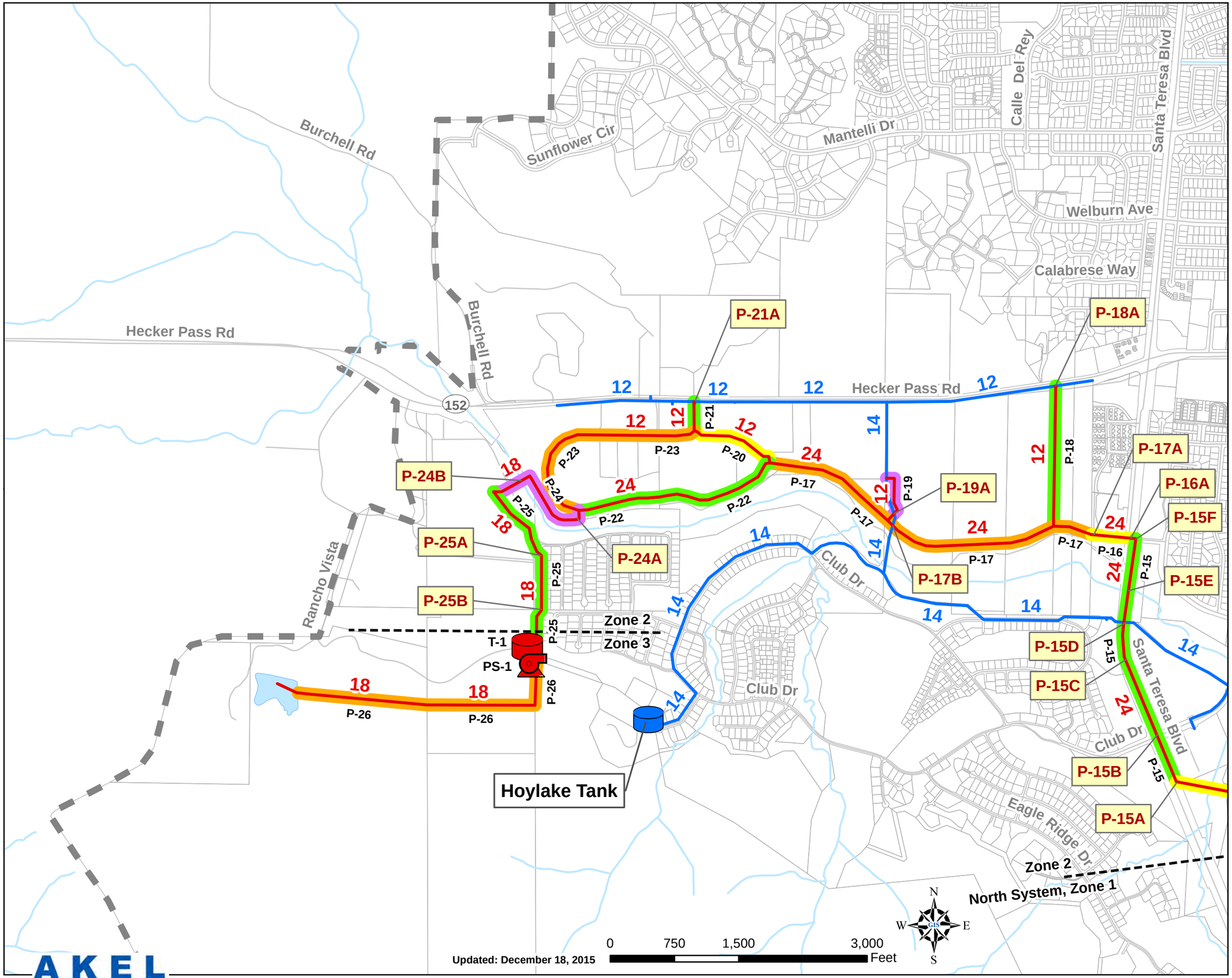
Santa Clara Valley Water District /
South County Regional Wastewater Authority

Santa Clara Valley Water District

Updated: December 18, 2015

AKEL ENGINEERING GROUP, INC.

File Name & Location: P:\xGIS\GIS_Projects\SCVWD\MWH\121715_10PercentDesign\SCVWD_KeyMap10PercentImp_121815.mxd



Legend

Proposed

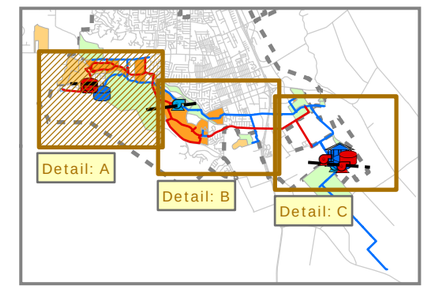
- Storage Tanks
- Booster Stations
- Proposed Pipe

Segment Improvement

- 24 — Improvement Size Label
- Highlight of Start & End of Segment
- P-22 — CIP Id Label

Existing

- Storage Tanks
- Recycled Water Pipelines
- Pressure Zone Line
- City Limits
- Parcels
- Roads
- Highways
- Railroads
- Lake
- Creeks



Crossings Identified: Water pipes, sewer pipes, storm drainage pipes, creeks, freeways, and railways.

Detail A
Baseline Improvements
10% Design

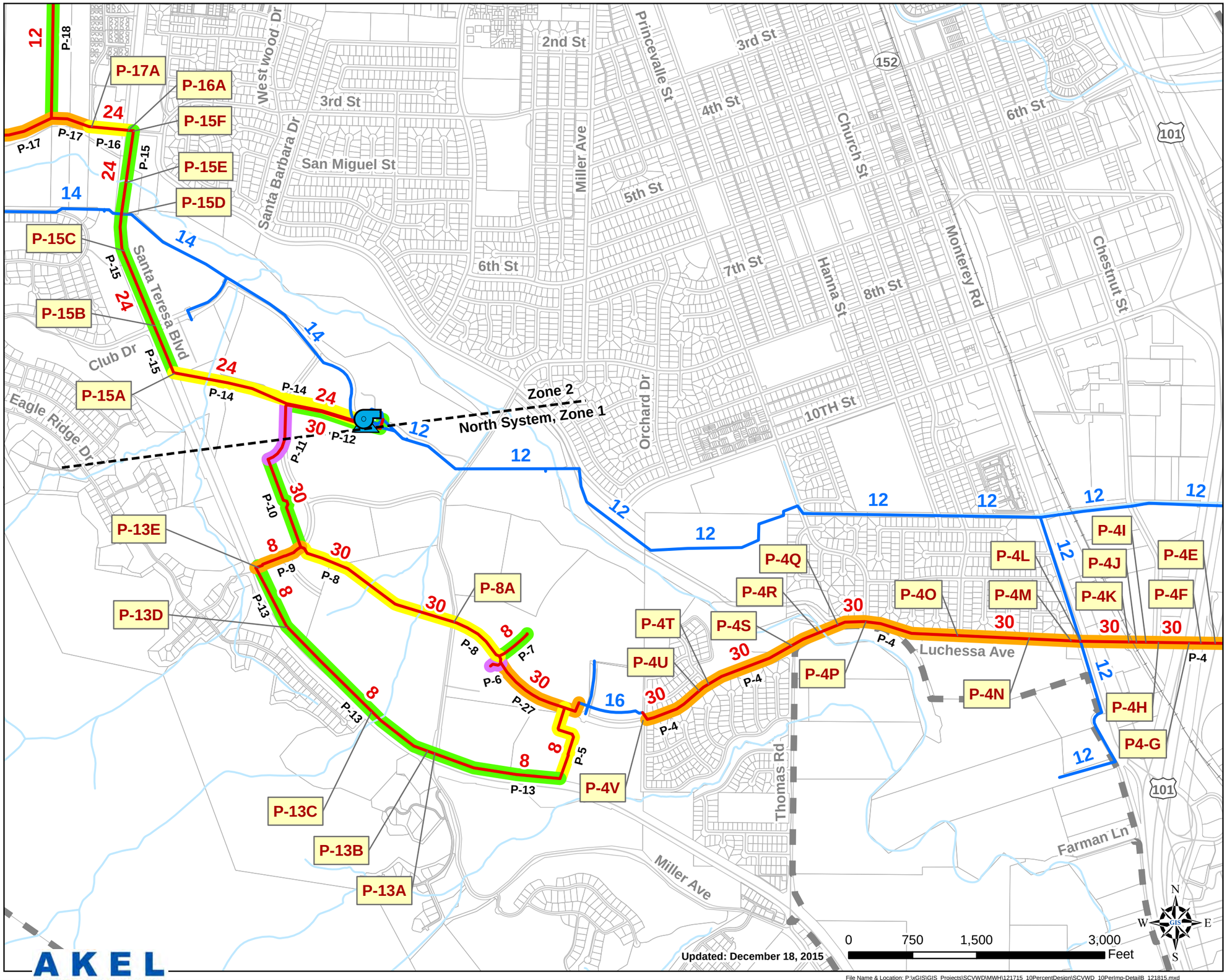
South County Recycled Water System

Santa Clara Valley Water District /
South County Regional Wastewater Authority

Santa Clara Valley Water District

AKEL ENGINEERING GROUP, INC.

File Name & Location: P:\xGIS\GIS_Projects\SCVWD\MWH\121715_10PercentDesign\SCVWD_10PerImp-DetailA_121815.mxd



Updated: December 18, 2015

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Legend

Proposed

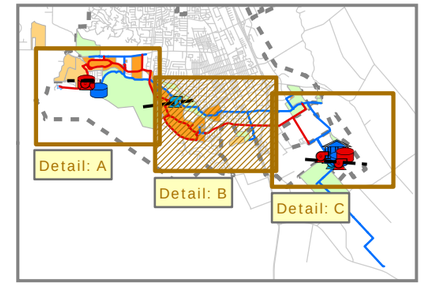
- Proposed Pipe

Segment Improvement

- 24 — Improvement Size Label
- Highlight of Start & End of Segment
- P-22 — CIP Id Label

Existing

- Booster Stations
- Recycled Water Pipelines
- Pressure Zone Line
- City Limits
- Parcels
- Roads
- Highways
- Railroads
- Creeks



Crossings Identified: Water pipes, sewer pipes, storm drainage pipes, creeks, freeways, and railways.

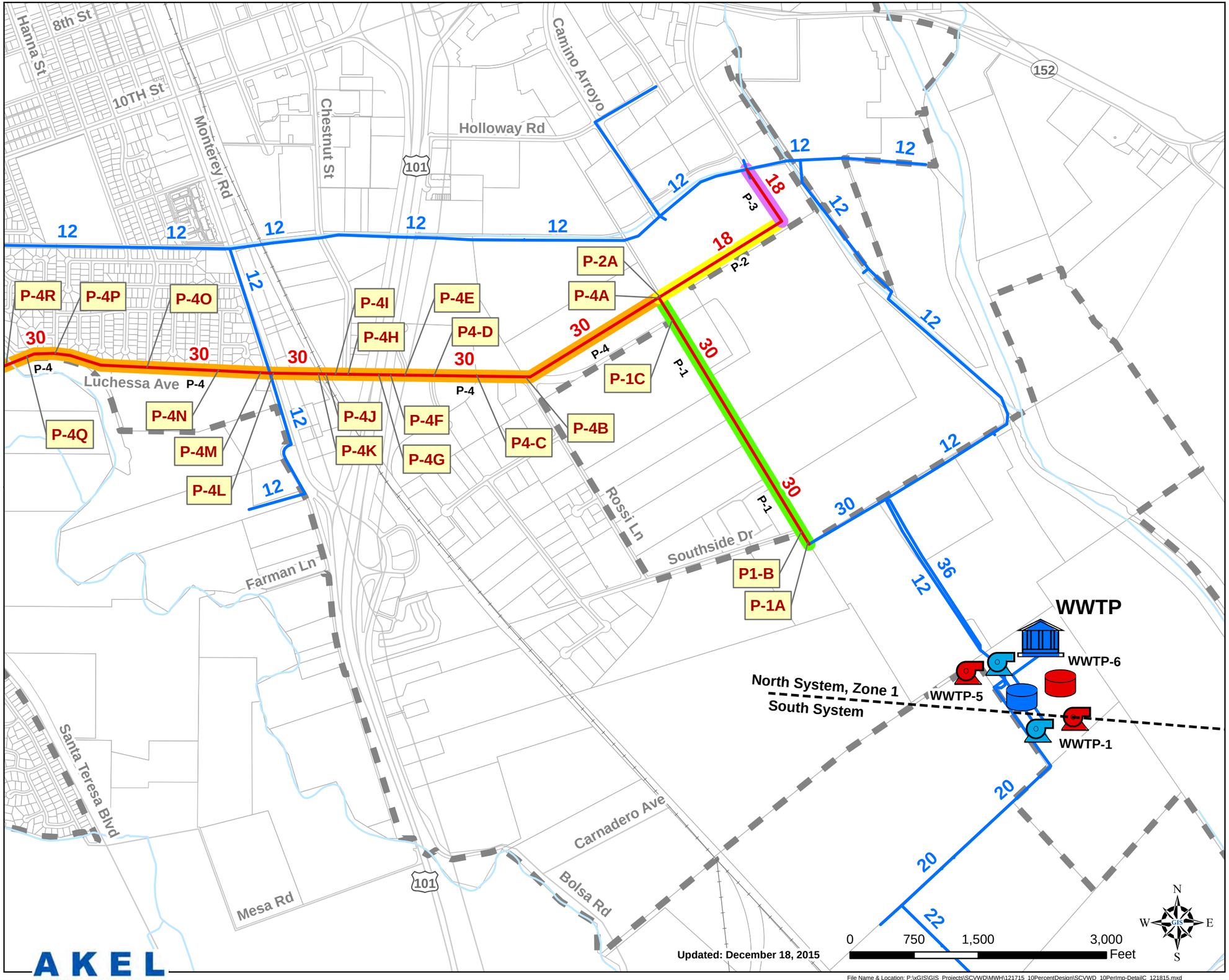
Detail B
Baseline Improvements
10% Design

South County Recycled Water System

Santa Clara Valley Water District /
South County Regional Wastewater Authority

Santa Clara Valley Water District

AKEL ENGINEERING GROUP, INC.



Legend

Proposed

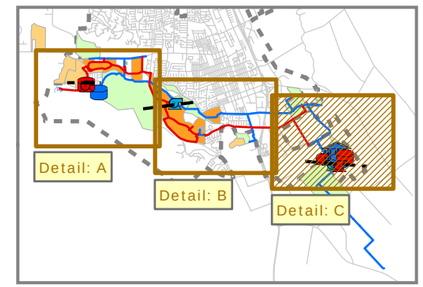
- Storage Tanks
- Booster Stations
- Proposed Pipe

Segment Improvement

- 24 — Improvement Size Label
- Highlight of Start & End of Segment
- P-22 — CIP Id Label

Existing

- WWTP
- Storage Tanks
- Booster Stations
- Recycled Water Pipelines
- Pressure Zone Line
- City Limits
- Parcels
- Roads
- Highways
- Railroads
- Creeks



Crossings Identified: Water pipes, sewer pipes, storm drainage pipes, creeks, freeways, and railways.

Detail C
Baseline Improvements
10% Design

South County Recycled Water System

Santa Clara Valley Water District /
South County Regional Wastewater Authority

Santa Clara Valley Water District

AKEL ENGINEERING GROUP, INC.

File Name & Location: P:\xGIS\GIS_Projects\SCVWD\MWH\121715_10PercentDesign\SCVWD_10PerImp-DetailC_121815.mxd

Proposed Recycled Water System Crossing Descriptions[1]

Improvement Number	Crossing Number	Pipeline		Pressure Zone	Street	Limits
		Diam. (in)	Length (ft)			
P-1		30	3,375	North - Zone 1	Through Agriculture Fields ROW	Southside Dr. to Luchessa Ave.
	P-1A	Storm Drain crossing in Southside Drive				
	P-1B	Parallel 33-inch and 24-inch Gravity Sewer				
	P-1C	18-inch sewer crossing to west				
P-2		18	1,700	North - Zone 1	Luchessa Avenue	Agriculture ROW to Cameron Blvd
	P-2A	Potential sewer crossing in agricultural ROW				
P-3		18	730	North - Zone 1	Cameron Boulevard	Luchessa Ave to Princevalle Drain
	P-3A	Connection existing 12-inch recycled water main in close proximity to Princevalle Channel				
P-4		30	10,260	North - Zone 1	Luchessa Avenue	Agriculture ROW to Greenfield Dr
	P-4A	Potential sewer crossing in agricultural ROW				
	P-4B	At Rossi Ln, unknown size storm drain crossing and begin parallel 8-inch water and 18-inch sewer with lateral crossings.				
	P-4C	Railroad Crossing approximately 515 ft east of Engle Wy				
	P-4D	8-inch water and 8-inch sewer to the south in Engle Wy				
	P-4E	8-inch water and 8-inch sewer to the north in Jameson Wy				
	P-4F	Approximately 155 ft west of Jameson Wy, storm drain culvert crossing				
	P-4G	Approximately 480 ft east of Chestnut St, cross under US 101				
	P-4H	10-inch sewer and 8-inch water north in Chestnut St				
	P-4I	Unknown size storm drain beginning at Chestnut St and extending west to the railroad crossing				
	P-4J	Railroad Crossing approximately 240 ft west of Chestnut St				
	P-4K	Unknown size storm drain beginning at the railroad crossing and extending west 110 ft				
	P-4L	At Monterey Road: Sewer: 8-inch and 18-inch crossing north Water: 10-inch crossing to north, end parallel 8-inch and begin parallel 12-inch Storm: 42-inch crossing to the north, 18-inch to the south with inlet laterals Recycled Water: Cross connection with existing 12-inch				
	P-4M	Potential 18-inch sewer crossing approximately 150 ft west of Monterey Rd				
	P-4N	6-inch water main to the north in Hyde Park Dr				
	P-4O	8-inch water main to the north in Church St				
	P-4P	8-inch water main to the north in Princevalle St				
	P-4Q	8-inch water main to the north approximately 330 ft west of Princevalle St				
	P-4R	Approximately 450 ft west of Princevalle St cross Uvas Creek				

Proposed Recycled Water System Crossing Descriptions[1]

Improvement Number	Crossing Number	Pipeline Diam. (in)	Pipeline Length (ft)	Pressure Zone	Street	Limits
	P-4S	At Thomas Road: Sewer: 10-inch crossing to the south Water: 12-inch crossing to south Storm: 18-inch storm drain to the south, begin 24-inch parallel				
	P-4T	At Village Place: Sewer: 8-inch crossing to the north Water: 8-inch crossing to north Storm: 15-inch storm drain to the north				
	P-4U	8-inch water to the south approximately 140 ft west of Village Pl				
	P-4V	End of parallel mains at Greenfield Dr: Sewer: 10-inch to the north Water: 8-inch to the north, 24-inch to the south Storm: 18-inch to the north and to the south				
P-5		10	990	North - Zone 1	Vista Bella	Luchessa Ave through Vista Bella Development
		No Water Sewer or Storm Crossings				
P-6		8	420	North - Zone 1	West Tenth Street	Luchessa Ave to 140 feet south
		No Water Sewer or Storm Crossings				
P-7		8	140	North - Zone 1	West Tenth Street	Luchessa Ave to 420 feet north
		No Water Sewer or Storm Crossings				
P-8		30	2,710	North - Zone 1	Luchessa Avenue	Miller Ave to Merlot Dr
	P-8A	Cross 2 12-inch water mains at Miller Ave				
P-9		8	590	North - Zone 1	Luchessa Avenue	Merlot Dr to Santa Teresa Blvd
		No Water Sewer or Storm Crossings				
P-10		30	1,130	North - Zone 1	Merlot Drive	Luchessa Ave to Syrah Dr
		No Water Sewer or Storm Crossings				
P-11		30	730	North - Zone 1	Syrah Drive	Merlot Dr to ROW through Home Ranch Development
		No Water Sewer or Storm Crossings				
P-12		30	1,240	North - Zone 1	ROW through Home Ranch Development	Syrah Dr to Zone 2 Pump Station Suction Side
		No Water Sewer or Storm Crossings				
P-13		8	4,860	North - Zone 1	Santa Teresa Boulevard	Luchessa Ave to 10th St
	P-13A	Crossing 2 12-inch water mains at Miller Ave				
	P-13B	At Miller Ave, begin parallel 16-inch and 24-inch water				
	P-13C	Potential 8-inch water crossing to the west				

Proposed Recycled Water System Crossing Descriptions[1]

Improvement Number	Crossing Number	Pipeline Diam. (in)	Pipeline Length (ft)	Pressure Zone	Street	Limits
	P-13D	Potential 8-inch sewer crossing to the west				
	P-13E	At Bally Bunion Dr: Water: Potential 16-inch water main crossing Sewer: Potential 8-inch sewer crossing				
P-14		24	2,080	North - Zone 2	ROW through Home Ranch Development	Zone 2 Pump Station Outlet to Santa Teresa Blvd
		No Water Sewer or Storm Crossings				
P-15		24	3,140	North - Zone 2	Santa Teresa Boulevard	Syrah Dr to 3rd St
	P-15A	Approximately 600 ft southeast of Club Dr: Water: Begin 24-inch parallel Sewer: Begin 8-inch parallel Storm: 18-inch culvert crossing				
	P-15B	At Club Drive: Sewer: 12-inch to the east, end parallel Water: 8-inch to the east, 12-inch to the west Storm: Begin 18-inch parallel				
	P-15C	Approximately 975 ft northwest of Club Dr: 10-inch water to the west				
	P-15D	Approximately 1,000 ft south of Third St: Sewer: 12-inch crossing Storm: 18-inch crossing Recycled: Cross connect to existing 14-inch				
	P-15E	Uvas Creek crossing approximately 575 ft south of Third St				
	P-15F	Sewer: 24-inch parallel approximately 250 ft south of Third St Storm: 42-inch and 18-inch parallel approximately 480 ft south of Third St				
P-16		24	520	North - Zone 2	3rd Street	Santa Teresa Blvd to Isabella Way
	P-16A	At Santa Teresa Blvd: Sewer: 24-inch sewer crossing Water: 24-inch crossing and 16-inch parallel Storm: 48-inch parallel				
P-17		24	4,130	North - Zone 2	3rd Street	Isabella Way to Meritage Loop
	P-17A	At Isabella Way: Sewer: 8-inch crossing to the north Water: 8-inch crossing to north Storm: 30-inch storm drain to the north				
	P-17B	Cross existing 12-inch recycled water pipe				

Proposed Recycled Water System Crossing Descriptions[1]

Improvement Number	Crossing Number	Pipeline Diam. (in)	Pipeline Length (ft)	Pressure Zone	Street	Limits
P-18		12	1,630	North - Zone 2	Through east side of Tract 10220	3rd St to Hecker Pass Highway
	P-18A	24-inch water main in Hecker Pass Rd Recycled: Connect to existing 12-inch on Hecker Pass Rd.				
P-19		12	640	North - Zone 2	Through west side of Tract 10220	3rd St to Connection to Existing System
	P-19A	Cross and connect to existing 12-inch recycled water pipe				
P-20		12	1,040	North - Zone 1	Upper Meritage Loop	3rd St to Future Meritage Road
		No Water Sewer or Storm Crossings				
P-21		12	340	North - Zone 2	Future Meritage Road	Meritage Loop to Hecker Pass Highway
	P-21A	24-inch water main in Hecker Pass Rd Recycled: Connect to existing 12-inch on Hecker Pass Rd.				
P-22		24	2,410	North - Zone 2	Lower Meritage Loop	Lower Loop from 3rd St to Lake Kathryne Stub Out
		No Water Sewer or Storm Crossings				
P-23		12	2,630	North - Zone 2	Upper Meritage Loop	Upper Loop from Two Oaks Lane to Lake Kathryne Stub Out
		No Water Sewer or Storm Crossings				
P-24		18	1,420	North - Zone 2	Uvas Creek ROW	Meritage Loop to Gilroy Gardens Service Road
	P-24A	Parallel 18-inch sewer				
	P-24B	Cross Uvas Creek approximately 1,000 ft southeast of Hecker Pass Rd and Buchell Rd				
P-25		18	2,360	North - Zone 2	Gilroy Gardens Service Road	Uvas Creek ROW to New Zone 2 Tank Site/Zone 3 PS (Elev. 383)
	P-25A	Along Calloway Ct: Sewer: Parallel 8-inch Water: Parallel 12-inch Storm: Parallel 18-inch				
	P-25B	Cross 12-inch storm drain at end of Calloway Ct				
P-26		18	3,230	North - Zone 3	Gilroy Gardens ROW	New Zone 2 Tank Site/Zone 3 PS to Lake Kathryne
		No Water Sewer or Storm Crossings				
P-27		30	1,200	North - Zone 1	Luchessa Avenue	Cimino St to Tenth St
		No Water Sewer or Storm Crossings				

Note:

1. Crossings identified include water mains, sewer pipes, storm drainage pipes, creek or drainage crossings, freeways, and railroads

AKEL ENGINEERING GROUP, INC.

12/18/2015

FUNDING ASSESSMENT REPORT

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1 INTRODUCTION & EXECUTIVE SUMMARY

The Santa Clara Valley Water District (SCVWD, or "District") currently charges two different wholesale rates for recycled water service in the South County. There is a lower "AG" rate for agricultural customers and an "M&I" (municipal and industrial) rate for non-agricultural customers. The lower AG rate is made possible by an Open Space Credit applied to the AG rate, which is funded by the District's 1% property tax revenue. The M&I rate is set at $20/acre-foot (AF) under the groundwater rate.[1]

Neither M&I nor AG rates are sufficient to pay for the cost of providing recycled water service. The resulting "funding gap" is closed with groundwater rate revenue. With three phases of improvements identified in the *2015 South County Recycled Water Master Plan Update* (2015 Master Plan Update), the annual capital and operating expenses for the recycled water distribution system are expected to increase and, consequently, the funding gap is also expected to increase.

This report explores alternative recycled water rate structures and opportunities in the customer base that may achieve additional cost recovery for the recycled water system. The following points are discussed:

1. Increasing rates alone will not make a material dent in the funding gap
2. Low groundwater rates have put a limit on the ability to charge adequate recycled water rates
3. The District's recycled water system is underutilized because of summer peaking
4. It will be difficult to substantially increase capacity utilization through customer selection
5. It will be challenging to encourage customers to increase consumption during shoulder months[2]
6. The best revenue opportunity is through connecting additional customers
7. Peaking Charges and interruptible service agreements can free up additional capacity to connect more customers

Managing demand peaks through a peak charge or through interruptible service may be the most feasible method to achieve greater system utilization and thus more revenue. However implementation would be contingent on customers having access to an alternative water supply (i.e., groundwater) during peak months. Therefore, the peaking charge and interruptible service agreements are recommended for further investigation.

2 ANALYSIS

The following subsections explore various methods for trying to increase recycled water revenue. As discussed in the sections below, some concepts have more merit than others.

[1] The District's potable water system is divided into North and South Counties, of which the South County system is supplied entirely from groundwater. Groundwater has lower distribution costs than recycled water.

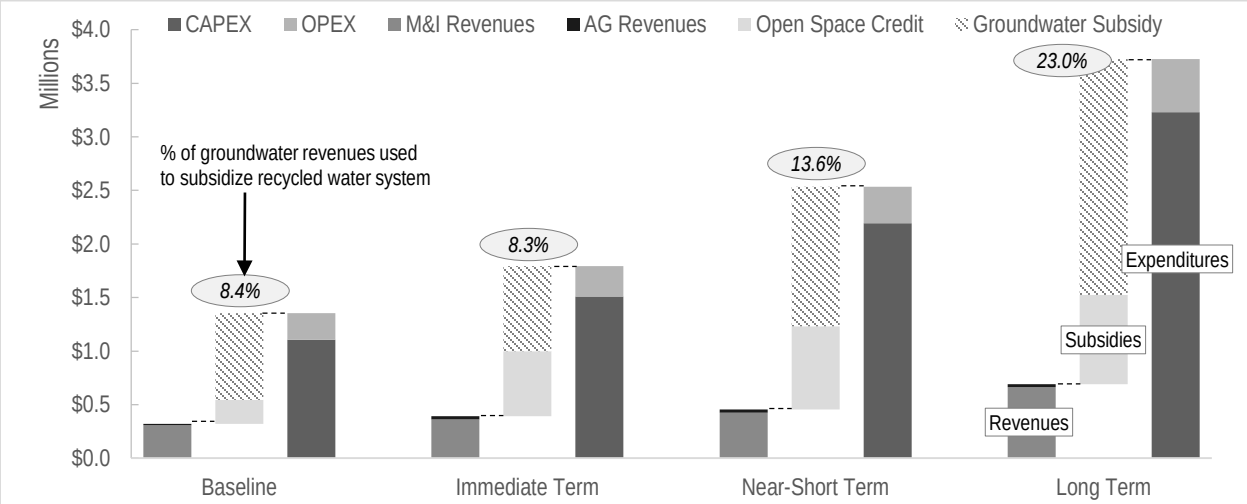
[2] Winter months where rainfall typically increases and recycled water demand drops off.

2.1 Increasing rates alone will not make a material dent in the funding gap

The 2015 Master Plan Update details three phases of improvements to the South County recycled water system. The update includes information on the estimated capital spending and increase in operating costs, as well as the forecasted increase in recycled water consumption. Figure 1 shows the breakdown of recycled water program funding through recycled water rate revenue, Open Space Credit revenue, and groundwater rate revenue for each of the three expansion phases (assuming 2014/2015 South County water rates[3]).

The increase in the recycled water funding gap (depicted by the hashed area in Figure 1) will necessitate an increase in funding (i.e. subsidy) from groundwater rate revenue. Furthermore, since the $20/AF difference between groundwater and recycled water rates is only a 6% difference, increasing recycled water rates to match groundwater rates will not make a material impact on closing the funding gap. On the contrary, increasing recycled water rates to match groundwater rates could discourage existing and future customers from using recycled water since recycled water is an imperfect substitute for groundwater.

Figure 1: Recycled Water Revenues, Expenditures, and Subsidies[4]



Source: 2015 Master Plan Update CIP cost estimates and demand prrojections. MWH Analysis.
Note: Groundwater subsidies percentages are based on an assumption of 30,000 AFY of groundwater sales at the 2015 rate of $319/AF as provided during a call with District staff on October 13, 2015.

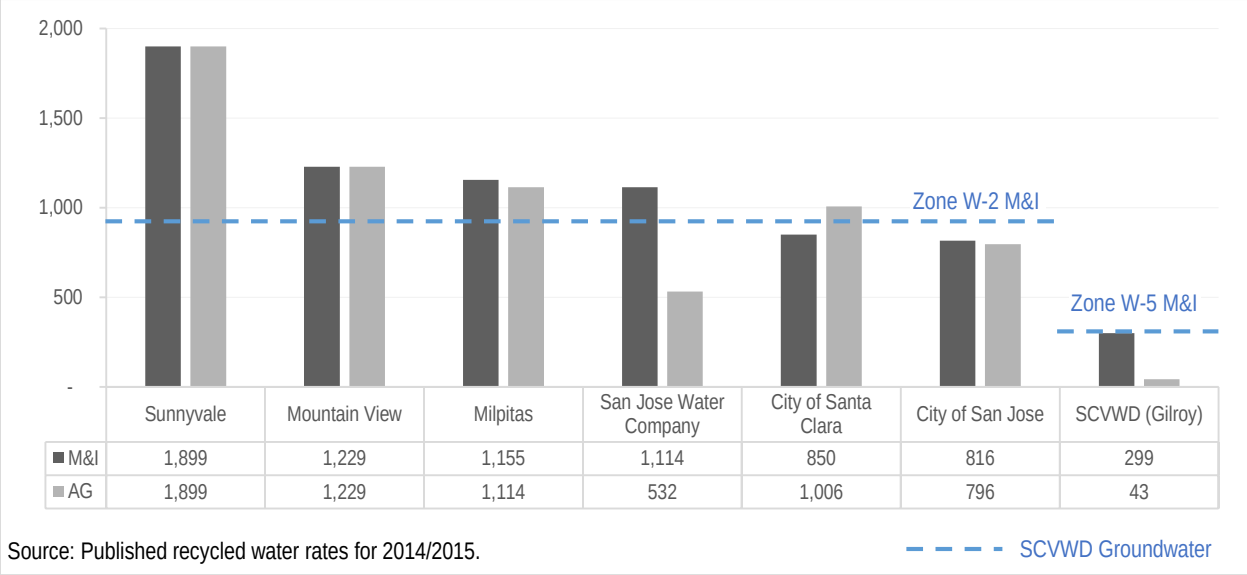
Figure 1 Takeaway: Subsidies are substantial portion of recycled water funding

[3] M&I recycled water at $299/AF, AG recycled water at $42.94/AF, and groundwater at $319/AF.
[4] Groundwater subsidies percentages are based on an assumption of 30,000 AFY of groundwater sales at the 2014/2015 rate of $319/AF as provided during a call with District staff on October 13, 2015.

2.2 Low groundwater rates have put a limit on the ability to charge adequate recycled water rates

While customers won't be willing to pay more for recycled water than for groundwater, their willingness to pay a higher rate for recycled water service *in the absence of a another source* is clearly demonstrated in the region based on the recycled water rates charged by other water utilities in the region. Figure 2 shows recycled water rates from peer agencies. Higher potable water rates in those service areas allow recycled water to be sold at a relatively higher price point.

Figure 2: Peer Agency Recycled Water Rates



	Sunnyvale	Mountain View	Milpitas	San Jose Water Company	City of Santa Clara	City of San Jose	SCVWD (Gilroy)
M&I	1,899	1,229	1,155	1,114	850	816	299
AG	1,899	1,229	1,114	532	1,006	796	43

Source: Published recycled water rates for 2014/2015.

Figure 2 Takeaway: District's potable water rates are low, limiting recycled water rates

It has been assumed that it is outside of the scope of this report to propose that groundwater rates be increased in order to be able to increase recycled water rate revenue.

2.3 The District's recycled water system is underutilized because of summer peaking

The ability of the South County recycled water system to take on new customers is limited by its capacity to provide service during peak demand periods. Figure 3 shows the system-wide recycled water deliveries in 2014. During the majority of the year, there is un-used capacity and therefore lost opportunity to generate revenue. While demand peaking in this region is unavoidable due to seasonal rainfall and crop establishment cycles, system capacity (at least 183.25 AF/month[5]) during the shoulder months could be better utilized.

Figure 3: 2014 Monthly Recycled Water Deliveries[6]

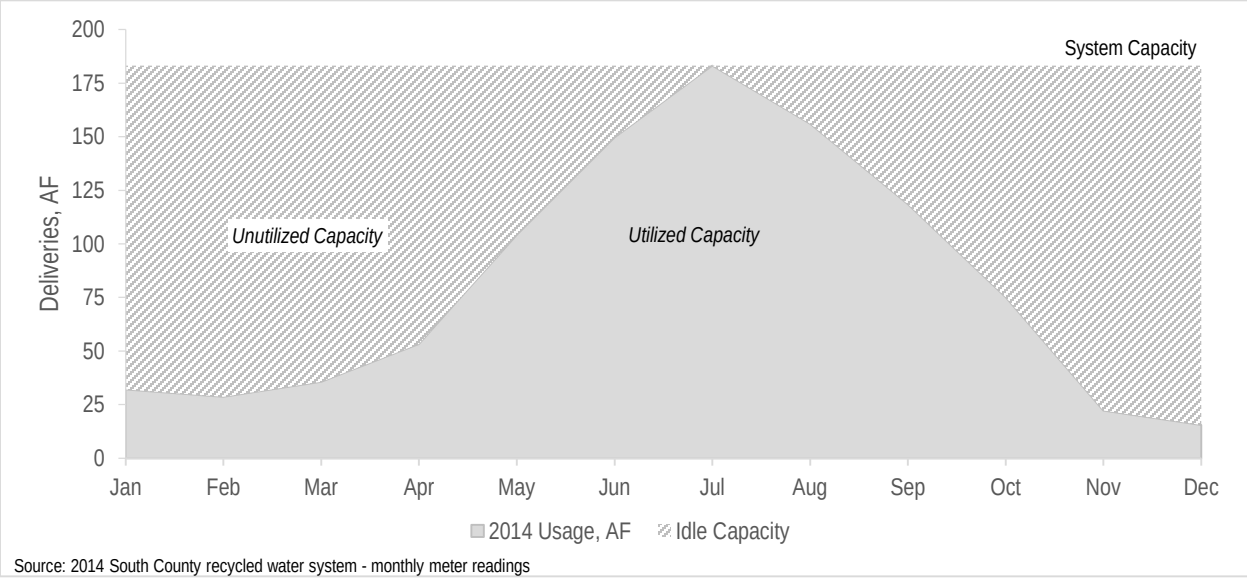


Figure 3 Takeaway: Year-round capacity could be better utilized

The hatched region of the figure shows the additional recycled water that could theoretically be sold to end users. These additional recycled water sales would both increase revenue and alleviate pressure on groundwater use.

The demand peaking behavior for all customers is uniformly centered on the summer months (June-August). Again, **the seasonal peaking behavior is the primary reason limiting the District's ability to connect more customers and sell more recycled water**, most of which will likely have some level of year-round recycled water demand.

[5] Based on 2014 max month deliveries. Actual system capacity is likely to be higher.
[6] Recycled water used as process water within the treatment facility is considered "non-revenue water," and thus excluded from the chart.

2.4 It will be difficult to substantially increase capacity utilization through customer selection

The 2015 Master Plan Update includes a Market Assessment, which ranks customers, in part, based on their likely seasonal utilization Figure 4 compares the 2014 season recycled water usage patterns of an existing “most desirable” customer and a “least desirable” customer, where more consistent year-round utilization is more desirable. The figure shows that the difference in peaking behavior between most and least desirable customers does not differ significantly.

As such, selectively targeting only “low peakers” as new customers (or even trying to replace high-peaking customers with lower peaking customers) may not address the issue of under-utilized year-round capacity.

Figure 4: How Different Types of Customers Affect Utilization Ratio

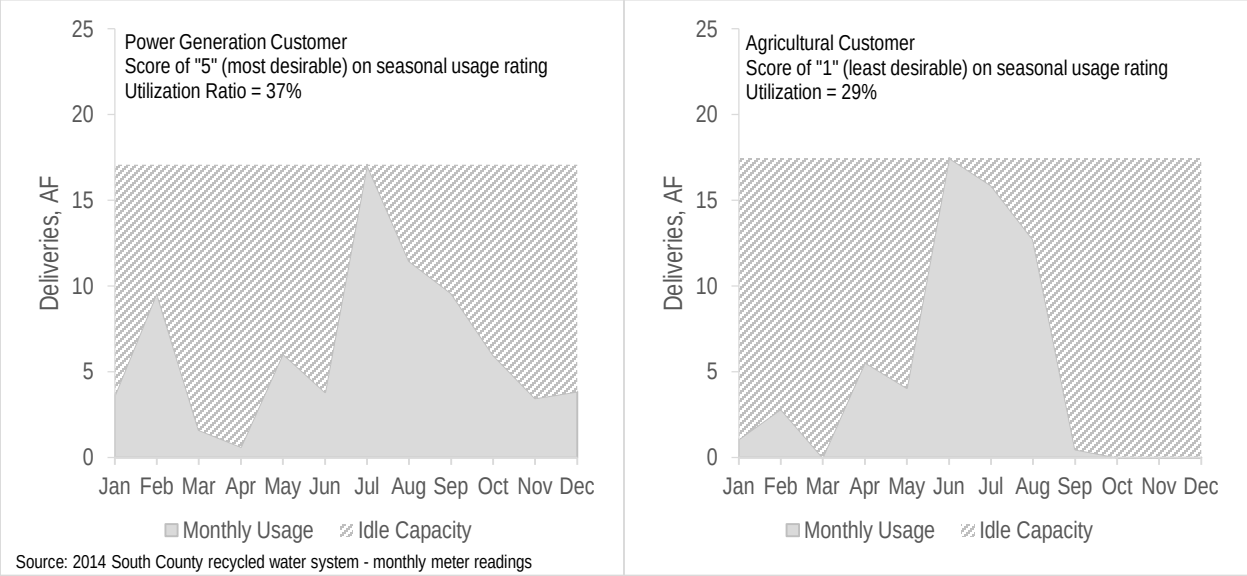


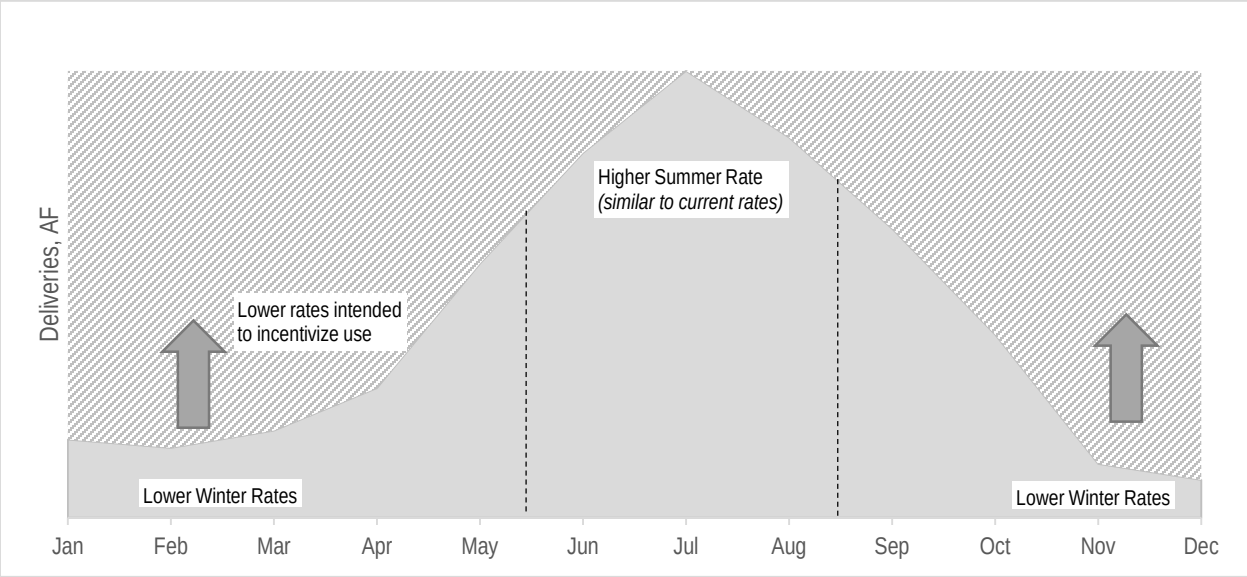
Figure 4 Takeaway: Even the “low peaking” customers show significant peaking behavior

2.5 It will be challenging to encourage customers to increase consumption during shoulder months

Some utilities charge lower rates during shoulder months to encourage higher water usage during that period (thus increasing total sales). Figure 5 illustrates the intended effects of seasonal rates.

Lowering rates during shoulder months to increase demand also has a fatal flaw; the drop-off in recycled water use in region during the shoulder months is due to a lack of demand (as opposed to a business decision to use less water). Irrigation customers don't need water during the cold and wet season, and industrial customers (e.g., such as electrical utilities) also use water commensurate with seasonal need. Given that the majority of identified potential customers are irrigation customers[7], there will always be a demand drop-off during the winter. The only users that may make the business decision to use more water during shoulder months due to a lowering of recycled water rates would be AG customers who may make the business decision to plant a second or third crop. However, since AG rates are already priced at a small fraction of M&I rates, lowering these rates is not likely to increase demand in a way that creates additional revenue.

Figure 5: Intended Effect of Seasonal Rates



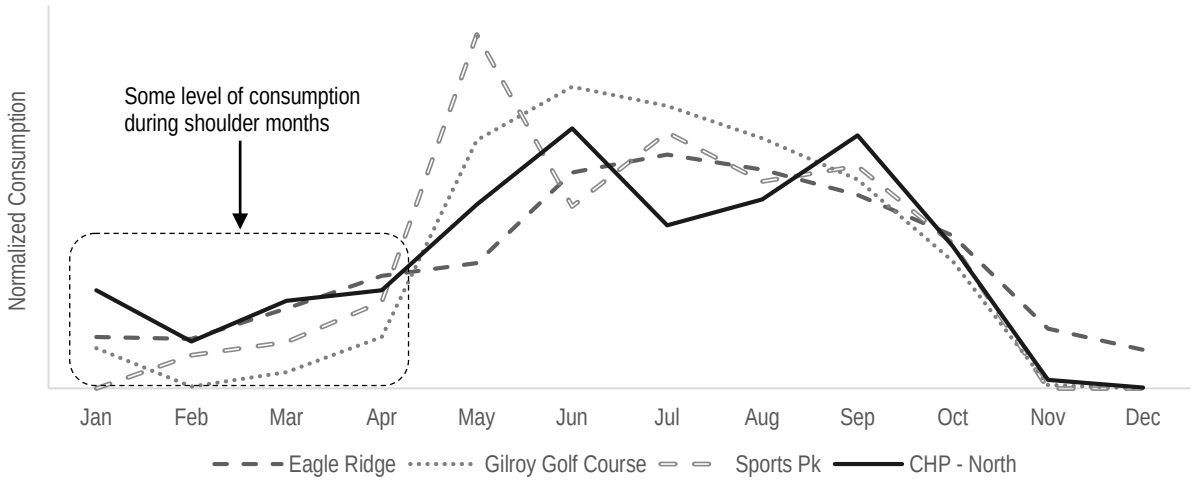
Most customers don't decide winter consumption based on price

[7] Based on the Market Assessment, approximately 75% of the existing and potential customers (62/84) were classified as "irrigation."

2.6 The best revenue opportunity is through connecting additional customers

Since lower seasonal rates are unlikely to result in additional recycled water sales, the best opportunity for additional sales during the shoulder months is by "making room" within the system capacity to connect to additional customers that have some degree of year-round usage. Figure 6 shows that existing M&I customers that consume over 10 AF per year (AFY) all show some level of shoulder month consumption[8]. This customer segment also fits the profile of a majority of the potential customers in the Market Assessment.

Figure 6: Behavior of Irrigation Customers with Annual Consumption >10AF



Note: Most customers with annual consumption of less than 10 AF did not use recycled water during shoulder months in 2014
Source: 2014 South County recycled water system - monthly meter readings

Figure 6 Takeaway: Connecting more users like this will increase shoulder month sales

However, those same customers still peak during the summer. So how might the District add these new customers without exceeding the system's capacity to deliver recycled water during the summer, creating a capacity shortfall, and decreasing the reliability of the recycled water service? How might the District "make room" for these additional customers? The following subsection provide potential solutions.

[8] The Market Assessment shows 67% of customers (55/82) are M&I customers that will likely have annual demands exceeding 10AF. Analysis of existing customer usage patterns in 2014 show that customers that use less than 10AF usually shut off their recycled water use entirely during shoulder months.

2.7 Peaking charges and interruptible service agreements may free up additional capacity to connect more customers

As commonly seen in the power industry, "peaking charges" are used to discourage usage during peak demand periods. Such rates are based on the customer's single highest usage event during the peak period, as compared the customer's year-round average usage. If peaking charges are significant enough, they discourage customers from peaking during peak seasons, thereby creating "more room" during period of capacity constraint and creating the opportunity for more year-round sales. Figure 7 illustrates the intended effect of seasonal peaking charges.

Figure 7: Intended Effect of Peaking Charges

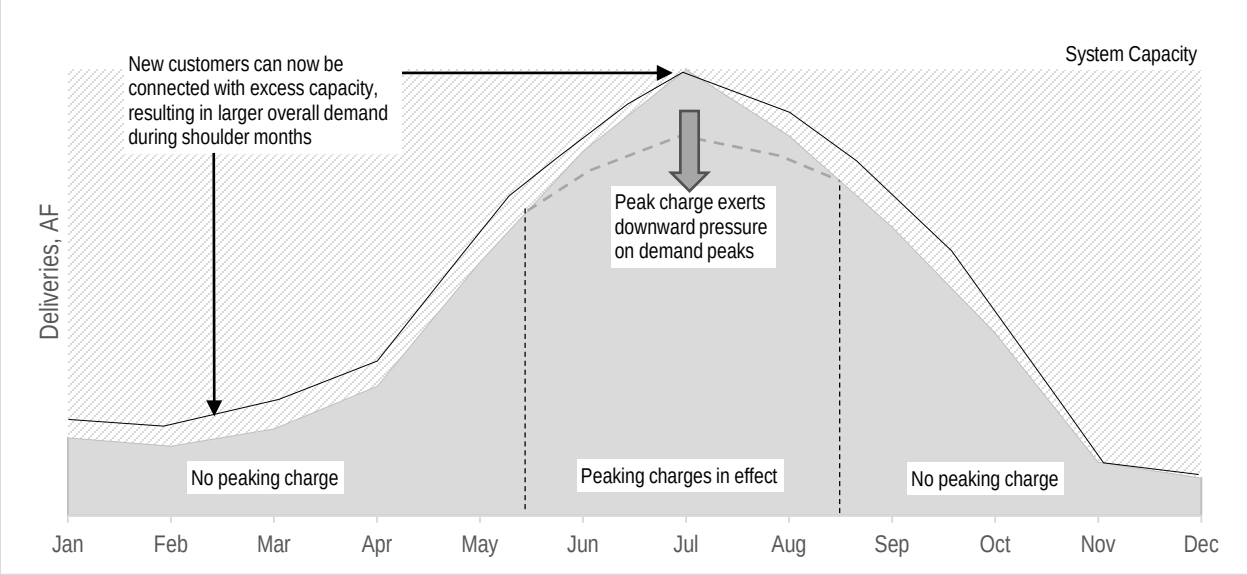


Figure 7 Takeaway: Adding customers generates additional shoulder month demands

There are two manners in which customers can positively react to peak pricing. The more desirable reaction is when customers simply use water more efficiently during peak periods. This reaction is most likely to occur if the customer realizes that recycled water is only the more affordable water supply option when they manage their peaking behavior.

The second reaction, which is still a good outcome for the District, is if the customer chooses to switch to groundwater during peak months. While this may seem counter-intuitive since the recycled water program is trying to reduce groundwater use, this is exactly what is being achieved when peaking is reduced and more year-round sales are achieved.

A more drastic (but also more predictable) measure of peak demand control is establishing "**interruptible service agreements**," whereby certain customers would agree to have their recycled water service entirely switched off during the peak months in exchange for a lower recycled water rate for the rest of the year. As previously mentioned, those customers would need to have access to groundwater supplies during those times when their recycled water service is shut off. If such agreements are made with the District's highest peakers, enough

capacity could be “freed up” during the peak months that more customers could be allowed to join the system.

Again, it is likely that the customers with interrupted service will switch to using groundwater during this period, but by making more room for year-round recycled water sales, the net effect will reduce groundwater depletion. Clearly the feasibility of such agreements depends on the customers’ ability to switch water supply and each contract may need to be negotiated individually.

Figure 8: Intended Effect of Interruptible Service

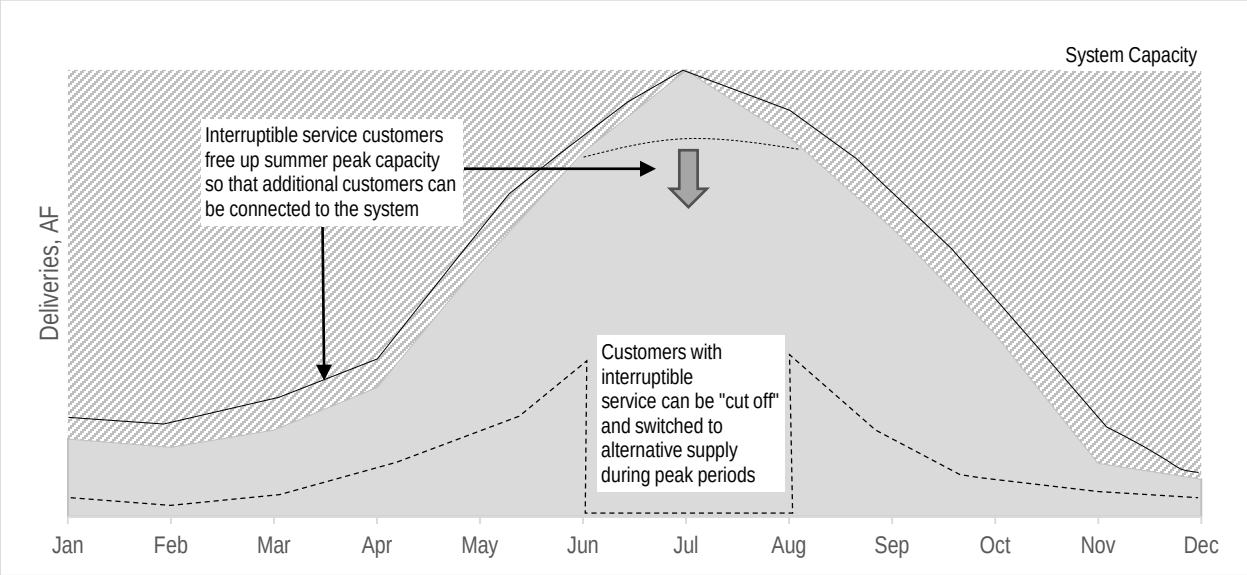


Figure 8 Takeaway: Adding customers generates additional shoulder month demands

3 SUMMARY AND RECOMMENDATION

The recommended Capital Improvement Program in the 2015 Master Plan Update will expand the District's recycled water system as well as increase annual costs. Since raising rates alone will not substantially cover the funding gap, additional methods are needed to recover additional revenue. The primary opportunity for increasing recycled water revenue is through connecting additional customers to the system, which requires a mechanism to manage the summer peaks. Table 1 summarizes the different rates structures that were discussed in this report.

Table 1: Summary of Rate Structures

Rate Structure	Intended Effect	Likely Effect
Increasing Existing Rates by Decreasing Price Difference Between Groundwater and Recycled Water	Generate more revenues from existing deliveries to close funding gap.	Minimal or negative effect on net revenues since (a) the difference between recycled water and groundwater rates is small and (b) higher prices may drive customers towards using groundwater.
Seasonal Rates	Lower recycled water rate in the winter will encourage more consumption and increase supply utilization.	Minimal or negative effect on net revenue since most customers do not have an economic incentive to use more water, regardless of the price, therefore lowering winter rates will simply decrease total revenue.
Seasonal Peaking Charges	Have a charge for high peak flows in the summer will reduce peaking behavior and make room for more customers.	Certain customer may elect to conserve or use groundwater during peak months, making room for more customers and allowing for more recycled water sales on a year-round basis.
Interruptible Service Agreements	A more drastic form of seasonal peaking charges – negotiate with certain customers to shut down their service during the peak months will create capacity to connect more users.	Certain customers may elect to use groundwater during peak months in exchange for cheaper recycled water, making room for more customers and allowing for more recycled water sales on a year-round basis.

Based on the data set that was analyzed from the 2015 Master Plan Update, seasonal peaking charges and interruptible service agreements appear to be the best structures that will meet the priorities of the District, and are thus recommended for further investigation.

IMPLEMENTATION FACTORS & PUBLIC OUTREACH TM

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1 INTRODUCTION

The Implementation Factors & Public Outreach Technical Memorandum (TM) highlights the primary considerations to be addressed in preparing and deploying the *2015 South County Recycled Water Master Plan Update* (2015 Master Plan Update). The implementation activities are then arrayed by four communication layers:

- Macro, Overarching Communications
- Internal Communications, Outreach and Change Management
- External Communications and Outreach
- Communications and Outreach Risk Management

Implementation considerations then are offered for each of the four layers. The TM closes with a summary of recommendations and suggested next steps.

2 SETTING AND CONTEXT

The Santa Clara Valley Water District (District) is the primary water resource agency for the two million residents of 15 Santa Clara County cities, supplying wholesale water, providing flood protection and serving as environmental steward for clean, safe creeks and healthy ecosystems.

About half the water used in the county originates hundreds of miles away in the Sierra Nevada and is delivered through the Sacramento-San Joaquin River Delta (Delta) or the Hetch Hetchy system. Most of the remainder comes from local rainfall, much of which is captured in the water District's 10 local reservoirs.

Water conservation and wastewater reuse are also important parts of the District's water supply planning. To provide greater reliability, the District also "banks" water in groundwater storage in and outside of the county, which can be called upon during dry times.

The South County Regional Wastewater Authority (SCRWA) is a joint powers authority established to own and manage the municipal wastewater facilities, including wastewater reuse for the Cities of Gilroy and Morgan Hill.

In partnership with the District, the SCRWA operates a recycled water facility co-located at its wastewater treatment plant (WWTP) site. The SCRWA WWTP was built in 1990 and is a model of energy efficiency and cost effective operation. The plant uses state-of-the-art, fully automated, high-efficiency equipment to save costs and resources. SCRWA reliably meets the steadily increasing demand for recycled water to irrigate local parks, golf courses, sports complex, landscape medians, and agricultural and industrial uses. The plant's remaining effluent is disposed of in percolation ponds. The ponds allow the water to soak into the soil and eventually add water to the underground aquifer. This process also allows recycled water to be used on agricultural buffer lands.

2.1 2015 SOUTH COUNTY RECYCLED WATER MASTER PLAN UPDATE

The District and SCRWA are developing the 2015 Master Plan Update for the District to include the expanded use of tertiary treated recycled water within the south county. The projects identified in the updated Master Plan will seek to increase the reliability of the County's long-term water supplies. Increased recycled water usage will also lessen the demand on groundwater and provide SCRWA with additional discharge alternatives.

2.2 PREVIOUS EFFORTS AND EXPERIENCE

The District is a leader in use of recycled water. In addition to work with SCRWA in the south county, the District, in a cooperative project with the City of San Jose and City of Santa Clara has constructed the Silicon Valley Advanced Water Purification Center (Purification Center). The Purification Center allows for even more recycled water uses in Santa Clara County by reducing the salt concentration of recycled water. However, that facility does not provide recycled water to the SCRWA service area.

With such an emphasis on increasing the use of recycled water, the District has long worked with the public to advance its awareness and acceptance of need, safety and feasibility. Communications efforts inform stakeholders and members of the public of the continued possibilities for purified water as a safe, reliable, local and drought-proof water supply for the County.

A number of external factors have increased public awareness of the need to increase water supply sources and storage solutions. In recent years, major news outlets have featured stories on the historic drought and contentious proposals for changes to the system that delivers water from the Delta. A long standing and escalating argument that Hetch Hetchy dam should be removed is now being litigated and, because it involves the iconic Yosemite National Park, also receives periodic national attention.

Concurrently there are an increasing number of potable reuse projects in the state of California (State) and throughout the world. The State has also recently revised its regulatory approach to recycled water and is supporting the expanded implementation of potable reuse projects, initially indirect potable reuse (IPR) and possibly direct potable reuse (IPR) in the future. Any type of potable use is likely to have significant resistance from the public, and therefore an effective public outreach and education program will be needed.

A variety of sources have examined how to address public concerns related to recycled water and listed lessons learned and best practices for implementing outreach and engagement. Retrospectives from other efforts, like the comprehensive public outreach program conducted for the Orange County Water District's (OCWD) Groundwater Replenishment System, have outlined specific strategies. OCWD officials found that a "grass tops" approach emphasizing acceptance of recycled water use by opinion leaders, elected officials, and celebrities was effective. Their tactics included support cards, letters, and resolutions from community leaders, organizations, and elected officials to their constituents.

The District's communication team has also developed strategic and other plans to raise awareness about the importance and resilience of potable reuse as a water supply source.

3 MACRO, OVERARCHING COMMUNICATIONS

Macro, overarching communications refers to non-project specific outreach and messaging related to alternative water sources generally and recycled water specifically. It may also refer to wastewater reuse information deployed by others (for different or related purposes) likely to drive public perception or action. In the case of the District, SCRWA, and other sister agencies, there is an overall interest in advancing the use of alternative water sources and wastewater reuse for multiple projects and initiatives far beyond just the wastewater reuse in the SCRWA service area

Implementation Recommendation 1

Leverage macro, non-project specific communication in support of wastewater reuse.

Macro messaging prepares audiences for more detailed communications by educating and creating a conceptual understanding of the need to take action. In this case communications will also reinforce messages and the safety, cost effectiveness, and benefits of water reuse in general.

3.1 BUILDING THE CASE FOR ALTERNATIVE WATER SOURCES

California's multi-year drought and the heightened discussions about global climate change have dramatically altered statewide discussions about implementation of alternative water sources. While water conservation and water use efficiency have never been hard to sell, there has been lingering doubt as to how much could be accomplished with alternative sources and at what price. Recent numbers regarding statewide urban water use reduction have demonstrated what is possible on the efficiency side; however, with these dramatic decreases now in place, conversation has realistically reached the point of diminishing returns. Once the lawns are gone and showerheads and toilets replaced, the cost and feasibility of doing more becomes an issue.

The next obvious sources of additional supply are desalination and wastewater reuse. Recycling for agriculture and landscape irrigation is widely accepted in the region; however, other uses have been considered speculative and cost prohibitive. That situation has changed with the drought, the change in the cost of existing supplies, and advances in treatment technologies changing the equation. It is the next steps with more M&I uses and IPR/DPR that become the tough sell.

Beyond cost and feasibility, one barrier to direct potable reuse (DPR) and indirect potable reuse (IPR) has been the regulatory environment. The State Water Board, once very skeptical of even indoor reuse for toilet flushing, is now engaged in rethinking the regulatory approach for DPR. This process is elevating the public debate about water reuse in a largely positive way.

Public opinion research conducted by multiple sources also indicates a new awareness of the need to move forward with water supply projects, including technology intensive sources such as desalination and recycling.

Implementation Tactics:

- Inventory macro messaging by the District, SCRWA and others to assess what is easily leveraged.
- Deploy (through the District and SCRWA routine communications) discussion of friendly third party source material.
- Identify trusted 3rd party messengers to advance macro messaging.
- Make available inventoried macro communications to provide background information to other communications partners, including civic groups, and the blogger and traditional media communities.
- Track general public opinion about wastewater reuse and adjust macro messages as needed.

3.2 ADVANCING THE DISTRICT AND SCRWA AS PART OF THE SOLUTION

Concurrent with macro messaging about alternative water sources is a need to advance the idea that the District and SCRWA are part of the solution. The purpose of this messaging is to emphasize that action is needed and is best taken by local agencies.

Through the California Water Plan and Integrated Regional Water Management initiatives, the State has long advanced the idea of regional self-sufficiency. The 2015 Master Plan Update is an excellent example of the types of efforts promoted by the State.

The political context related to Bay Area water supply is also a driver. The heated debates on the fate of the Delta and litigation related to Hetch Hetchy illustrate that external events can greatly impact the fate of Bay Area communities These examples can be used in communications that emphasize the wisdom of managing locally, that which the agencies can control.

Additional communications messages can affirm that the District is among the most respected of water agencies in the country and that in collaboration with SCRWA is able to competently execute wastewater reuse projects.

Implementation Tactics

- Build messaging about regional self-sufficiency for inclusion in general communications.
- Communicate the track record of the District in promoting local leadership.

4 INTERNAL COMMUNICATIONS, OUTREACH, AND CHANGE MANAGEMENT

For the 2015 Master Plan Update, internal communications refer to interactions with those individuals that are members of the implementing organizations. Internal communications, outreach, and change management are as important as external ones and have additional considerations. There are four primary communications and outreach focuses related to implementation planning for internal audiences:

- Translation of Macro and External Messaging
- Technical Concurrence
- Operational Adjustments

- Project Management

The purpose of this type of change management, communications and outreach is to increase the capacity of internal stakeholders to project organizationally consistent macro and external messages and to deploy best management practices for project implementation.

Implementation Recommendation 2

Create a proactive outreach and communications strategy for internal staff in support of the 2015 Master Plan Update.

4.1 TRANSLATION OF MACRO AND EXTERNAL MESSAGING

While internal audiences are likely more receptive to messages about wastewater reuse in general they are equally likely to interact with family, friends and neighbors and other audiences with differing perspectives. Internal audiences need sufficient information to provide information to others. Equally important is a need for the District and SCRWA personnel to deploy consistent messages. Uneven and consistent messages from internal parties create confusion and add to project risk.

It is also important to ensure the internal audiences are not surprised by external messages. Staff dissention can be created by personnel hearing about something from a third party and being unable to adequately inform or respond. In addition to being embarrassing to the employee, it diminishes the external view of the organization as a capable project manager.

Implementation Tactics

- Deploy and test macro and external project messaging with internal personnel.
- Ensure internal staff are trained and receive to critical project messages prior to external release.

- Develop speaker bureau presentation

4.2 TECHNICAL CONCURRENCE, OPERATIONAL ADJUSTMENTS, AND PROJECT MANAGEMENT

Internal communications are important to project success. Organizational members have the greatest understanding of the system, and this institutional knowledge is a tremendous asset. Further, the changes prescribed by the 2015 Master Plan Update will most directly affect the people operating and maintaining the current delivery system.

Early consultation may yield improved design and implementation procedures. Plans for training on new skills and methods will be required. Additionally, individuals providing input into changes are typically more adaptive to the change.

A critical component of internal communications and outreach is change management. Change management is the application of a structured process and set of tools for leading the people side of change to achieve a desired outcome.

Change management considers any needed adjustments to the organizational culture, process or personnel that will be required as a result of project activities. This includes all levels of the organization including executives, senior leaders, middle managers and line supervisors. When change management is done well, people feel engaged in the change process and work collectively towards a common objective, realizing benefits and delivering results.

Figure 1 illustrates the intersection of change management factors involved in moving forward with plans and projects. Organizational culture, processes and personnel are all likely to be impacted when the 2015 Master Plan Update is implemented.

Internal change management communications include six key steps:

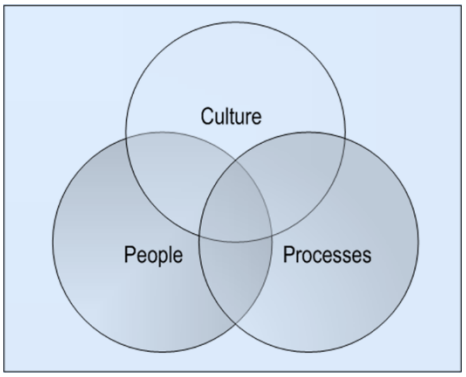

Figure 1. Internal Change

1. Clearly define what changes will occur. This means the actual changes, not the outcomes. For example it may mean one or more new inspection procedures may be implemented, or that people will use new tools or skills.
2. Outline the impact of the change to the individual and the individual's group.
3. Explain the process and methods to be used in implementing the change.
4. Describe the benefits of action and the costs of inaction.
5. Ask for assistance in determining who else may be impacted by the change and how.
6. Ask for improvements that can be made to the change, process, and methods.

The remaining primary outreach and communications areas identified for the 2015 Master Plan Update are:

- Technical Concurrence
- Operational Adjustments
- Project Management

Technical Concurrence

Implementation of the 2015 Master Plan Update will involve a high level of complexity. Research indicates that early engagement in solution building results in better project implementation. Discussion and broad evaluation of selected approaches will facilitate technical concurrence among the many internal experts. Based on project management research, this type of engagement typically results in better projects.[1] Technical concurrence will be needed to ensure consistent project messaging and reduce resistance to new approaches.

[1] Project Management Institute: http://www.pmi.org/~/media/PDF/Publications/Enabling-Change-Through-Strategic-Initiatives.ashx

Operational Adjustments

Similarly, the 2015 Master Plan Update will result in operational changes and adjustments. Further, in many projects, the organizational understanding about existing systems and procedures are not always accurate. There are many reasons for this, but often the published methods and standards have been adapted to unique circumstances and requirements but have not always been discussed or documented. Consultation with operations personnel to validate the existing system is vital.

In tandem, operations personnel often have a perspective of how methods work or don't work in a real world setting. Early consultation with operations personnel about adjustments to the system reduces difficulties in later implementation.

Project Management

A key function of project management is outreach and communications, both to the project team[2] and to external parties. Preparation of project management plans and charters should be aligned with overall communications strategies to build consistency and project support.

Implementation Tactics

- Utilize the change management communications and outreach six step process to frame the overall approach for internal communications and outreach.
- Engage technical and operational personnel early in the process to inform and interact on design and methods. Aim for concurrence on approach.
- Include internal communications and outreach in project management plans and team charters.

5 EXTERNAL COMMUNICATIONS AND OUTREACH

External communications and outreach refers to interactions with those outside of the implementing organizations. Six primary project implementation factors are identified as requiring communications and outreach strategies. Those implementation factors include:

1. Market
2. Project Footprint
3. Regulatory Environment
4. Funding
5. Governance
6. Education & Community Support

Communications and outreach strategies should be defined for each implementation factor and tied to any decisions of importance to stakeholders

Implementation Recommendation 3:

Using the six implementation factors as a starting point, identify likely stakeholder areas of issues and interests. Establish the appropriate level of engagement for each issue and interest and design communications and outreach to meet project needs.

[2] A Project Team is the group responsible for planning and executing the project. It consists of a Project Manager and a variable number of Project Team members, who are brought in to deliver their tasks according to the project schedule.

5.1 MARKET

As it relates to the 2015 Master Plan Update, market communications and outreach focus on demand. The District and SCRWA need a strong understanding of how much water is wanted, at what quality, for what price, and under what conditions. Market development, outreach and analysis will be critical to determining project design and sizing as well as economics.

The Master Plan Update includes an updated Market Assessment (identification, quantification, water quality needs, screening). Market communications should also address the following issues and interests:

- Water Quality – tie quality with intended use, emphasize safety.
- Pricing – tie price to reliability and operational flexibility. Note that alternative water sources like groundwater (without recharge) and rainfall have decreasing reliability.

Implementation Tactics

- Develop and deploy project specific marketing messages.

5.2 PROJECT FOOTPRINT

The project footprint relates to the physical location where the 2015 Master Plan Update will be implemented. This is relevant to communications as it helps define the stakeholders that must be engaged and what topics they will be interested in. In this case topics will include final siting, conflicts with other activities, and the potential to leverage construction activities with other projects with similar needs (e.g. excavation, movement of utilities, etc.). The planning should also include a detailed assessment of communications and outreach needed to acquire rights-of-way and access.

There will be a need for a supplemental public outreach plan for project phases involving construction. The level and duration of the effort will be determined by scale and timing of the project phases.

Implementation Tactics

- Survey other agencies on planned projects in the project footprint area to determine potential conflicts and identify opportunities for shared activities. Agencies with shared interests may include other utilities, transportation agencies, recreation districts, etc.
- Develop a list of project footprint issues likely to require interactions with the public.
- Plan for supplemental outreach plans during construction phases.

5.3 REGULATORY ENVIRONMENT

Project communications should include a plan for working with the regulatory agencies. This will be important for managing technical issues and permitting but also important from the standpoint of collaborating on interactions with stakeholders that both the regulators and 2015 Master Plan Update agencies work with. The project team may also need to revisit and monitor recycled water ordinances.

The goal of regulatory communications is to facilitate trouble-free project approvals.

Implementation Tactics

- Create an inventory of all likely permit and regulatory actions and form a communications strategy facilitating trouble free approval.
- Identify shared stakeholders and collaborate with permitting and regulatory agencies on mutually beneficial outreach and messaging.

5.4 FUNDING

Project outreach and communications related to funding involve message development on the following topics:

- Funding Sources – Messages relate directly to how the project will be paid for and highlights efforts to acquire funds from external sources. Project design and messaging should also position the project to be eligible for as many fund sources as reasonably possible.
- Pay Back – Messages relate to the project return on investment.
- Offsets for Larger Goals (water conservation, etc.) – Messages relate to the ability of the project to achieve larger goals, and how the benefits are extended beyond just the immediate recipients of project water.
- Beneficiaries– Messages relate to who will pay for specific customer improvements and why.

Implementation Tactics

- Further refine funding messages and the stakeholders for each funding topic. Deploy communications and outreach appropriate to each audience (this may range from simple informational materials to direct consultation with critical stakeholders).

5.5 GOVERNANCE

External communications associated with governance has two forms. The first relates to how implementing agencies communicate to their individual stakeholders as to the benefits of joint governance. Stakeholders want assurances that the governance arrangements are beneficial and will not disadvantage future transactions.

The second form of governance communications relates to specific actions and agreements involving external parties. This includes topics such as:

- Customer agreements
- Land acquisition
- Coordination with developers

Implementation activities need to include a clear delineation as to communications roles and responsibilities, and how agreements will be managed.

Implementation Tactics

- Prepare benefit statements for Project Governance Agreements.
- Prepare Project Communications RACI Charts. RACI is the acronym for Responsible, Accountable, Consulted, and Informed. RACI charts delineate each core function and task then assign communications roles and responsibilities.

5.6 EDUCATION & COMMUNITY SUPPORT

Education and community support communications are similar to macro messaging but are project specific. The personnel assigned to communications at both SCVWA and SCRWA has extensive experience with this type of project outreach. Prescribed outreach will also be required as part of compliance with the California Environmental Quality Act (CEQA).

Prior to implementation, a best practice is to conduct a situation assessment. Assessments are part of an information-gathering process that informs outreach, engagement and collaboration. A situation assessment is considered an intervention. In other words it presents the first communications and engagement effort of the project. Because it is an assessment, it allows for the non-binding, initial introduction to the project and allows the project team to test ideas and make any needed adjustments before they are broadly deployed.

To prepare for larger community outreach on the 2015 Master Plan Update and expanded use of wastewater reuse, the project team would benefit in knowing more about:

- Opinion leaders and their perspectives
- Advocates and detractors
- Attitudes and knowledge about the project
- Potential for localized and neighborhood impacts (positive and negative)
- Other elements that would be useful to the crafting of a broadly supported project
- The external and internal context in which the project will occur. A typical question is, “What outside or internal events will drive or impact the project?”
- Existing communications channels (newsletters, websites, customer meetings, etc.) that should be utilized to provide education and build support.

Implementation Tactics

- Identify and plan for legally prescribed outreach such as public input process required by CEQA.
- Conduct a situation assessment to refine outreach and communications planning.

- Review strategic communication plan to build specific project outreach plans at neighborhood level.

- Leverage coalition of supporters to help serve as messengers for appropriate groups

6 COMMUNICATIONS AND OUTREACH RISK MANAGEMENT

A core function of implementation planning is to reduce risk. Risk management is the identification, assessment, and prioritization of risks (defined as the effect of uncertainty on

achieving objectives) followed by coordinated, efficient and economical strategies and actions to minimize, monitor, and control the probability and/or impact of negative events. Strategies and actions may also be used to avert risk by leveraging strengths and opportunities. Several risk management standards have been developed. The one presented here utilizes standards from the Project Management Institute. Table 1 outlines standardized outreach and communications risk categories.

Table 1. Risk Factors

RISK CATEGORY	Managing Outreach RISK FACTORS
Technical, quality, or performance	Communications planning has realistic performance goals, scope, and objectives
Project management	Project management incorporates: Quality outreach design Outreach deployment coupled with a change management perspective Appropriate allocation of time and resources Adequate support for outreach in project management plans
Organizational / Internal	There is internal support through: Strong executive sponsorship Proper prioritization of efforts Management of conflicts with other functions Proper distribution of workload between organizational and consultant teams
Historical	The organization has: Positive past experiences with similar projects (or if not, has mitigated for this) Organizational relations with stakeholders Policy and data adequacy Designed outreach to avoid media and stakeholder fatigue
External	Decision makers and the project team have anticipated and planned for the project: Legal and regulatory environment Changing priorities Risks related to political dynamics

Implementation Recommendation 4:

Utilize information gathered from the situation assessment and other outreach and communications planning steps to conduct a risk assessment.

Implementation Tactic

- Using the risk management factors as a starting point, regularly revisit communications planning to ensure that risks have been eliminated or mitigated.

7 SUMMARY

Four outreach and communication approaches have been outlined for use in successfully implementing the South County improvements:

- Macro, Overarching Communications, including broad county-wide communications about potable reuse for sustainable water supply
- Internal Communications, Outreach and Change Management
- External Communications and Outreach
- Communications and Outreach Risk Management

Appendix A summarizes implementation recommendations and tactics. It also identifies timing for the activity.

8 SUGGESTED NEXT STEPS

Four recommendations and a number of implementation tactics have been identified. Some recommendations and tactics, like those related macro messaging, will require coordination with those outside of the project and communication teams. A typical next step is preparation of a formal project communications plan.

The communications plan would be constructed using information from the situation and risk assessments. The plan would also incorporate the project team's view on how to align communications and outreach steps with project phases and decision points. The next element of the communications plan would be to assign resources to initiate promising tactics. The final elements involve evaluation and a process to incorporate any needed adjusts to the communications approach based on feedback.

IMPLEMENTATION SUMMARY

Recommendations	Tactics	Timing
1. Leverage macro, non-project specific communication in support of the 2015 Master Plan Update. Reference 2015 Strategic Communications Plan for Recycled & Purified Water	• Inventory macro messaging by the District, SCRWA and others to assess what is easily leveraged. • Deploy (through the District and SCRWA routine communications) discussion of friendly third party source material. • Identify trusted 3rd party messengers to advance macro messaging. • Make available inventoried macro communications to provide background information to other communications partners, including civic groups, and the blogger and traditional media communities. • Track general public opinion about wastewater reuse and adjust macro messages as needed. • Build/ expand messaging about regional self-sufficiency for inclusion in general communications. • Communicate the track record of the District in promoting local leadership.	• Conduct inventory and assess other communication channels early in the process. • Outreach to occur throughout the planning and implementation phases.
2. Include communications tactics targeted at internal staff in support of the 2015 Master Plan Update.	• Deploy and test macro and external project messaging with internal personnel. • Ensure internal personnel are exposed to critical project messages prior to external release. • Utilize the change management communications and outreach six-step process to frame the overall approach for internal communications and outreach. • Engage technical and operational personnel early in the process to inform and interact on design and methods. Aim for concurrence on approach. • Include internal communications and outreach in project management plans and team charters.	• Continuous and concurrent with planning and implementation phases.

IMPLEMENTATION SUMMARY

Recommendations	Tactics	Timing
3. Develop project specific community outreach plans that inform residents of projects at the neighborhood level. Using the six implementation factors* as a starting point, identify likely stakeholder areas of issues and interests. Establish the appropriate level of engagement for each issue and interest and design communications and outreach to meet project needs. ***[* The six factors are: Market, Project Footprint, Regulatory, Funding, Governance, and Education & Community Support.]***	• Develop and deploy project specific marketing messages. • Plan for any needed additional market surveys to both assist in proper design development and create an additional opportunity for project education. • Survey other agencies on planned projects within the project footprint area to determine potential conflicts and identify opportunities for shared activities. • Develop a list of project footprint issues likely to require interactions with the public. • Plan for supplemental outreach plans during construction phases. • Create an inventory of all likely permit and regulatory actions and form a communications strategy facilitating trouble free approval. • Identified shared stakeholders and collaborate with permitting and regulatory on mutually beneficial outreach and messaging. • Prepare benefit statements for Project Governance Agreements. • Prepare Project Communications RACI Charts. [RACI is the acronym for Responsible, Accountable, Consulted, and Informed. The RACI charts delineate each core function and task then assign communications roles and responsibilities.] • Identify and plan for legally prescribed outreach such as public input process required by CEQA. • Conduct a situation assessment to refine outreach and communications planning.	• Tie to the applicable project phases.
4. Utilize information gathered from the situation assessment and other outreach and communications planning steps to conduct a risk assessment.	• Using the risk management factors as a starting point, revisit communications planning to ensure that risks have been eliminated or mitigated.	• After Situation Assessment, and periodic review thereafter.

Model Results

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SOUTH COUNTY REGIONAL WASTEWATER AUTHORITY

Santa Clara Valley Water District

2015 SOUTH COUNTY RECYCLED WATER
MASTER PLAN UPDATE

TECHINCAL MEMORANDUM

MODELING RESULTS

SUMMARY

MAY 2016

AKEL ENGINEERING GROUP, INC.

MWH

AKEL
ENGINEERING GROUP, INC.

May 10, 2016

Santa Clara Valley Water District
5750 Almaden Expy,
San Jose, CA 95118

Attention: Katrina Jessop, P.E.
SCVWD Recycled and Purified Water Program

Subject: Modeling Results Summary – Technical Memorandum

Dear Katrina:

We are pleased to submit this technical memorandum for the Modeling Results Summary. This memorandum summarizes the hydraulic model calibration, analysis criteria, identified alternatives, and the rational for selecting the preferred alternative.

1.0 HYDRAULIC MODEL UPDATE AND CALIBRATION

Santa Clara Valley Water District's (SCVWD) recycled water hydraulic model combines information on the physical characteristics of the system (pipelines, pump, storage reservoirs) and operational characteristics (how they operate). The hydraulic model then performs calculations and solves series of equations to simulate flows in pipes and calculate pressures at nodes or junctions.

The hydraulic model was updated using Innovyze's InfoWater water distribution system modeling software, which offers an intuitive graphical interface and robust integration with ESRI's ArcGIS. The model was updated to reflect current facility improvements and alignments based on as-builts for the South Pipeline as received from SCVWD. Operational controls were updated based on operations staff data and SCADA received for the WWTP pump stations. The SCADA data contained flow and discharge pressures for the Area 93 and Area 94 Pump Stations. The model was updated with current pressure set-points and variable frequency drive (VFD) pumps in order to calibrate the existing system model. **Figure 1** documents the flows from the Area 93 and Area 94 pumps stations as predicted in the hydraulic model and compared to maximum day demands as recorded in SCADA in June and July of 2014.

2.0 SYSTEM PERFORMANCE AND DESIGN CRITERIA

One components of meeting the level of service is to provide appropriate pressures to recycled water customers. Velocity, headlosses, and pressures are important factors in the design of a

recycled water distribution system. To meet the required level of service and properly serve customers, the velocities and headlosses need to be limited to a reasonable amount, and the system needs to provide adequate pressure for customer use.

The recycled water distribution system components of the required level of service are listed in **Table 1.** The criteria are intended for maintaining efficient system operation while providing reliable service to the recycled water system customers.

For MDDs and PHDs, the following criteria were used for evaluating the capacity adequacy of pipelines:

- Velocities less than 5 feet per second (fps)
- Headloss less than 4 feet per 1,000 feet (ft/kft)
- Minimum pressures of 35 psi
- Normal operating pressures in the range of 60-120 psi

For pump stations, the following criteria were used for evaluating the capacity adequacy:

- Meet PHDs with largest unit out of service (for pressure zones without storage)
- Meet MDDs with largest unit out of service (for pressure zones with storage)

3.0 PRELIMINARY PROJECT ALTERNATIVES DEVELOPMENT

The recycled water system alternatives were developed to mitigate the existing system deficiencies and then to analyze potential alignments to expand the system to potential users.

3.1 Preliminary Pipeline Alignments

The first step in developing potential alignments was to mitigate deficiencies in the existing recycled water system. Through meetings with SCVWD, a baseline system similar to the 2004 Master Plan proposed baseline alignment was developed to mitigate the high headlosses and low pressures observed in the existing system. Once the baseline system was developed, preliminary alignments through four corridors in the City of Gilroy and three alternatives for the City of Morgan Hill were proposed as a way to expand the recycled water system to new customers.

City of Gilroy Alignments: These alignments and the recycled water system conceptual buildout are shown on **Figure 2**.

- **Baseline Alignment:** The baseline alignments were similar to those proposed in the 2004 Master Plan and were revised based on the imminent improvements planned for the Glen Loma and Meritage Developments. These improvements included a new 30-inch main in Luchessa Ave through the Glen Loma Development to the Zone 2 Pump Station and a new 24-inch main to the Meritage Development. The baseline alignment was assumed to be included with the other preliminary expansion alignments.

- **First Street Alignment:** The first preliminary alignment expanded the recycled water system to potential customers in northwest Gilroy along First Street and Santa Teresa Boulevard.
- **Lake Kathryne Alignment:** The second preliminary alignment extended westward from the Meritage Development to Lake Kathryne to service the existing nurseries in west Gilroy. This alignment is similar to the proposed Hecker Pass extension improvements in the 2004 Master Plan to bring service to the users in western Gilroy. This alignment would require either a new tank in Zone 2 with a higher hydraulic grade line (HGL) than the existing Hoylake tank and a new/upgraded pump station, or the formation of a new Zone 3 with a new pump station to fill Lake Kathryne.
- **High Speed Rail Alignment**: This was the third preliminary alignment, and it extended service along the future High Speed Rail easement along Monterey Road to service potential customers in central Gilroy. This alternative was intended to take advantage of construction in conjunction with the High Speed Rail. The High Speed Rail alignment is based on the *California High-Speed Train Alternative Analysis Alignment Maps, San Jose to Merced: Morgan Hill / Gilroy Subsection East of UPRR – Trench Option*, dated April 2010.
- **Cameron Boulevard Alignment:** This was the fourth alignment and it extended service along Cameron Boulevard in east Gilroy to serve customers in central Gilroy similar to the High Speed Rail Alignment.

City of Morgan Hill Alternatives: Since Morgan Hill currently does not have a way to bring recycled water from the SCRWA WWTP, the following three alternatives, shown on **Figure 3**, were evaluated and present ways to expand the recycled water system to Morgan Hill. Furthermore, all of these alternatives are refinements of the 2004 Master Plan extensions for service to the City of Morgan Hill.

- **Alternative 1: Morgan Hill (MH) High Speed Rail Transmission Main:** This Morgan Hill alignment extended a Morgan Hill recycled water transmission main along the future High Speed Rail easement along Monterey Road to service potential customers and/or for potential recharge in Morgan Hill. This alternative was intended to take advantage of construction in conjunction with the High Speed Rail.
- **Alternative 2: Joint Trunk Transmission Main:** Similar to the Morgan Hill High Speed Rail Alignment, this transmission main along the existing sewer joint trunk was intended to take advantage of the existing easements to Morgan Hill and the possibility of re-purposing the existing sewer trunk for recycled water purposes if the existing sewer trunk was decommissioned.
- **Scalping Plant:** This alternative included construction of a scalping plant, which would be a decentralized wastewater treatment plant to intercept and treat wastewater before it flowed to the centralized treatment facility. This alternative also included a separate recycled water system to serve potential recycled water customers in Morgan Hill.

4.0 DISTRIBUTION SYSTEM PROJECTS SELECTED FOR IMPLEMENTATION

The preliminary pipeline alignments were evaluated to determine the selected alignment moving forward. **Table 2** shows the evaluation of the preliminary pipeline alignments including advantages and disadvantages of each alignment.

The evaluation of the preliminary alignments documented on **Table 2**, the potential customer rankings developed in the 2015 South County Recycled Water Master Plan Update, and with input from SCRWA, the District, and the City of Gilroy resulted with the selection of the Baseline plus the Lake Kathryne Alignments. This Baseline plus Lake Kathryne alignment is an update to the 2004 Master Plan proposed Baseline Alternative and includes revised alignments through Glen Loma and Hecker Pass based on updates to the land development plan. This selected alternative will mitigate the existing system deficiencies and allow system expansion for new potential customers to connect.

The evaluation results of the preliminary alignments documented on **Table 2**, the potential customer rankings in the 2015 South County Recycled Water Master Plan Update, and with input from SCRWA, SCVWD, and the City of Gilroy resulted with the selection of the Baseline plus the Lake Kathryne Alignments. **Table 3** documents the evaluation results including the potential annual demands, average market assessment score, and cost per acre-foot of recycled water for the considered alignments. The selected Baseline plus Lake Kathryne alignment is an update to the 2004 Master Plan proposed Baseline Alternative and includes revised alignments through Glen Loma and Hecker Pass based on updates to the land development plan. This selected alternative will mitigate the existing system deficiencies and allow system expansion for new potential customers to connect.

The First Street, High Speed Rail, and Cameron Boulevard alignments for Gilroy and the Morgan Hill Alternatives were not selected for implementation as these alternatives would not present enough benefit for expansion due to small water demands and the high cost of infrastructure that would be required.

5.0 HYDRAULIC MODELING ANALYSIS OF SELECTED ALTERNATIVES

The hydraulic model was used to evaluate the selected alignments in the City of Gilroy. The baseline and Lake Kathryne alignments were split into three improvement scenarios; Immediate Term Improvements, Short Term Improvements, and Long Term Improvements (Lake Kathryne). The improvement pipe diameters documented for each segment refer to the inner diameter of the pipe. A summary of the potential customers and demands for the City of Gilroy selected alignments is included in **Table 4**. The hydraulic model output results are included in **Attachment A** and summarize the peak hour flows and pressures for the 2014 existing system, baseline immediate term, baseline short term, and baseline long term (Lake Kathryne) modeling scenarios.

We are extending our thanks to Katrina Jessop P.E., SCVWD Recycled and Purified Water Program; Vanessa Nishikawa P.E., Principal Water Resources Engineer at MWH; Michael Price P.E., VP, Northern California Water Practice Leader at MWH, and other SCVWD and MWH staff whose courtesy and cooperation were valuable components in completing the hydraulic analysis and producing this technical memorandum.

Sincerely,

AKEL ENGINEERING GROUP, INC.

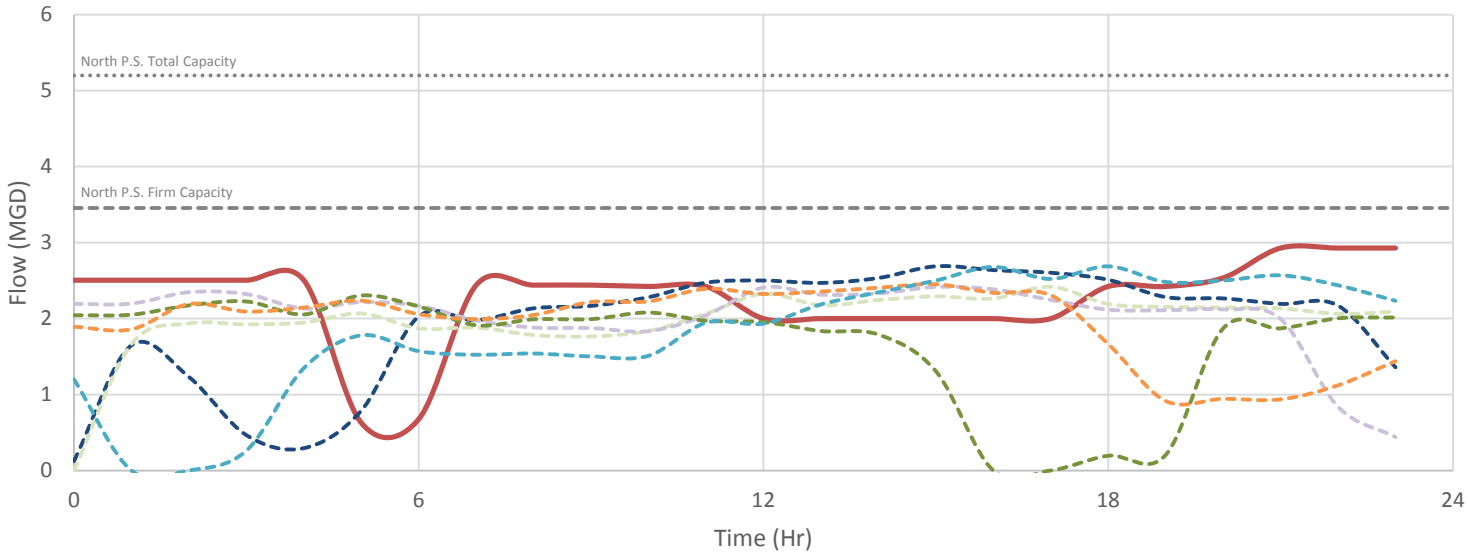
Tony Akel, P.E.

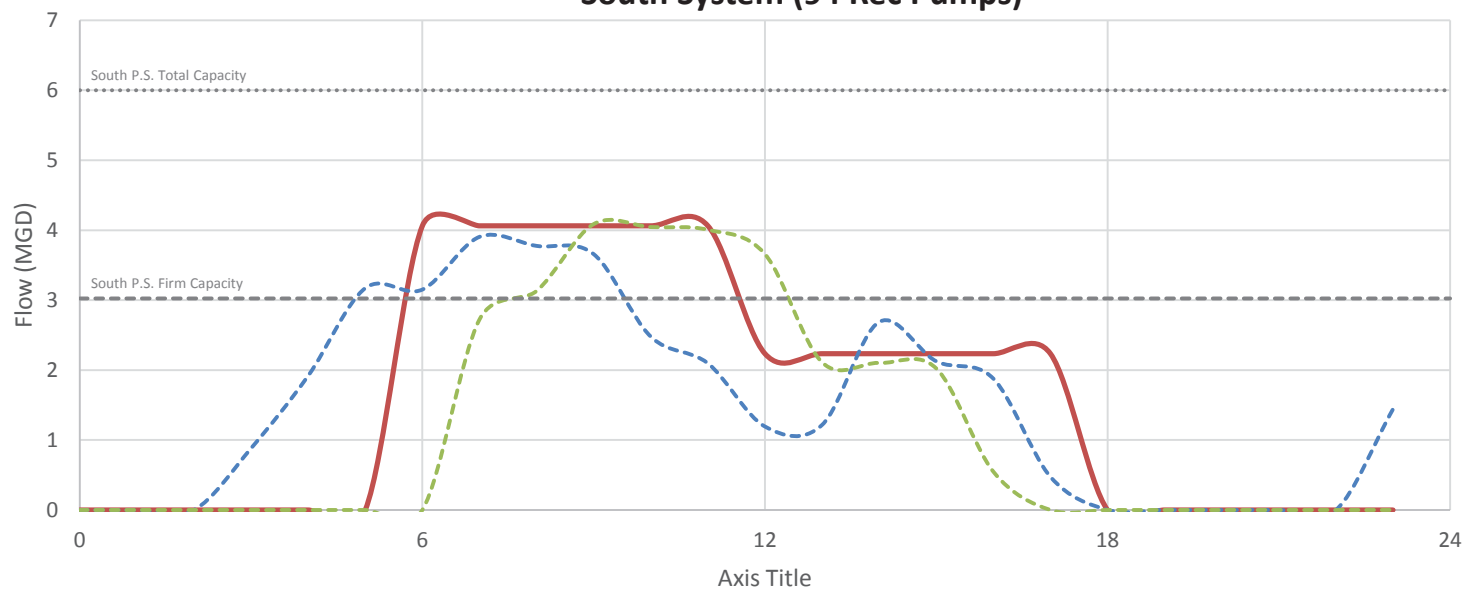
Principal

TABLES

AND

FIGURES





September 21, 2015

LEGEND

- Hydraulic Model: North System
- 6/9/2015
- 6/30/2015
- 7/2/2015
- 7/10/2015
- 7/14/2015
- 7/30/2015
- Ex. Max P.S. (North) Design Flow
- Ex. Firm P.S. (North) Flow

- Hydraulic Model: South System
- 7/9/2015
- 6/11/2015
- Ex. Max P.S. (South) Design Flow
- Ex. Firm P.S. (South) Design Flow

Figure 1

Recycled Water Model Results

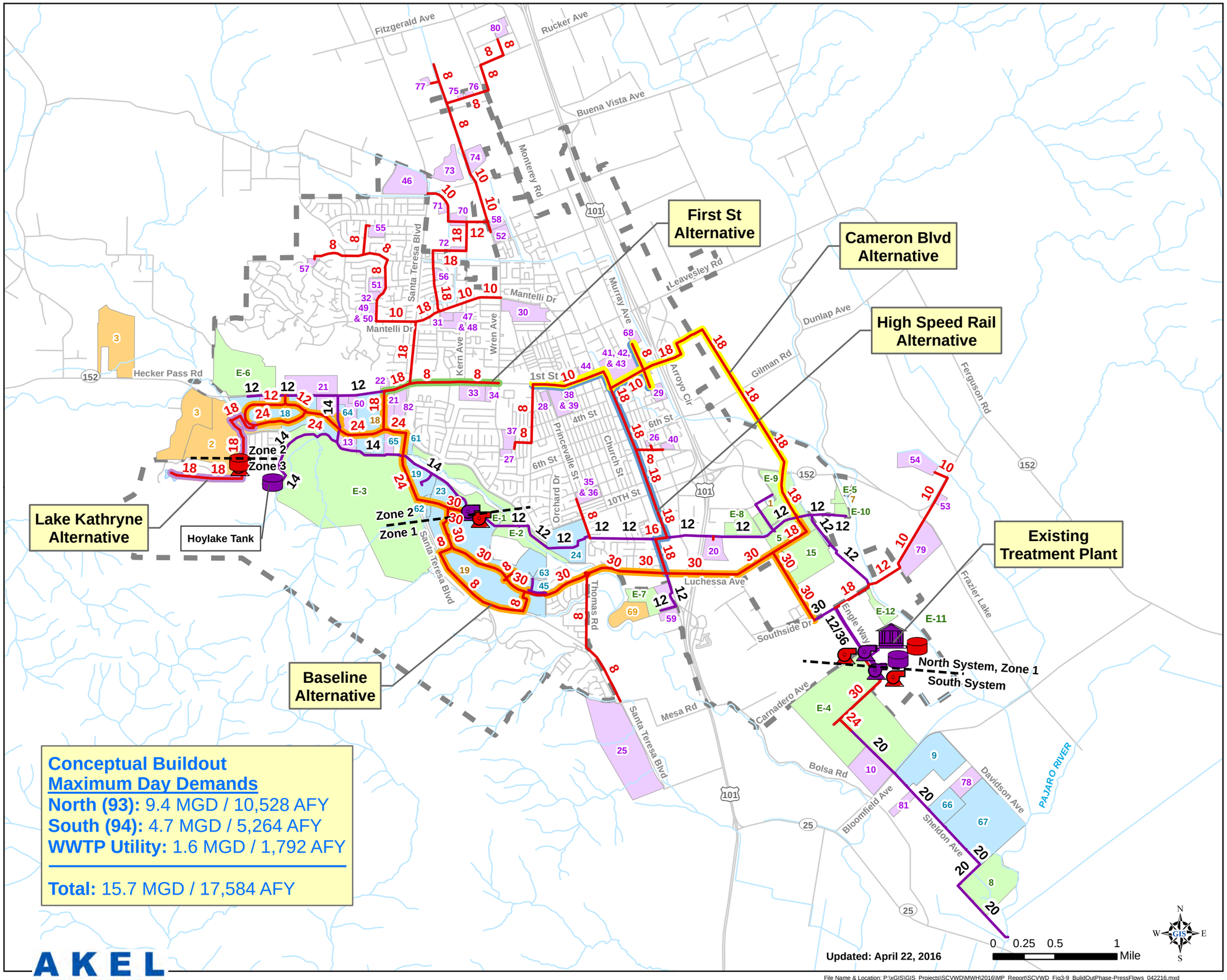
SCADA Comparison

South County Recycled Water System

Santa Clara Valley Water District/South County Regional Wastewater Authority

Santa Clara Valley Water District

AKEL ENGINEERING GROUP, INC



Legend

Proposed

- Storage Tanks
- Booster Stations
- Buildout Proposed Pipe
- Baseline Alternative
- First St Alternative
- Cameron Blvd Alternative
- High Speed Rail Alternative
- Lake Kathryne Alternative

Existing

- WWTP
- Storage Tanks
- Booster Stations
- Recycled Water Pipelines
- Pressure Zone Line
- Existing Users
- In Progress Users
- Baseline Users
- Potential Users
- City Limits
- Roads
- Creeks
- Lake

Figure 2
Existing System + Conceptual Buildout (Gilroy)
South County Recycled Water System

Santa Clara Valley Water District /
South County Regional Wastewater Authority

Santa Clara Valley Water District

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File Name & Location: P:\xGIS\GIS_Projects\SCVWD\MWH2016\MP_Report\SCVWD_Fig3-9_BulidOutPhase-PressFlows_042216.mxd

Morgan Hill Recycled Water (2.25 MGD) Option 1

Indirect Potable Reuse Alternative

Morgan Hill Recycled Water (2.25 MGD) Option 2

Alternative 3 Scalping Plant

Gilroy - Baseline/Lake Kathryne Alternative

Transmission Main Alternative 1

Transmission Main Alternative 2

Proposed Pump Station(s)

Existing Treatment Plant

MORGAN HILL

GILROY

Madrone Channel

Main Ave Ponds

San Pedro Ponds

Church Ave Ponds

Kirby

Hale

Monterey

Diana

Main

Lakeview

Oakwood

Hill

Tennant

Dunne

Spring

Maple

Middle

Edmundson

Watsonville

California

Harding

Highland

San Martin

Sycamore

Center

Foothill

Church

Rucker

Fitzgerald

Buena Vista

Day

New

Marcella

Las Animas

Leavesley

Burchell

Wren

Gilman

Ferguson

4th

Miller

Southside

Bolsa

Santa Teresa

Bloomfield

101

152

24

S-18

S-21

S-24

S-27

S-30

S-33

S-42

12

14

20

22

30

12/36

Legend

Proposed

- Storage Tanks
- Booster Stations
- Alternative Scalping Plant
- Gilroy - Baseline/Lake Kathryne Alternative
- Transmission Main Alternative 1
- Transmission Main Alternative 2
- MH Recycled Water (2.25 MGD) Option 1
- MH Recycled Water (2.25 MGD) Option 2
- Indirect Potable Reuse Alternative
- Sewer Relief Trunk

Existing

- WWTP
- Storage Tanks
- Booster Stations
- Recycled Water Pipelines
- Existing Users
- Recharge Ponds
- Sewer Joint Trunk
- City Limits
- Roads
- Lakes

Updated: April 22, 2016

0 0.25 0.5 1 Mile

N W GIS E S

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Figure 3
Morgan Hill and Gilroy Alternatives

South County Recycled Water System

Santa Clara Valley Water District /
South County Regional Wastewater Authority

Santa Clara Valley Water District

Table 1 System Performance Criteria

South County Recycled Water System Master Plan
Santa Clara Valley Water District/South County Regional Wastewater Authority

Distribution System Performance Criteria	
Pipe Headloss	< 4 ft/kft
Pipe Velocity	< 5 fps
Minimum Pressure[1]	35 psi
Normal Pressure Range[1]	60-120 psi
Pump Station Performance Criteria	
Pressure Zones with Storage	Meet **maximum day** demand with largest unit out of service
Pressure Zones without Storage	Meet **peak hour** demands with largest unit out of service

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5/3/2016

Note:

1. AWWA recommends a minimum working pressure of 35 psi and normal working pressure should range from 60-80 psi.

Table 2 Evaluation of Preliminary Pipeline Alignments

South County Recycled Water System Master Plan

Santa Clara Valley Water District/South County Regional Wastewater Authority

Alternative	Advantages	Disadvantages
Baseline Alignment	• Increase system reliability • Mitigates system deficiencies • Lowest cost supply (900 $/af) • Peak demand projections greater than existing treatment capacity	• Recycled water service for Morgan Hill resident only available from a potential fill station at the WWTP.
First Street Alignment	• Expansion of recycled water service in western Gilroy.	• Requires completion of Gilroy Baseline Alignment
Lake Kathryne	• Expansion of recycled water service in western Gilroy. • Potentially service two customers with large annual demands • Low cost of supply (1,100$/af)	• Requires completion of Gilroy Baseline Alignment • New pump station required to lift recycled water to Lake Kathryne
High Speed Rail Alignment	• Expansion of recycled water service in central Gilroy.	• Requires completion of Gilroy Baseline Alignment • Land and easement acquisition tied to future railroad project
Cameron Blvd Alignment	• Expansion of recycled water service in eastern and central Gilroy.	• Requires completion of Gilroy Baseline Alignment
Morgan Hill - Alternative 1 and 2 (Transmission Main)	• Service to Morgan Hill • Dual use opportunity for NPR/IPR (up to 8.5 mgd). • Alternative 2: Potential for joint construction with Morgan Hill sanitary sewer project	• High cost supply (6,100 – 8,800$/af) • Alternative 1: Land and easement acquisition tied to future railroad project
Morgan Hill – Scalping Plant	• Service to Morgan Hill • Dual use opportunity for NPR/IPR (up to 2.5 mgd)	• Higher cost supply (6,800 –9,900 $/af) than Baseline Alternative • Inability to meet existing customer demands due to reduced WWTP influent during peak demand periods. • Inadequate flow in sewer collection system could create odor and clogging problems. • Resulting sludge loading and reduced flow could substantially change composition of WWTP influent potentially leading to compliance issues.

Table 3 Evaluation Results

South County Recycled Water System Master Plan

Santa Clara Valley Water District/South County Regional Wastewater Authority

	Potential Annual Average Demand (afy)	Market Assessment Average Score (1-25)	Cost (Annual Basis) ($/AF)	
City of Gilroy				
Baseline Alignment	**2,240**	**18**	**900**	**Recommended**
First Street Alignment	1,580	12	-	
Lake Kathryne Alignment	**2,465**	**22**	**1,100**	**Recommended**
High Speed Rail Alignment	1,585	12	-	
Cameron Boulevard Alignment	1,575	12	-	
City of Morgan Hill				
Tranmission Main + Distribution Mains (1 mgd)	345-495	12-13	6,100-8,800	
Scalping Plant (1 MGD) + Distribution Mains	380-495	12	6,800-9,900	

Table 4 Gilroy Alternative Users and Demands

South County Recycled Water System Master Plan
Santa Clara Valley Water District/South County Regional Wastewater Authority

System	Customers	Average Annual Demand (mgd/afy)	Maximum Day Demand (mgd/afy)	Peak Hour Demand (mgd/afy)
Existing System - 2014				
North System Users				
E-1	Christmas Hill Park - Ranch			
E-2	Christmas Hill Park			
E-3	Eagle Ridge Golf Course			
E-8	Obata Farms (North)			
E-5	Calpine Power Plant - Peaker			
E-10	Calpine Power Plant - Cogen			
E-6	City of Gilroy - Golf Course			
E-7	City of Gilroy - Sports Park			
E-9	McCarthy Business Park			
E-12	City of Gilroy - Shooting Range			
	Sub-Total	1.0 mgd / 1,120 afy	2.3 mgd / 2,528 afy	2.9 mgd / 3,248 afy
South System Users				
E-4	SCRWA Farms (Ag Lease) Turnout #1-#6			
	Sub-Total	0.2 mgd / 224 afy	1.6 mgd / 1,763 afy	4.1 mgd / 4,592 afy
WWTP				
E-11	WWTP Utility Water			
	Total	**2.2 mgd / 2,464 afy**	**5.2 mgd / 5,830 afy**	**8.2 mgd / 9,184 afy**
Baseline Immediate Term Improvements				
North System Users				
E-1	Christmas Hill Park - Ranch	E-9	McCarthy Business Park	
E-2	Christmas Hill Park	E-12	City of Gilroy - Shooting Range	
E-3	Eagle Ridge Golf Course	15	Obata (new turnout)	
E-8	Obata Farms (North)	5	United Natural Food	
E-5	Calpine Power Plant - Peaker	1	Cintas Corporation	
E-10	Calpine Power Plant - Cogen	7	Calpine Power Plant - Additional Demand	
E-6	City of Gilroy - Golf Course	69	Gilroy Sports Park Expansion	
E-7	City of Gilroy - Sports Park	59	Fiorio Farms (Gilroy Sports Park)	
18	Meritage Development	19	Glen Loma Ranch Development	
	Sub-Total	1.4 mgd / 1,568 afy	3.8 mgd / 4,251 afy	5.4 mgd / 6,060 afy
South System Users				
E-4	SCRWA Farms (Ag Lease) Turnout #1-#6			
8	C & E Farms			
66	C & E Farms (Additional Parcel)			
	Sub-Total	0.4 mgd / 448 afy	2.3 mgd / 2,587 afy	6.0 mgd / 6,746 afy
WWTP				
E-11	WWTP Utility Water			
	Total	**2.9 mgd / 3,248 afy**	**7.7 mgd / 8,606 afy**	**13.2 mgd / 14,742 afy**
Baseline Short Term Improvements				
North System Users				
E-1	Christmas Hill Park - Ranch	1	Cintas Corporation	
E-2	Christmas Hill Park	7	Calpine Power Plant - Additional Demand	
E-3	Eagle Ridge Golf Course	69	Gilroy Sports Park Expansion	
E-8	Obata Farms (North)	59	Gilroy Sports Park (Agriculture)	
E-5	Calpine Power Plant - Peaker	19	Glen Loma Ranch Development	
E-10	Calpine Power Plant - Cogen	63	Sydney Casper City Park	
E-6	City of Gilroy - Golf Course	23	Ascension Solorsano Middle School	
E-7	City of Gilroy - Sports Park	62	Glen Loma Second Park (Santa Teresa Blvd and Club Dr)	
E-9	McCarthy Business Park	18	Meritage Development	
E-12	City of Gilroy - Shooting Range	64	City Park (Hecker Pass)	
15	Obata (new turnout)	24	Gilroy High School	
5	United Natural Food	45	Las Animas Elementary	
60	Hecker Pass (Agriculture)	21	Hoey Development	
13	Syngenta	61	Santa Teresa & Third Street Park	
		65	City Park (SW corner of Santa Teresa Blvd and 3rd St)	
	Sub-Total	1.6 mgd/ 1,792 afy	4.6 mgd / 5,107 afy	7.3 mgd / 8,146 afy
South System Users				
E-4	SCRWA Farms (Ag Lease) Turnout #1-#6			
8	C & E Farms			
66	C & E Farms (Additional Parcel)			
	Sub-Total	0.4 mgd / 448 afy	2.3 mgd / 2,587 afy	6.1 mgd / 6,825 afy
WWTP				
E-11	WWTP Utility Water			
	Total	**3.0 mgd / 3,360 afy**	**8.5 mgd / 9,492 afy**	**15.3 mgd / 17,173 afy**
Baseline Long Term Improvements				
North System Users				
E-1	Christmas Hill Park - Ranch	69	Gilroy Sports Park Expansion	
E-2	Christmas Hill Park	59	Gilroy Sports Park (Agriculture)[1]	
E-3	Eagle Ridge Golf Course	19	Glen Loma Ranch Development	
E-8	Obata Farms (North)[1]	63	Sydney Casper City Park	
E-5	Calpine Power Plant - Peaker	23	Ascension Solorsano Middle School	
E-10	Calpine Power Plant - Cogen	62	Glen Loma Second Park (Santa Teresa Blvd and Club Dr)	
E-6	City of Gilroy - Golf Course	18	Meritage Development	
E-7	City of Gilroy - Sports Park	64	City Park (Hecker Pass)	
E-9	McCarthy Business Park	61	Santa Teresa & Third Street Park	
E-12	City of Gilroy - Shooting Range	65	City Park (SW corner of Santa Teresa Blvd and 3rd St)	
15	Obata (new turnout)[1]	2	Gilroy Gardens (formerly Bonafante)	
5	United Natural Food	3	Western Tree Nursery I & II	
1	Cintas Corporation	24	Gilroy High School	
7	Calpine Power Plant - Additional Demand	45	Las Animas Elementary	
60	Hecker Pass (Agriculture)[1]	21	Hoey Development[1]	
13	Syngenta[1]			
	Sub-Total	2.0 mgd / 2,240 afy	5.6 mgd / 6,311 afy	7.6 mgd / 8,484 afy
South System Users				
E-4	SCRWA Farms (Ag Lease) Turnout #1-#6			
8	C & E Farms[1]			
66	C & E Farms (Additional Parcel)[1]			
	Sub-Total	0.2 mgd / 224 afy	1.6 mgd / 1,763 afy	4.1 mgd / 4,550 afy
WWTP				
E-11	WWTP Utility Water			
	Total	**3.3 mgd / 3,696 afy**	**8.8 mgd / 9,843 afy**	**12.1 mgd / 13,499 afy**

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Note: 4/26/2016

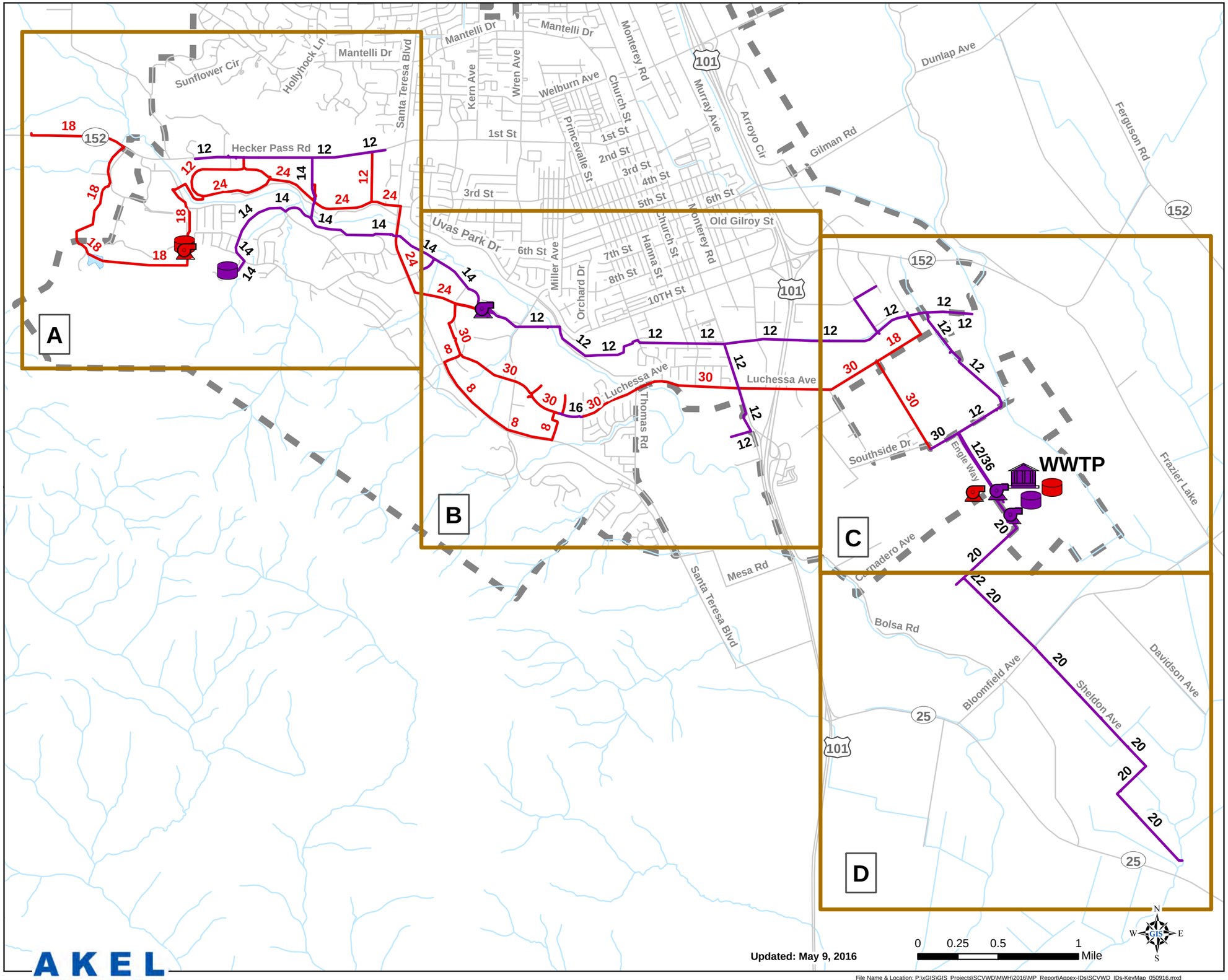
1. These users were excluded in this scenario to remain under the current recycled water treatment capacity permit of 8.5 MGD.

ATTACHMENT A

Hydraulic Mode Output Results

This attachment includes hydraulic model outputs for junctions and pipes for the following scenarios:

- **2014 Existing System** (Tables A1 and A2)
- **Baseline Immediate Term** (Tables A3 and A4)
- **Baseline Short Term** (Tables A5 and A6)
- **Baseline Long Term** (Lake Kathryne) (Tables A7 and A8)



Legend

Proposed

- Storage Tanks
- Booster Stations
- Pipes

Existing

- WWTP
- Storage Tanks
- Booster Stations
- Recycled Water Pipelines
- City Limits
- Roads
- Creeks
- Lake

Key Map
Pipe and Junction IDs

South County Recycled Water System

Santa Clara Valley Water District /
South County Regional Wastewater Authority

Santa Clara Valley Water District

Updated: May 9, 2016

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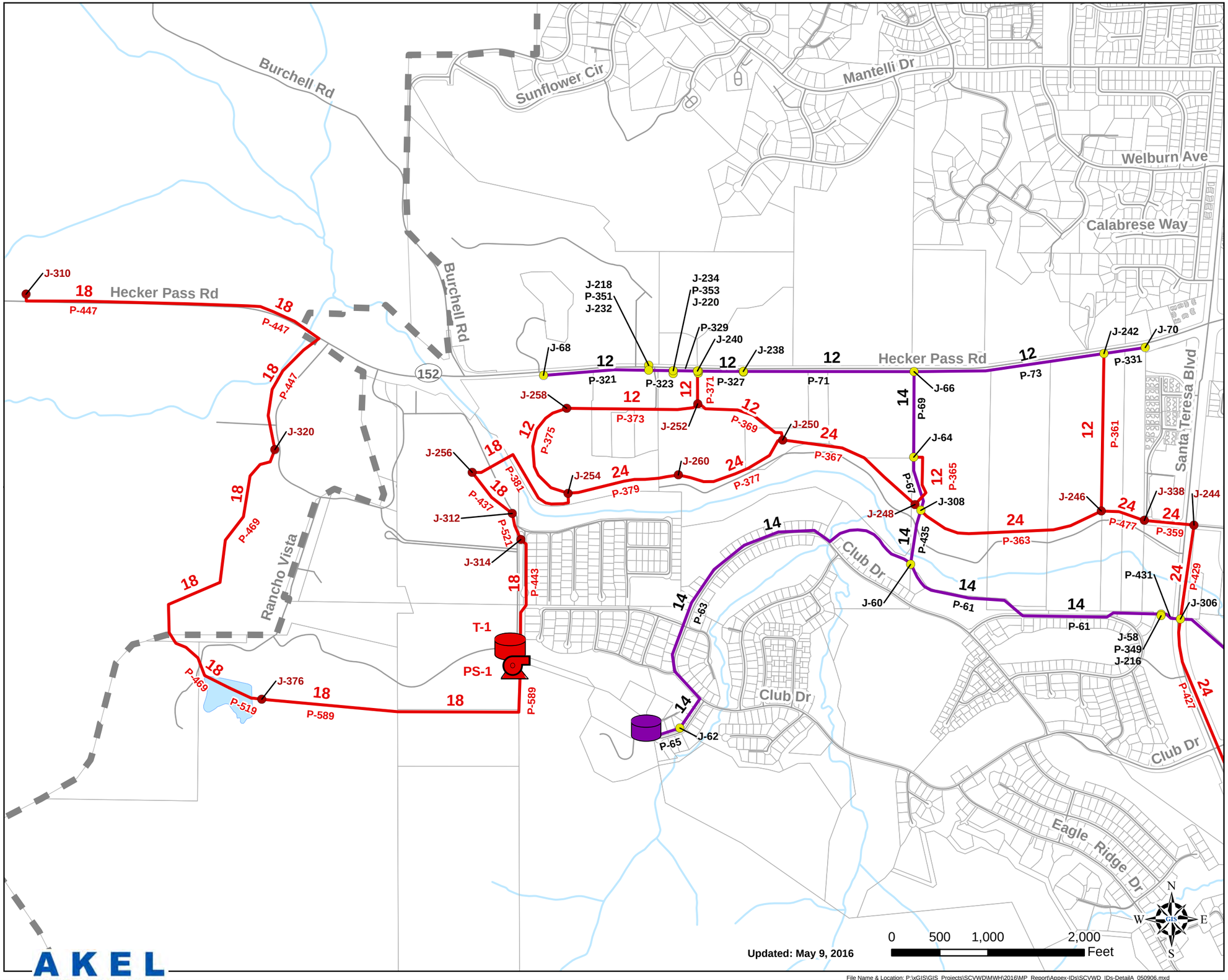


Updated: May 9, 2016

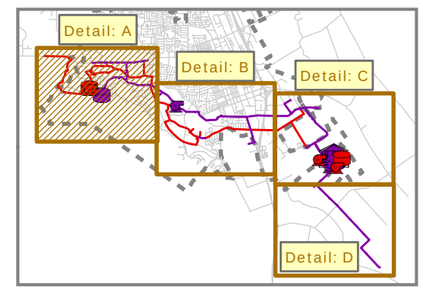
Legend

Proposed

- Junctions
- Storage Tank
- Booster Station
- Pipes

Existing

- Junctions
- Storage Tank
- Pipes
- City Limits
- Parcels
- Roads
- Lake
- Creeks



Detail A
Pipe and Junction IDs

South County Recycled Water System

Santa Clara Valley Water District /
South County Regional Wastewater Authority

Santa Clara Valley Water District

AKEL ENGINEERING GROUP, INC.

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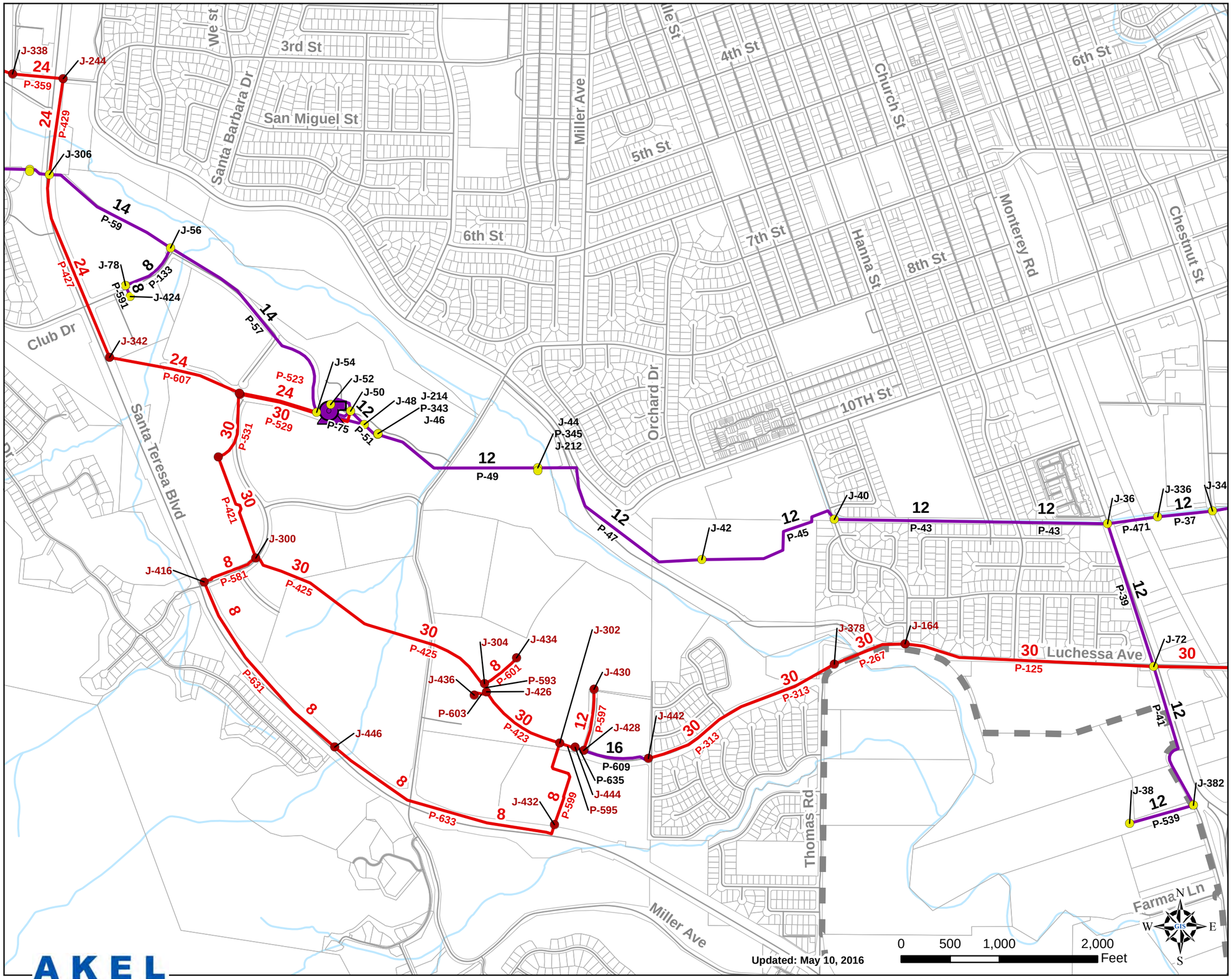


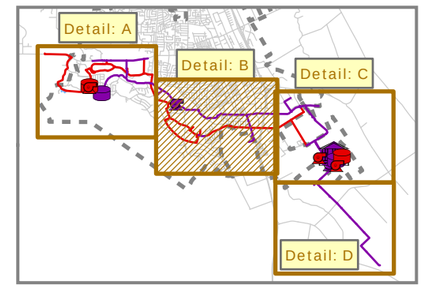
Legend

Proposed

- Junctions
- Pipes

Existing

- Junctions
- Booster Station
- Pipes
- City Limits
- Parcels
- Roads
- Creeks



Detail B
Pipe and Junction IDs
South County Recycled Water System

Santa Clara Valley Water District /
South County Regional Wastewater Authority

Santa Clara Valley Water District

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Updated: May 10, 2016

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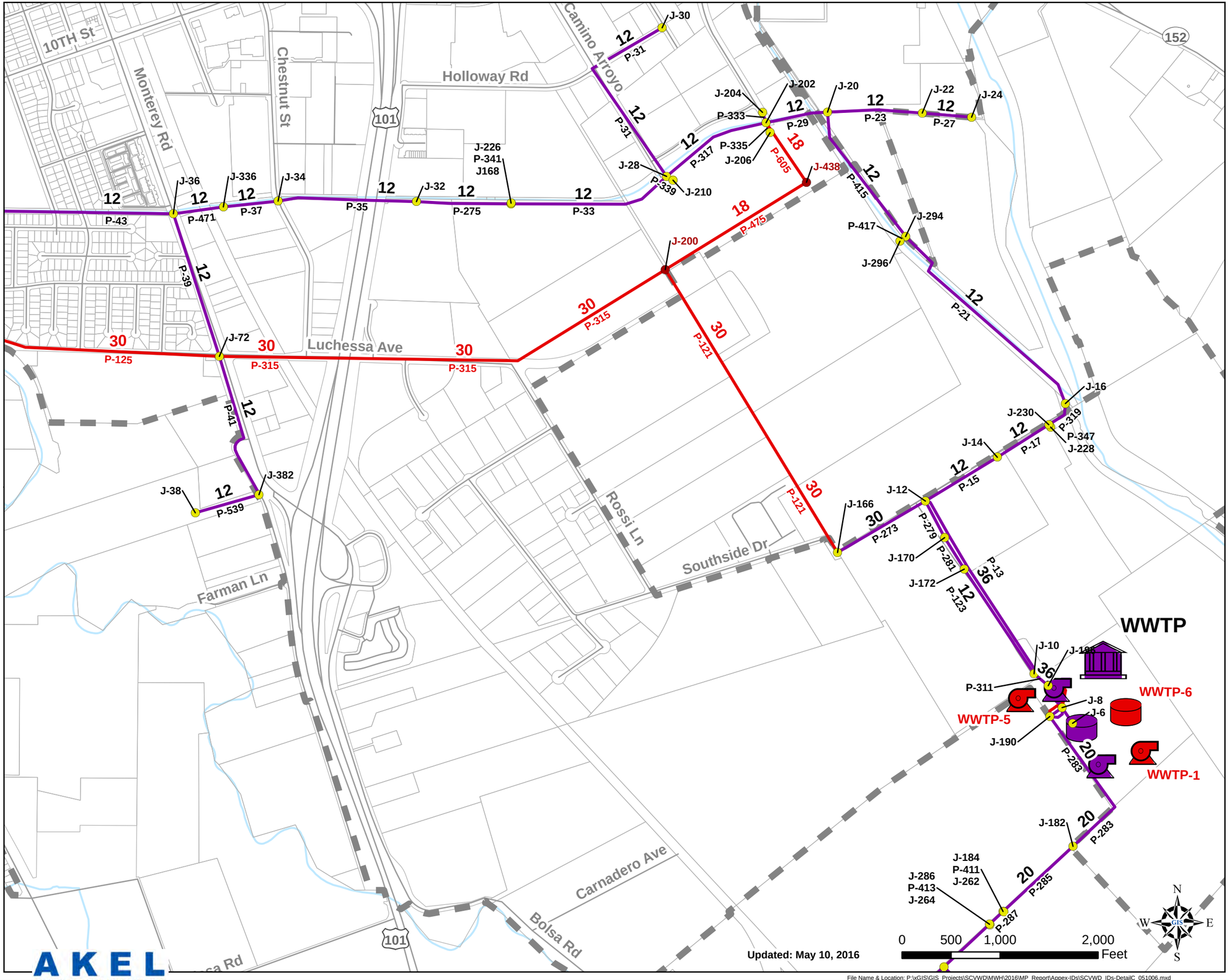


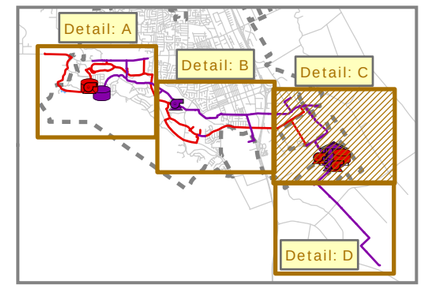
Legend

Proposed

- Junctions
- Storage Tank
- Booster Stations
- Pipes

Existing

- Junctions
- WWTP
- Storage Tank
- Booster Stations
- Pipes
- City Limits
- Parcels
- Roads
- Creeks



Detail C
Pipe and Junction IDs
South County Recycled Water System

Santa Clara Valley Water District /
South County Regional Wastewater Authority

Santa Clara Valley Water District

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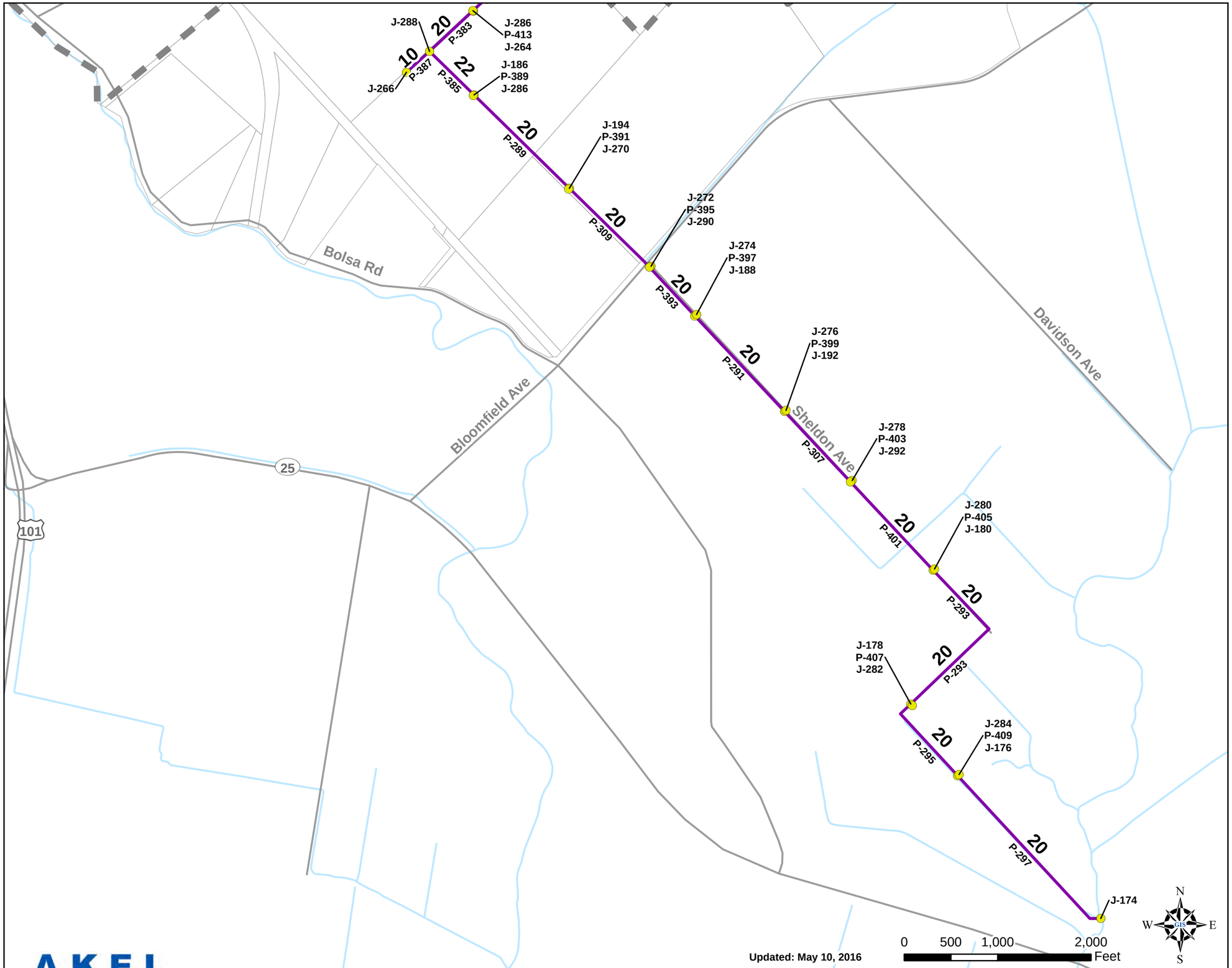


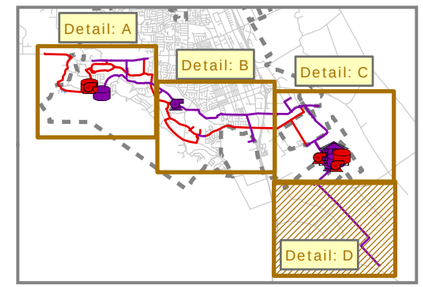
Legend

Proposed

- Junctions
- Storage Tank
- Booster Stations
- Pipes

Existing

- Junctions
- WWTP
- Storage Tank
- Booster Stations
- Pipes
- City Limits
- Parcels
- Roads
- Creeks



Detail D
Pipe and Junction IDs
South County Recycled Water System

Santa Clara Valley Water District /
South County Regional Wastewater Authority

Santa Clara Valley Water District

Updated: May 10, 2016

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Table A1 Junctions: 2014 Existing System

South County Recycled Water System Master Plan

Santa Clara Valley Water District/South County Regional Wastewater Authority

ID	Peak Demand (gpm)	Max Pressure (psi)	Min Pressure (psi)	Elevation (ft)
J-16	0	107.2	97.7	165
J-36	0	94.4	39.4	190
J-42	0	87.9	21.3	205
J-44	0	87.9	15.7	205
J-46	0	81.4	5.2	220
J-58	0	85.2	61.9	220
J-60	0	76.5	62.2	235
J-66	0	70.0	55.7	250
J-68	0	72.2	57.9	245
J-48	0	80.3	3.7	222.5
J-54	0	87.2	60.8	222.5
J-72	0	94.4	39.1	190
J-6	1,188	9.2	7.8	160
J-12	0	105.6	105.3	170
J-8	0	9.2	7.8	160
J-10	0	110.0	109.6	160
J-50	0	80.3	3.3	222.5
J-52	0	87.3	60.8	222.5
J-20	0	103.8	73.4	170
J-28	0	103.5	65.2	170
J-56	0	88.2	63.7	216
J-78	0	86.4	61.9	220
J-70	0	72.2	57.9	245
J-30	0	101.4	63.0	175
J-34	0	96.5	44.9	185
J-32	0	98.8	50.4	180
J-40	0	91.8	29.6	196
J-14	0	105.3	100.7	170
J-64	0	77.6	63.3	232.5
J-62	0	23.2	19.1	353
J-38	154	94.4	39.0	190
J-24	152	100.6	70.3	177
J-22	12	100.7	70.3	177
J-166	0	105.6	105.3	170
J-168	0	99.8	54.3	178
J-170	0	105.6	105.3	170
J-172	0	105.6	105.3	170
J-174	0	95.7	17.7	137
J-176	0	94.9	16.9	139

Table A1 Junctions: 2014 Existing System

South County Recycled Water System Master Plan

Santa Clara Valley Water District/South County Regional Wastewater Authority

ID	Peak Demand (gpm)	Max Pressure (psi)	Min Pressure (psi)	Elevation (ft)
J-178	0	94.0	16.0	141
J-180	0	92.7	14.7	144
J-182	0	88.2	9.9	155
J-184	0	88.0	9.9	155
J-186	0	87.9	9.9	155
J-188	0	87.1	9.1	157
J-190	0	88.5	9.9	155
J-192	0	91.4	13.4	147
J-194	0	89.2	11.2	152
J-196	0	110.0	109.6	160
J-202	0	103.7	70.4	170
J-204	78	103.7	70.4	170
J-206	0	103.7	70.4	170
J-210	0	103.5	65.2	170
J-212	81	87.9	15.7	205
J-214	38	81.4	5.2	220
J-216	2,289	85.2	61.9	220
J-218	664	73.1	58.7	243
J-220	0	73.5	59.2	242
J-222	0	74.4	60.0	240
J-224	0	104.7	90.4	170
J-226	294	99.8	54.3	178
J-228	12	107.3	99.4	165
J-230	0	107.3	99.4	165
J-232	0	73.1	58.7	243
J-234	0	73.5	59.2	242
J-236	0	74.4	60.0	240
J-238	0	104.7	90.4	170
J-240	0	74.4	60.0	240
J-242	0	72.2	57.9	245
J-262	1,477	88.0	9.9	155
J-264	0	88.0	9.9	155
J-266	710	87.8	9.9	155
J-268	635	87.9	9.9	155
J-270	0	87.9	9.9	155
J-272	0	87.9	9.9	155
J-274	0	87.9	9.9	155
J-276	0	87.9	9.9	155
J-278	0	87.9	9.9	155

Table A1 Junctions: 2014 Existing System

South County Recycled Water System Master Plan

Santa Clara Valley Water District/South County Regional Wastewater Authority

ID	Peak Demand (gpm)	Max Pressure (psi)	Min Pressure (psi)	Elevation (ft)
J-280	0	87.9	9.9	155
J-282	0	87.9	9.9	155
J-284	0	87.9	9.9	155
J-286	0	88.0	9.9	155
J-288	0	87.9	9.9	155
J-290	0	87.9	9.9	155
J-292	0	87.9	9.9	155
J-294	0	104.3	82.0	170
J-296	0	104.3	82.0	170
J-306	0	85.3	61.9	220
J-308	0	77.6	63.3	232.5
J-336	0	96.5	43.1	185
J-382	0	94.4	39.1	190
J-424	0	86.4	61.9	220

5/9/2016

Table A2 Pipes: 2014 Existing System

South County Recycled Water System Master Plan

Santa Clara Valley Water District/South County Regional Wastewater Authority

ID	Max Flow (gpm)	Max Velocity (fps)	Max Headloss (ft/kft)	Length (ft)	Diameter (in)
P-17	2,034	5.8	12.9	621	12
P-47	1,344	3.8	6.0	2,175	12
P-49	1,263	3.6	5.3	1,736	12
P-51	1,225	3.5	5.0	174	12
P-59	1,225	2.6	1.7	1,464	14
P-61	2,289	4.8	5.5	2,822	14
P-63	2,289	4.8	5.5	4,284	14
P-71	664	1.9	1.6	1,774	12
P-75	0	0.0	0.0	500	12
P-11	4,516	1.4	0.2	192	36
P-53	1,225	3.5	5.0	195	12
P-55	1,225	2.6	1.7	162	14
P-21	2,034	5.8	12.9	2,440	12
P-23	164	0.5	0.1	1,946	12
P-29	1,870	5.3	11.0	637	12
P-57	1,225	2.6	1.7	2,390	14
P-133	0	0.0	0.0	624	8
P-73	0	0.0	0.0	1,986	12
P-33	1,792	5.1	10.2	1,684	12
P-31	0	0.0	0.0	2,160	12
P-35	1,498	4.3	5.4	1,415	12
P-37	1,498	4.3	7.3	561	12
P-43	1,344	3.8	6.0	2,782	12
P-45	1,344	3.8	6.0	1,674	12
P-15	2,034	5.8	12.9	859	12
P-69	664	1.9	1.6	886	12
P-13	112	0.3	0.1	2,100	12
P-65	2,289	4.8	5.5	398	14
P-123	1,922	0.6	0.0	2,264	36
P-85	678	2.8	2.3	100	10
P-99	678	2.8	2.3	100	10
P-83	881	3.6	3.7	100	10
P-91	881	3.6	3.7	100	10
P-77	1,389	5.7	8.7	100	10
P-93	1,389	5.7	8.7	100	10
P-105	1,225	5.0	12.2	10	10
P-111	1,225	5.0	12.2	10	10
P-107	0	0.0	0.0	10	10
P-113	0	0.0	0.0	10	10
P-109	0	0.0	0.0	10	10
P-115	0	0.0	0.0	10	10
P-39	154	0.4	0.1	4,801	12
P-27	152	0.4	0.1	505	12

Table A2 Pipes: 2014 Existing System

South County Recycled Water System Master Plan

Santa Clara Valley Water District/South County Regional Wastewater Authority

ID	Max Flow (gpm)	Max Velocity (fps)	Max Headloss (ft/kft)	Length (ft)	Diameter (in)
P-41	154	0.4	0.1	1,559	12
P-273	0	0.0	0.0	1,038	30
P-275	1,498	4.3	7.3	967	12
P-279	1,922	0.6	0.0	421	36
P-281	1,922	0.9	0.1	378	30
P-283	2,821	2.9	1.3	1,720	20
P-285	2,821	2.9	1.3	975	20
P-287	1,344	1.4	0.3	190	20
P-289	0	0.0	0.0	1,428	20
P-291	0	0.0	0.0	1,403	20
P-293	0	0.0	0.0	2,028	20
P-295	0	0.0	0.0	1,054	20
P-297	0	0.0	0.0	2,200	20
P-299	1,552	1.1	0.2	70	24
P-301	1,922	1.4	0.3	95	24
P-303	1,552	1.1	0.2	85	24
P-305	1,922	1.4	0.3	110	24
P-307	0	0.0	0.0	1,033	20
P-309	0	0.0	0.0	1,204	20
P-311	2,034	0.6	0.0	189	36
P-317	1,792	5.1	10.2	1,181	12
P-319	2,034	5.8	12.9	305	12
P-321	0	0.0	0.0	1,096	12
P-323	664	1.9	1.6	254	12
P-325	664	1.9	1.6	9	12
P-327	664	1.9	1.6	467	12
P-329	664	1.9	1.6	252	12
P-331	0	0.0	0.0	434	12
P-333	78	0.2	0.0	112	12
P-335	0	0.0	0.0	109	12
P-339	0	0.0	0.0	76	12
P-341	294	0.8	0.4	7	12
P-343	38	0.1	0.0	10	12
P-345	81	0.2	0.0	30	12
P-347	12	0.0	0.0	31	12
P-349	2,289	4.8	5.5	18	14
P-351	664	1.9	1.6	51	12
P-353	0	0.0	0.0	32	12
P-355	0	0.0	0.0	21	12
P-357	0	0.0	0.0	7	12
P-383	1,344	1.4	0.3	637	20
P-385	635	0.5	0.1	666	22
P-387	710	2.9	2.9	333	10

Table A2 Pipes: 2014 Existing System

South County Recycled Water System Master Plan

Santa Clara Valley Water District/South County Regional Wastewater Authority

ID	Max Flow (gpm)	Max Velocity (fps)	Max Headloss (ft/kft)	Length (ft)	Diameter (in)
P-389	635	1.8	1.0	9	12
P-391	0	0.0	0.0	10	12
P-393	0	0.0	0.0	712	20
P-395	0	0.0	0.0	20	12
P-397	0	0.0	0.0	24	12
P-399	0	0.0	0.0	20	12
P-401	0	0.0	0.0	1,294	20
P-403	0	0.0	0.0	24	12
P-405	0	0.0	0.0	20	12
P-407	0	0.0	0.0	21	12
P-409	0	0.0	0.0	20	12
P-411	1,477	4.2	4.6	9	12
P-413	0	0.0	0.0	7	12
P-415	2,034	5.8	12.9	1,531	12
P-417	0	0.0	0.0	75	12
P-431	1,225	2.6	1.7	217	14
P-435	664	1.9	1.6	572	12
P-471	1,498	4.3	7.3	514	12
P-539	154	0.4	0.1	675	12
P-591	0	0.0	0.0	122	8
P-67	664	1.9	1.6	571	12

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Table A3 Junctions: Immediate Term Improvements

South County Recycled Water System Master Plan

Santa Clara Valley Water District/South County Regional Wastewater Authority

ID	Peak Demand (gpm)	Max Pressure (psi)	Min Pressure (psi)	Elevation (ft)
J-16	0	108.5	107.4	165
J-36	0	96.3	89.5	190
J-42	0	86.3	65.9	205
J-44	0	84.8	57.6	205
J-46	0	77.1	44.4	220
J-58	0	81.1	76.2	220
J-60	0	73.9	70.3	235
J-66	0	67.4	63.8	250
J-68	0	69.6	66.0	245
J-48	0	75.9	42.6	222.5
J-54	0	81.0	80.7	222.5
J-72	0	97.8	96.9	190
J-6	1,365	8.6	6.9	160
J-12	0	106.5	106.2	170
J-8	0	8.5	6.9	160
J-10	0	110.9	110.7	160
J-50	0	75.8	41.9	222.5
J-52	0	81.0	80.9	222.5
J-20	0	106.0	104.1	170
J-28	0	105.7	102.4	170
J-56	0	83.2	80.2	216
J-78	0	81.5	78.5	220
J-70	0	69.6	66.0	245
J-30	199	103.4	100.1	175
J-34	0	98.6	92.4	185
J-32	0	101.0	95.2	180
J-40	0	91.4	76.2	196
J-14	0	106.5	105.7	170
J-64	0	75.0	71.4	232.5
J-62	0	22.1	20.0	353
J-38	372	97.8	96.4	190
J-24	478	102.2	100.2	177
J-22	74	102.3	100.4	177
J-164	0	90.4	89.6	207
J-166	0	106.5	106.1	170
J-168	0	102.0	96.7	178
J-170	0	106.5	106.2	170
J-172	0	106.5	106.2	170
J-174	0	95.7	17.1	137

Table A3 Junctions: Immediate Term Improvements

South County Recycled Water System Master Plan

Santa Clara Valley Water District/South County Regional Wastewater Authority

ID	Peak Demand (gpm)	Max Pressure (psi)	Min Pressure (psi)	Elevation (ft)
J-176	0	94.9	16.3	139
J-178	0	94.0	15.4	141
J-180	0	92.7	14.1	144
J-182	0	88.2	9.3	155
J-184	0	88.0	9.3	155
J-186	0	87.9	9.3	155
J-188	0	87.1	8.5	157
J-190	0	88.5	9.3	155
J-192	0	91.4	12.8	147
J-194	0	89.2	10.6	152
J-196	0	110.9	110.7	160
J-200	0	104.3	103.5	175
J-202	0	106.2	104.6	170
J-204	78	106.2	104.6	170
J-206	101	106.2	104.6	170
J-210	0	105.7	102.4	170
J-212	81	84.8	57.6	205
J-214	38	77.1	44.4	220
J-216	2,289	81.1	76.2	220
J-218	664	70.5	66.8	243
J-220	0	70.9	67.3	242
J-222	0	71.8	68.1	240
J-224	0	102.1	98.5	170
J-226	294	102.0	96.7	178
J-228	12	108.6	107.6	165
J-230	0	108.6	107.6	165
J-232	0	70.5	66.8	243
J-234	0	70.9	67.3	242
J-236	0	71.8	68.1	240
J-238	0	102.1	98.5	170
J-240	0	71.8	68.1	240
J-242	0	69.6	66.0	245
J-246	0	75.0	71.4	232.5
J-248	0	75.0	71.4	232.5
J-250	0	75.0	71.4	232.5
J-252	101	75.0	71.4	232.5
J-262	1,477	88.0	9.3	155
J-264	0	88.0	9.3	155
J-266	710	87.8	9.3	155

Table A3 Junctions: Immediate Term Improvements

South County Recycled Water System Master Plan

Santa Clara Valley Water District/South County Regional Wastewater Authority

ID	Peak Demand (gpm)	Max Pressure (psi)	Min Pressure (psi)	Elevation (ft)
J-268	635	87.9	9.3	155
J-270	0	87.9	9.3	155
J-272	0	87.9	9.3	155
J-274	0	87.9	9.3	155
J-276	380	87.9	9.3	155
J-278	0	87.9	9.3	155
J-280	0	87.9	9.3	155
J-282	982	87.9	9.3	155
J-284	0	87.9	9.3	155
J-286	0	88.0	9.3	155
J-288	0	87.9	9.3	155
J-290	0	87.9	9.3	155
J-292	0	87.9	9.3	155
J-294	0	106.2	104.0	170
J-296	737	106.2	104.0	170
J-302	0	60.1	59.2	277
J-304	131	53.1	52.3	293
J-306	0	81.1	76.5	220
J-308	0	75.0	71.4	232.5
J-336	0	98.5	92.0	185
J-338	0	75.0	71.4	232.5
J-378	0	86.9	86.1	215
J-382	0	97.8	96.6	190
J-424	0	81.5	78.5	220
J-426	0	52.3	51.4	295
J-428	0	62.2	61.4	272
J-430	0	57.9	57.1	282
J-432	0	57.5	56.6	283
J-434	0	60.9	60.1	275
J-436	0	50.5	49.7	299
J-438	0	106.3	105.0	170
J-442	0	62.2	61.4	272
J-444	0	62.2	61.4	272

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Table A4 Pipes: Immediate Term Improvements

South County Recycled Water System Master Plan

Santa Clara Valley Water District/South County Regional Wastewater Authority

ID	Max Flow (gpm)	Max Velocity (fps)	Max Headloss (ft/kft)	Length (ft)	Diameter (in)
P-17	571	1.6	1.2	621	12
P-47	1,686	4.8	9.1	2,175	12
P-49	1,686	4.8	9.1	1,736	12
P-51	1,686	4.8	9.1	174	12
P-59	1,686	3.5	3.2	1,464	14
P-61	855	1.8	0.9	2,822	14
P-63	855	1.8	0.9	4,284	14
P-71	275	0.8	0.3	1,774	12
P-75	0	0.0	0.0	500	12
P-11	7,776	2.5	0.5	192	36
P-53	1,686	4.8	9.1	195	12
P-55	1,686	3.5	3.2	162	14
P-21	565	1.6	1.2	2,440	12
P-23	552	1.6	0.8	1,946	12
P-29	809	2.3	2.3	637	12
P-57	1,686	3.5	3.2	2,390	14
P-133	0	0.0	0.0	624	8
P-73	107	0.3	0.1	1,986	12
P-33	932	2.7	3.0	1,684	12
P-31	199	0.6	0.1	2,160	12
P-35	737	2.1	1.4	1,415	12
P-37	737	2.1	2.0	561	12
P-43	1,686	4.8	9.1	2,782	12
P-45	1,686	4.8	9.1	1,674	12
P-15	571	1.6	1.2	859	12
P-69	169	0.5	0.1	886	12
P-121	3,200	1.5	0.3	3,374	30
P-13	208	0.6	0.2	2,100	12
P-65	855	1.8	0.9	398	14
P-123	3,550	1.1	0.1	2,264	36
P-85	1,253	5.1	7.2	100	10
P-99	1,253	5.1	7.2	100	10
P-83	1,253	5.1	7.2	100	10
P-91	1,253	5.1	7.2	100	10
P-77	1,253	5.1	7.2	100	10
P-93	1,253	5.1	7.2	100	10
P-105	1,686	6.9	22.1	10	10
P-111	1,686	6.9	22.1	10	10
P-107	0	0.0	0.0	10	10
P-113	0	0.0	0.0	10	10
P-109	0	0.0	0.0	10	10
P-115	0	0.0	0.0	10	10
P-39	1,025	2.9	3.6	4,801	12

Table A4 Pipes: Immediate Term Improvements

South County Recycled Water System Master Plan

Santa Clara Valley Water District/South County Regional Wastewater Authority

ID	Max Flow (gpm)	Max Velocity (fps)	Max Headloss (ft/kft)	Length (ft)	Diameter (in)
P-27	478	1.4	0.7	505	12
P-41	372	1.1	0.6	1,559	12
P-125	131	0.1	0.0	2,553	30
P-267	131	0.1	0.0	759	30
P-273	3,200	1.5	0.2	1,038	30
P-275	737	2.1	2.0	967	12
P-279	3,550	1.1	0.1	421	36
P-281	3,550	1.6	0.3	378	30
P-283	4,183	4.3	2.6	1,720	20
P-285	4,183	4.3	2.6	975	20
P-287	2,706	2.8	1.2	190	20
P-289	1,362	1.4	0.3	1,428	20
P-291	1,362	1.4	0.3	1,403	20
P-293	982	1.0	0.2	2,028	20
P-295	0	0.0	0.0	1,054	20
P-297	0	0.0	0.0	2,200	20
P-299	2,092	1.5	0.3	70	24
P-301	2,091	1.5	0.3	95	24
P-303	2,092	1.5	0.3	85	24
P-305	2,091	1.5	0.3	110	24
P-307	982	1.0	0.2	1,033	20
P-309	1,362	1.4	0.3	1,204	20
P-311	3,758	1.2	0.1	189	36
P-313	131	0.1	0.0	2,141	30
P-315	1,443	0.7	0.1	4,813	30
P-317	1,131	3.2	4.3	1,181	12
P-319	565	1.6	1.2	305	12
P-321	0	0.0	0.0	1,096	12
P-323	664	1.9	1.6	254	12
P-325	275	0.8	0.3	9	12
P-327	275	0.8	0.3	467	12
P-329	664	1.9	1.6	252	12
P-331	0	0.0	0.0	434	12
P-333	78	0.2	0.0	112	12
P-335	101	0.3	0.1	109	12
P-339	0	0.0	0.0	76	12
P-341	294	0.8	0.4	7	12
P-343	38	0.1	0.0	10	12
P-345	81	0.2	0.0	30	12
P-347	12	0.0	0.0	31	12
P-349	2,289	4.8	5.5	18	14
P-351	664	1.9	1.6	51	12
P-353	0	0.0	0.0	32	12

Table A4 Pipes: Immediate Term Improvements

South County Recycled Water System Master Plan

Santa Clara Valley Water District/South County Regional Wastewater Authority

ID	Max Flow (gpm)	Max Velocity (fps)	Max Headloss (ft/kft)	Length (ft)	Diameter (in)
P-355	0	0.0	0.0	21	12
P-357	0	0.0	0.0	7	12
P-361	107	0.3	0.0	1,633	12
P-363	107	0.1	0.0	1,989	24
P-367	490	0.4	0.0	1,591	24
P-369	490	1.4	0.7	1,035	12
P-371	418	1.2	0.5	342	12
P-383	2,706	2.8	1.2	637	20
P-385	1,997	1.7	0.4	666	22
P-387	710	2.9	2.9	333	10
P-389	635	1.8	1.0	9	12
P-391	0	0.0	0.0	10	12
P-393	1,362	1.4	0.3	712	20
P-395	0	0.0	0.0	20	12
P-397	0	0.0	0.0	24	12
P-399	380	1.1	0.4	20	12
P-401	982	1.0	0.2	1,294	20
P-403	0	0.0	0.0	24	12
P-405	0	0.0	0.0	20	12
P-407	982	2.8	2.1	21	12
P-409	0	0.0	0.0	20	12
P-411	1,477	4.2	4.6	9	12
P-413	0	0.0	0.0	7	12
P-415	288	0.8	0.3	1,531	12
P-417	737	2.1	2.0	75	12
P-423	131	0.1	0.0	934	30
P-431	1,686	3.5	3.2	217	14
P-433	658	0.5	0.0	84	24
P-435	765	2.2	2.1	572	12
P-471	737	2.1	2.0	514	12
P-475	1,856	2.3	1.1	1,693	18
P-477	0	0.0	0.0	463	24
P-539	372	1.1	0.6	675	12
P-591	0	0.0	0.0	122	8
P-593	131	0.1	0.0	90	30
P-595	131	0.1	0.0	173	30
P-597	0	0.0	0.0	634	12
P-599	0	0.0	0.0	988	8
P-601	0	0.0	0.0	424	8
P-603	0	0.0	0.0	141	8
P-605	1,856	2.3	1.1	732	18
P-609	131	0.2	0.0	678	16
P-621	0	0.0	0.0	101	24

Table A4 Pipes: Immediate Term Improvements

South County Recycled Water System Master Plan

Santa Clara Valley Water District/South County Regional Wastewater Authority

ID	Max Flow (gpm)	Max Velocity (fps)	Max Headloss (ft/kft)	Length (ft)	Diameter (in)
P-623	0	0.0	0.0	103	24
P-635	131	0.2	0.0	92	16
P-365	169	0.5	0.1	637	12

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Table A5 Junctions: Short Term Improvements

South County Recycled Water System Master Plan

Santa Clara Valley Water District/South County Regional Wastewater Authority

ID	Peak Demand (gpm)	Max Pressure (psi)	Min Pressure (psi)	Elevation (ft)
J-16	0	102.6	101.3	165
J-36	0	91.8	89.1	190
J-42	349	85.3	81.8	205
J-44	0	85.3	81.3	205
J-46	0	78.9	74.5	220
J-58	0	81.9	62.4	220
J-60	0	75.2	58.1	235
J-66	262	68.8	49.7	250
J-68	0	71.0	51.9	245
J-48	0	77.8	73.4	222.5
J-54	0	80.9	61.5	222.5
J-72	0	91.9	89.9	190
J-6	1,365	8.2	6.2	160
J-12	0	100.6	100.0	170
J-8	0	8.2	6.2	160
J-10	0	105.0	104.7	160
J-50	0	77.8	73.4	222.5
J-52	0	81.0	61.5	222.5
J-20	0	100.3	98.0	170
J-28	0	100.4	98.1	170
J-56	0	83.7	64.3	216
J-78	0	81.9	62.5	220
J-70	0	71.0	51.9	245
J-30	199	98.1	95.8	175
J-34	0	94.0	91.3	185
J-32	0	96.1	93.4	180
J-40	0	89.2	86.0	196
J-14	0	100.5	99.6	170
J-64	110	76.4	57.3	232.5
J-62	0	23.3	21.0	353
J-38	372	91.9	89.8	190
J-24	478	96.4	94.1	177
J-22	74	96.5	94.3	177
J-164	0	84.5	82.3	207
J-166	0	100.5	99.8	170
J-168	0	97.0	94.3	178
J-170	0	100.6	100.1	170
J-172	0	100.6	100.1	170
J-174	0	116.3	91.6	137

Table A5 Junctions: Short Term Improvements

South County Recycled Water System Master Plan

Santa Clara Valley Water District/South County Regional Wastewater Authority

ID	Peak Demand (gpm)	Max Pressure (psi)	Min Pressure (psi)	Elevation (ft)
J-176	0	115.4	90.7	139
J-178	0	114.6	89.8	141
J-180	0	113.3	88.7	144
J-182	0	108.5	86.5	155
J-184	0	108.5	85.4	155
J-186	0	108.5	84.8	155
J-188	0	107.6	83.4	157
J-190	0	108.5	88.5	155
J-192	0	112.0	87.6	147
J-194	0	109.8	85.9	152
J-196	0	105.0	104.7	160
J-200	0	98.4	97.0	175
J-202	0	100.4	98.6	170
J-204	78	100.4	98.6	170
J-206	101	100.4	98.6	170
J-210	0	100.4	98.1	170
J-212	81	85.3	81.3	205
J-214	38	78.9	74.5	220
J-216	2,289	81.9	62.4	220
J-218	664	71.9	52.8	243
J-220	0	72.3	53.2	242
J-222	0	73.2	54.1	240
J-224	82	103.5	84.4	170
J-226	294	97.0	94.3	178
J-228	12	102.6	101.4	165
J-230	0	102.6	101.4	165
J-232	0	71.9	52.8	243
J-234	0	72.3	53.2	242
J-236	0	73.2	54.1	240
J-238	0	103.5	84.4	170
J-240	0	73.2	54.1	240
J-242	0	71.0	51.9	245
J-244	122	76.5	57.2	232.5
J-246	0	76.4	57.2	232.5
J-248	0	76.4	57.3	232.5
J-250	0	76.4	57.3	232.5
J-252	0	76.4	57.3	232.5
J-254	0	76.4	57.3	232.5
J-258	101	76.4	57.3	232.5

Table A5 Junctions: Short Term Improvements

South County Recycled Water System Master Plan

Santa Clara Valley Water District/South County Regional Wastewater Authority

ID	Peak Demand (gpm)	Max Pressure (psi)	Min Pressure (psi)	Elevation (ft)
J-260	0	76.4	57.3	232.5
J-262	1,477	108.5	85.3	155
J-264	0	108.5	85.3	155
J-266	710	108.5	84.5	155
J-268	635	108.5	84.8	155
J-270	0	108.5	84.6	155
J-272	0	108.5	84.4	155
J-274	0	108.5	84.3	155
J-276	429	108.5	84.1	155
J-278	0	108.5	84.0	155
J-280	0	108.5	83.9	155
J-282	982	108.5	83.7	155
J-284	0	108.5	83.8	155
J-286	0	108.5	85.3	155
J-288	0	108.5	84.9	155
J-290	0	108.5	84.4	155
J-292	0	108.5	84.0	155
J-294	0	100.3	97.9	170
J-296	737	100.3	97.9	170
J-298	122	78.9	74.5	220
J-300	131	41.2	37.0	307
J-302	0	54.2	50.3	277
J-304	0	47.2	43.3	293
J-306	0	81.9	62.6	220
J-308	0	76.4	57.3	232.5
J-336	0	94.0	91.3	185
J-338	61	76.4	57.2	232.5
J-340	0	51.6	47.3	283
J-342	0	55.1	35.7	282
J-378	0	81.0	78.8	215
J-382	0	91.9	89.9	190
J-416	48	31.2	27.1	330
J-424	61	81.9	62.5	220
J-426	0	46.4	42.4	295
J-428	61	56.3	52.7	272
J-430	61	52.0	48.3	282
J-432	0	51.6	47.7	283
J-434	0	55.0	51.1	275
J-436	0	44.6	40.7	299

Table A5 Junctions: Short Term Improvements

South County Recycled Water System Master Plan

Santa Clara Valley Water District/South County Regional Wastewater Authority

ID	Peak Demand (gpm)	Max Pressure (psi)	Min Pressure (psi)	Elevation (ft)
J-438	0	100.5	98.8	170
J-440	0	82.0	62.6	220
J-442	0	56.3	53.9	272
J-444	0	56.3	52.5	272
J-446	61	22.5	18.5	350

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Table A6 Pipes: Short Term Improvements

South County Recycled Water System Master Plan

Santa Clara Valley Water District/South County Regional Wastewater Authority

ID	Max Flow (gpm)	Max Velocity (fps)	Max Headloss (ft/kft)	Length (ft)	Diameter (in)
P-17	560	1.6	1.2	621	12
P-47	337	1.0	0.5	2,175	12
P-49	337	1.0	0.5	1,736	12
P-51	337	1.0	0.5	174	12
P-59	641	1.3	0.5	1,464	14
P-61	1,248	2.6	1.8	2,822	14
P-63	2,777	5.8	7.9	4,284	14
P-71	247	0.7	0.3	1,774	12
P-75	0	0.0	0.0	500	12
P-11	9,325	2.9	0.8	192	36
P-53	337	1.0	0.5	195	12
P-55	3,152	6.6	10.0	162	14
P-21	548	1.6	1.1	2,440	12
P-23	552	1.6	0.8	1,946	12
P-29	840	2.4	2.5	637	12
P-57	641	1.3	0.5	2,390	14
P-133	61	0.4	0.1	624	8
P-73	155	0.4	0.1	1,986	12
P-33	350	1.0	0.5	1,684	12
P-31	199	0.6	0.1	2,160	12
P-35	249	0.7	0.2	1,415	12
P-37	249	0.7	0.3	561	12
P-43	407	1.2	0.7	2,782	12
P-45	407	1.2	0.7	1,674	12
P-15	560	1.6	1.2	859	12
P-69	182	0.5	0.2	886	12
P-121	4,533	2.1	0.5	3,374	30
P-13	281	0.8	0.3	2,100	12
P-65	2,777	5.8	7.9	398	14
P-123	4,812	1.5	0.2	2,264	36
P-85	1,273	5.2	7.4	100	10
P-99	1,273	5.2	7.4	100	10
P-83	1,273	5.2	7.4	100	10
P-91	1,273	5.2	7.4	100	10
P-77	1,904	7.8	15.6	100	10
P-93	1,904	7.8	15.6	100	10
P-105	1,899	7.8	27.5	10	10
P-111	1,899	7.8	27.5	10	10
P-107	1,576	6.4	19.5	10	10
P-113	1,576	6.4	19.5	10	10
P-109	0	0.0	0.0	10	10
P-115	0	0.0	0.0	10	10
P-79	1,273	5.2	7.4	100	10

Table A6 Pipes: Short Term Improvements

South County Recycled Water System Master Plan

Santa Clara Valley Water District/South County Regional Wastewater Authority

ID	Max Flow (gpm)	Max Velocity (fps)	Max Headloss (ft/kft)	Length (ft)	Diameter (in)
P-95	1,273	5.2	7.4	100	10
P-81	0	0.0	0.0	100	10
P-97	0	0.0	0.0	100	10
P-39	312	0.9	0.4	4,801	12
P-27	478	1.4	0.7	505	12
P-41	372	1.1	0.6	1,559	12
P-125	2,823	1.3	0.2	2,553	30
P-267	2,823	1.3	0.2	759	30
P-273	4,533	2.1	0.4	1,038	30
P-275	249	0.7	0.3	967	12
P-279	4,812	1.5	0.2	421	36
P-281	4,812	2.2	0.5	378	30
P-283	4,232	4.3	2.7	1,720	20
P-285	4,232	4.3	2.7	975	20
P-287	2,755	2.8	1.2	190	20
P-289	1,411	1.4	0.4	1,428	20
P-291	1,411	1.4	0.4	1,403	20
P-293	982	1.0	0.2	2,028	20
P-295	0	0.0	0.0	1,054	20
P-297	0	0.0	0.0	2,200	20
P-299	1,289	0.9	0.1	70	24
P-301	1,121	0.8	0.1	95	24
P-303	1,289	0.9	0.1	85	24
P-305	1,121	0.8	0.1	110	24
P-307	982	1.0	0.2	1,033	20
P-309	1,411	1.4	0.4	1,204	20
P-311	5,093	1.6	0.2	189	36
P-313	2,823	1.3	0.2	2,141	30
P-315	3,280	1.5	0.3	4,813	30
P-317	549	1.6	1.1	1,181	12
P-319	548	1.6	1.1	305	12
P-321	0	0.0	0.0	1,096	12
P-323	664	1.9	1.6	254	12
P-325	203	0.6	0.2	9	12
P-327	203	0.6	0.2	467	12
P-329	664	1.9	1.6	252	12
P-331	0	0.0	0.0	434	12
P-333	78	0.2	0.0	112	12
P-335	101	0.3	0.1	109	12
P-339	0	0.0	0.0	76	12
P-341	294	0.8	0.4	7	12
P-343	38	0.1	0.0	10	12
P-345	81	0.2	0.0	30	12

Table A6 Pipes: Short Term Improvements

South County Recycled Water System Master Plan

Santa Clara Valley Water District/South County Regional Wastewater Authority

ID	Max Flow (gpm)	Max Velocity (fps)	Max Headloss (ft/kft)	Length (ft)	Diameter (in)
P-347	12	0.0	0.0	31	12
P-349	2,289	4.8	5.5	18	14
P-351	664	1.9	1.6	51	12
P-353	0	0.0	0.0	32	12
P-355	0	0.0	0.0	21	12
P-357	82	0.2	0.0	7	12
P-359	1,294	0.9	0.1	518	24
P-361	155	0.4	0.1	1,633	12
P-363	1,192	0.9	0.1	1,989	24
P-367	609	0.4	0.0	1,591	24
P-369	353	1.0	0.4	1,035	12
P-371	508	1.4	0.7	342	12
P-373	172	0.5	0.1	1,376	12
P-375	256	0.7	0.2	1,254	12
P-377	256	0.2	0.0	1,246	24
P-379	256	0.2	0.0	1,165	24
P-383	2,755	2.8	1.2	637	20
P-385	2,046	1.7	0.4	666	22
P-387	710	2.9	2.9	333	10
P-389	635	1.8	1.0	9	12
P-391	0	0.0	0.0	10	12
P-393	1,411	1.4	0.4	712	20
P-395	0	0.0	0.0	20	12
P-397	0	0.0	0.0	24	12
P-399	429	1.2	0.5	20	12
P-401	982	1.0	0.2	1,294	20
P-403	0	0.0	0.0	24	12
P-405	0	0.0	0.0	20	12
P-407	982	2.8	2.1	21	12
P-409	0	0.0	0.0	20	12
P-411	1,477	4.2	4.6	9	12
P-413	0	0.0	0.0	7	12
P-415	328	0.9	0.4	1,531	12
P-417	737	2.1	2.0	75	12
P-421	2,823	1.3	0.2	1,127	30
P-423	2,759	1.3	0.2	934	30
P-425	2,759	1.3	0.2	2,714	30
P-427	2,512	1.8	0.5	2,156	24
P-429	1,416	1.0	0.2	984	24
P-431	2,183	4.6	5.1	217	14
P-433	791	0.6	0.1	84	24
P-435	1,529	4.3	7.6	572	12
P-471	249	0.7	0.3	514	12

Table A6 Pipes: Short Term Improvements

South County Recycled Water System Master Plan

Santa Clara Valley Water District/South County Regional Wastewater Authority

ID	Max Flow	Max Velocity	Max Headloss	Length	Diameter
	(gpm)	(fps)	(ft/kft)	(ft)	(in)
P-475	1,253	1.6	0.5	1,693	18
P-477	1,285	0.9	0.1	463	24
P-523	2,512	1.8	0.5	813	24
P-529	2,823	1.3	0.2	1,240	30
P-531	2,823	1.3	0.2	730	30
P-539	372	1.1	0.6	675	12
P-581	70	0.5	0.1	590	8
P-591	61	0.4	0.1	122	8
P-593	2,759	1.3	0.2	90	30
P-595	2,823	1.3	0.2	173	30
P-597	61	0.2	0.0	634	12
P-599	74	0.5	0.2	988	8
P-601	0	0.0	0.0	424	8
P-603	0	0.0	0.0	141	8
P-605	1,253	1.6	0.5	732	18
P-607	2,512	1.8	0.5	1,272	24
P-609	2,823	4.5	4.3	678	16
P-621	1,899	1.4	0.3	101	24
P-623	1,899	1.4	0.3	103	24
P-631	65	0.4	0.1	2,168	8
P-633	74	0.5	0.2	2,525	8
P-635	2,823	4.5	4.3	92	16
P-365	186	0.5	0.1	637	12

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Table A7 Junctions: Long-Term Improvements

South County Recycled Water System Master Plan

Santa Clara Valley Water District/South County Regional Wastewater Authority

ID	Peak Demand (gpm)	Max Pressure (psi)	Min Pressure (psi)	Elevation (ft)
J-16	0	102.4	101.7	165
J-36	0	91.0	88.5	190
J-42	349	84.1	79.3	205
J-44	0	83.9	79.0	205
J-46	0	77.2	72.3	220
J-58	0	80.3	78.6	220
J-60	0	73.6	72.3	235
J-66	61	67.0	65.8	250
J-68	0	69.1	67.8	245
J-48	0	76.1	71.2	222.5
J-54	0	79.7	79.0	222.5
J-72	0	91.2	89.3	190
J-6	1,365	7.8	6.7	160
J-12	0	100.4	99.9	170
J-8	0	7.7	6.6	160
J-10	0	104.8	104.6	160
J-50	0	76.1	71.2	222.5
J-52	0	80.0	79.9	222.5
J-20	0	99.8	98.6	170
J-28	0	99.8	98.1	170
J-56	0	82.2	81.2	216
J-78	0	80.5	79.5	220
J-70	0	69.3	68.0	245
J-30	199	97.5	95.8	175
J-34	0	93.2	90.9	185
J-32	0	95.4	93.2	180
J-40	0	88.1	84.2	196
J-14	0	100.3	99.7	170
J-64	0	74.6	73.4	232.5
J-62	0	22.3	21.2	353
J-38	225	91.2	89.1	190
J-24	478	95.9	94.7	177
J-22	74	96.1	94.8	177
J-164	0	83.8	81.5	207
J-166	0	100.3	99.7	170
J-168	0	96.3	94.3	178
J-170	0	100.4	100.0	170
J-172	0	100.4	100.1	170
J-174	0	115.9	94.7	137

Table A7 Junctions: Long-Term Improvements

South County Recycled Water System Master Plan

Santa Clara Valley Water District/South County Regional Wastewater Authority

ID	Peak Demand (gpm)	Max Pressure (psi)	Min Pressure (psi)	Elevation (ft)
J-176	0	115.1	93.8	139
J-178	0	114.2	92.9	141
J-180	0	112.9	91.6	144
J-182	0	108.1	87.5	155
J-184	0	108.1	87.0	155
J-186	0	108.1	86.9	155
J-188	0	107.3	86.0	157
J-190	0	108.1	88.5	155
J-192	0	111.6	90.3	147
J-194	0	109.4	88.2	152
J-196	0	104.8	104.6	160
J-200	0	97.9	96.7	175
J-202	0	99.9	98.6	170
J-204	78	99.9	98.6	170
J-206	101	99.9	98.6	170
J-210	0	99.8	98.1	170
J-212	81	83.9	79.0	205
J-214	38	77.2	72.3	220
J-216	2,289	80.3	78.6	220
J-218	664	69.9	68.6	243
J-220	0	70.4	69.2	242
J-222	0	71.2	70.0	240
J-224	0	101.6	100.4	170
J-226	0	96.3	94.3	178
J-228	12	102.4	101.8	165
J-230	0	102.4	101.8	165
J-232	0	69.9	68.7	243
J-234	0	70.4	69.2	242
J-236	0	71.2	70.0	240
J-238	72	101.6	100.4	170
J-240	0	71.2	70.0	240
J-242	0	69.3	68.0	245
J-244	122	74.9	73.6	232.5
J-246	0	74.8	73.5	232.5
J-248	0	74.6	73.4	232.5
J-250	0	74.5	73.3	232.5
J-252	0	74.5	73.3	232.5
J-254	0	74.3	73.1	232.5
J-256	0	68.3	67.3	245

Table A7 Junctions: Long-Term Improvements

South County Recycled Water System Master Plan

Santa Clara Valley Water District/South County Regional Wastewater Authority

ID	Peak Demand (gpm)	Max Pressure (psi)	Min Pressure (psi)	Elevation (ft)
J-258	101	74.4	73.2	232.5
J-260	0	74.4	73.2	232.5
J-262	1,477	108.1	87.0	155
J-264	0	108.1	87.0	155
J-266	710	108.1	86.5	155
J-268	635	108.1	86.9	155
J-270	0	108.1	86.9	155
J-272	0	108.1	86.9	155
J-274	0	108.1	86.9	155
J-276	0	108.1	86.9	155
J-278	0	108.1	86.9	155
J-280	0	108.1	86.9	155
J-282	0	108.1	86.9	155
J-284	0	108.1	86.9	155
J-286	0	108.1	87.0	155
J-288	0	108.1	86.9	155
J-290	0	108.1	86.9	155
J-292	0	108.1	86.9	155
J-294	0	100.0	98.9	170
J-296	0	100.0	98.9	170
J-298	122	77.2	72.5	220
J-300	131	39.6	35.0	307
J-302	0	52.7	48.4	277
J-304	0	45.7	41.4	293
J-306	0	80.4	79.1	220
J-308	0	74.6	73.4	232.5
J-310	1,113	40.3	38.7	295
J-312	0	70.2	69.3	240
J-314	0	67.9	67.1	245
J-320	632	50.3	48.8	275
J-336	0	93.2	90.8	185
J-338	0	74.8	73.5	232.5
J-340	0	49.9	45.2	283
J-342	0	53.7	52.7	282
J-376	0	33.7	33.2	395
J-378	0	80.3	78.0	215
J-382	0	91.2	89.1	190
J-416	0	29.6	25.1	330
J-424	61	80.5	79.5	220

Table A7 Junctions: Long-Term Improvements

South County Recycled Water System Master Plan

Santa Clara Valley Water District/South County Regional Wastewater Authority

ID	Peak Demand (gpm)	Max Pressure (psi)	Min Pressure (psi)	Elevation (ft)
J-426	0	44.9	40.5	295
J-428	61	54.9	50.9	272
J-430	61	50.6	46.6	282
J-432	0	50.1	45.8	283
J-434	0	53.5	49.2	275
J-436	0	43.1	38.8	299
J-438	0	100.0	98.7	170
J-440	0	80.7	79.9	220
J-442	61	55.5	53.0	272
J-444	61	54.9	50.6	272
J-446	0	21.0	16.6	350

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Table A8 Pipes: Long Term Improvements

South County Recycled Water System Master Plan

Santa Clara Valley Water District/South County Regional Wastewater Authority

ID	Max Flow (gpm)	Max Velocity (fps)	Max Headloss (ft/kft)	Length (ft)	Diameter (in)
P-17	373	1.1	0.6	621	12
P-47	416	1.2	0.7	2,175	12
P-49	416	1.2	0.7	1,736	12
P-51	416	1.2	0.7	174	12
P-59	714	1.5	0.6	1,464	14
P-61	509	1.1	0.3	2,822	14
P-63	565	1.2	0.4	4,284	14
P-71	332	0.9	0.5	1,774	12
P-75	0	0.0	0.0	500	12
P-11	7,053	2.2	0.5	192	36
P-53	416	1.2	0.7	195	12
P-55	3,512	7.3	12.3	162	14
P-21	373	1.1	0.6	2,440	12
P-23	552	1.6	0.8	1,946	12
P-29	322	0.9	0.4	637	12
P-57	714	1.5	0.6	2,390	14
P-133	61	0.4	0.1	624	8
P-73	222	0.6	0.2	1,986	12
P-33	324	0.9	0.4	1,684	12
P-31	199	0.6	0.1	2,160	12
P-35	324	0.9	0.3	1,415	12
P-37	324	0.9	0.4	561	12
P-43	622	1.8	1.4	2,782	12
P-45	622	1.8	1.4	1,674	12
P-15	373	1.1	0.6	859	12
P-69	176	0.5	0.1	886	12
P-121	5,079	2.3	0.6	3,374	30
P-13	301	0.9	0.4	2,100	12
P-65	565	1.2	0.4	398	14
P-123	5,150	1.6	0.2	2,264	36
P-85	1,363	5.6	8.4	100	10
P-99	1,363	5.6	8.4	100	10
P-83	1,363	5.6	8.4	100	10
P-91	1,363	5.6	8.4	100	10
P-77	1,363	5.6	8.4	100	10
P-93	1,363	5.6	8.4	100	10
P-105	1,756	7.2	23.8	10	10
P-111	1,756	7.2	23.8	10	10
P-107	1,756	7.2	23.8	10	10
P-113	1,756	7.2	23.8	10	10
P-109	0	0.0	0.0	10	10
P-115	0	0.0	0.0	10	10
P-79	1,363	5.6	8.4	100	10

Table A8 Pipes: Long Term Improvements

South County Recycled Water System Master Plan

Santa Clara Valley Water District/South County Regional Wastewater Authority

ID	Max Flow (gpm)	Max Velocity (fps)	Max Headloss (ft/kft)	Length (ft)	Diameter (in)
P-95	1,363	5.6	8.4	100	10
P-81	0	0.0	0.0	100	10
P-97	0	0.0	0.0	100	10
P-39	298	0.9	0.4	4,801	12
P-27	478	1.4	0.7	505	12
P-41	225	0.6	0.2	1,559	12
P-125	3,752	1.7	0.3	2,553	30
P-267	3,752	1.7	0.3	759	30
P-273	5,079	2.3	0.5	1,038	30
P-275	324	0.9	0.4	967	12
P-279	5,150	1.6	0.2	421	36
P-281	5,150	2.3	0.5	378	30
P-283	2,821	2.9	1.3	1,720	20
P-285	2,821	2.9	1.3	975	20
P-287	1,344	1.4	0.3	190	20
P-289	0	0.0	0.0	1,428	20
P-291	0	0.0	0.0	1,403	20
P-293	0	0.0	0.0	2,028	20
P-295	0	0.0	0.0	1,054	20
P-297	0	0.0	0.0	2,200	20
P-299	529	0.4	0.0	70	24
P-301	460	0.3	0.0	95	24
P-303	529	0.4	0.0	85	24
P-305	460	0.3	0.0	110	24
P-307	0	0.0	0.0	1,033	20
P-309	0	0.0	0.0	1,204	20
P-311	5,452	1.7	0.2	189	36
P-313	3,752	1.7	0.3	2,141	30
P-315	4,276	1.9	0.4	4,813	30
P-317	523	1.5	1.0	1,181	12
P-319	373	1.1	0.6	305	12
P-321	0	0.0	0.0	1,096	12
P-323	664	1.9	1.6	254	12
P-325	311	0.9	0.4	9	12
P-327	311	0.9	0.4	467	12
P-329	664	1.9	1.6	252	12
P-331	0	0.0	0.0	434	12
P-333	78	0.2	0.0	112	12
P-335	101	0.3	0.1	109	12
P-339	0	0.0	0.0	76	12
P-341	0	0.0	0.0	7	12
P-343	38	0.1	0.0	10	12
P-345	81	0.2	0.0	30	12

Table A8 Pipes: Long Term Improvements

South County Recycled Water System Master Plan

Santa Clara Valley Water District/South County Regional Wastewater Authority

ID	Max Flow (gpm)	Max Velocity (fps)	Max Headloss (ft/kft)	Length (ft)	Diameter (in)
P-347	12	0.0	0.0	31	12
P-349	2,289	4.8	5.5	18	14
P-351	664	1.9	1.6	51	12
P-353	0	0.0	0.0	32	12
P-355	0	0.0	0.0	21	12
P-357	0	0.0	0.0	7	12
P-359	1,948	1.4	0.3	518	24
P-361	222	0.6	0.2	1,633	12
P-363	1,726	1.2	0.2	1,989	24
P-367	1,925	1.4	0.3	1,591	24
P-369	407	1.2	0.5	1,035	12
P-371	424	1.2	0.5	342	12
P-373	244	0.7	0.2	1,376	12
P-375	244	0.7	0.2	1,254	12
P-377	1,606	1.1	0.2	1,246	24
P-379	1,606	1.1	0.2	1,165	24
P-381	1,850	2.3	1.1	1,423	18
P-383	1,344	1.4	0.3	637	20
P-385	635	0.5	0.1	666	22
P-387	710	2.9	2.9	333	10
P-389	635	1.8	1.0	9	12
P-391	0	0.0	0.0	10	12
P-393	0	0.0	0.0	712	20
P-395	0	0.0	0.0	20	12
P-397	0	0.0	0.0	24	12
P-399	0	0.0	0.0	20	12
P-401	0	0.0	0.0	1,294	20
P-403	0	0.0	0.0	24	12
P-405	0	0.0	0.0	20	12
P-407	0	0.0	0.0	21	12
P-409	0	0.0	0.0	20	12
P-411	1,477	4.2	4.6	9	12
P-413	0	0.0	0.0	7	12
P-415	373	1.1	0.6	1,531	12
P-417	0	0.0	0.0	75	12
P-421	3,377	1.5	0.3	1,127	30
P-423	3,428	1.6	0.3	934	30
P-425	3,428	1.6	0.3	2,714	30
P-427	2,798	2.0	0.6	2,156	24
P-429	2,070	1.5	0.3	984	24
P-431	2,028	4.2	4.4	217	14
P-433	2,101	1.5	0.3	84	24
P-435	459	1.3	0.8	572	12

Table A8 Pipes: Long Term Improvements

South County Recycled Water System Master Plan

Santa Clara Valley Water District/South County Regional Wastewater Authority

ID	Max Flow (gpm)	Max Velocity (fps)	Max Headloss (ft/kft)	Length (ft)	Diameter (in)
P-437	1,850	2.3	1.1	600	18
P-443	1,850	2.3	1.1	1,370	18
P-447	1,113	1.4	0.7	4,560	18
P-469	1,745	2.2	1.6	3,342	18
P-471	324	0.9	0.4	514	12
P-475	843	1.1	0.3	1,693	18
P-477	1,948	1.4	0.3	463	24
P-519	1,522	1.9	0.8	270	18
P-521	1,850	2.3	1.1	287	18
P-523	2,798	2.0	0.6	813	24
P-529	3,255	1.5	0.3	1,240	30
P-531	3,377	1.5	0.3	730	30
P-533	1,522	1.9	0.8	93	18
P-539	225	0.6	0.2	675	12
P-581	80	0.5	0.2	590	8
P-587	1,522	1.9	0.8	6	18
P-589	1,522	1.9	0.8	3,144	18
P-591	61	0.4	0.1	122	8
P-593	3,428	1.6	0.3	90	30
P-595	3,508	1.6	0.3	173	30
P-597	61	0.2	0.0	634	12
P-599	80	0.5	0.2	988	8
P-601	0	0.0	0.0	424	8
P-603	0	0.0	0.0	141	8
P-605	843	1.1	0.3	732	18
P-607	2,798	2.0	0.6	1,272	24
P-609	3,691	5.9	7.0	678	16
P-621	1,871	1.3	0.2	101	24
P-623	1,871	1.3	0.2	103	24
P-631	80	0.5	0.2	2,168	8
P-633	80	0.5	0.2	2,525	8
P-635	3,569	5.7	6.6	92	16
P-365	176	0.5	0.1	637	12

5/9/2016