Santa Clara Valley Water District

CITY OF SAN JOSE
CAPITAL OF SILICON VALLEY

SOUTH BAY WATER RECYCLING

Strategic and Master Planning

VOLUME 1

REPORT

RMC water and environment in association with CDM Smith

December 2014

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CITY OF SAN JOSE
CAPITAL OF SILICON VALLEY

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South Bay Water Recycling Strategic and Master Planning

Report

Prepared by:

RMC water and environment

In Association with:

CDM Smith

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Acknowledgements

The Recycled Water Strategic and Master Plan Report is the culmination of a multi-year assessment of the feasibility of recycled water as a reliable, sustainable water supply for northern Santa Clara County. The following organizations and individuals provided key contributions to the development of this Report.

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South Bay Water Recycling
Strategic and Master Plan

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List of Abbreviations

µg/l	Micrograms per liter
ADWF	Average dry weather flow
AF	Acre-feet
AFY	Acre-feet per year
AGR	Agricultural water supply
AOP	Advanced oxidation process
ARRA	American Recovery and Reinvestment Act
AWP	Advanced water purification
AWPF	Advanced water purification facilities
BAC	Biologically activated carbon
CCC	Chlorine contact channel or Criteria Continuous Concentrations
CCSCE	Center for the Continuing Study of the California Economy
CDBM	Chlorodibromomethane
CDPH	California Department of Public Health
CEC	Constituents of emerging concern
cfs	Cubic feet per second
City	The City of San Jose
CMC	Criteria Maximum Concentrations
CRMWD	Colorado River Municipal Water District
CTR	California Toxics Rule
CVP	Central Valley Project
CWA	Clean Water Act
CWC	California Water Code
DCBM	Dichlorobromomethane
DDW	Division of Drinking Water
District	Santa Clara Valley Water District
DPB	Disinfection By-products
DWR	California Department of Water Resources
EBDA	East Bay Discharge Authority
FAHCE	Fisheries and Aquatic Habitat Collaborative Effort
FAT	Full advanced treatment
ft	Feet
GAC	Granular activated carbon
gpcd	Gallons per capita per day
gpd	Gallons per day
gpm	Gallons per minute
GWR	Groundwater replenishment
H&SC	Health and Safety Code
HAA	Haloacetic Acid
HCP	Habitat Conservation Plan
hp	Horse power
HRT	Hydraulic retention time
I-Bank	California Infrastructure and Economic Development Bank
IEUA	Inland Empire Utilities Agency
IND	Industrial service water supply
IPR	Indirect potable reuse
IWC	Instream Waste Concentration
IWRP	Integrated Water Resource Plan
kWh	Kilowatt-hours
LACDPW	Los Angeles County Department of Public Works
LACSCD	Los Angeles County Sanitation Districts
LBWD	Long Beach Water District
LOS	Level of service
MBR	Membrane bioreactor
MCL	Maximum Contaminant Level
MF	Microfiltration
MG	Million gallon
mg/l	Milligram per liter
mgd	Million gallons per day
MUN	Municipal and domestic supply
N	Nitrogen
NDMA	Nitrosodimethylamine
ng/l	Nanograms per liter
NL	Notification levels
nm	Nanometers
NPDES	National Pollutant Discharge Elimination System
NPR	Non-potable reuse
O&M	Operations and maintenance
OCSD	Orange County Sanitation District
OCWD	Orange County Water District
PDWF	Peak dry weather flow
Plan	Strategic and Master Plan
ppm	Parts per million
ppt	Parts per trillion
PROC	Industrial process water supply
PS	Pump station
PWPS	Product water pump station
PWWF	Peak wet weather flow
RO	Reverse Osmosis
RRT	Response Retention Time
RSWRF	Reno-Stead Water Reclamation Facility
RWC	Recycled Water Contribution
RWF	San Jose/Santa Clara Regional Wastewater Facility
RWMP	Recycled Water Master Plan
RWQCB	Regional Water Quality Control Board
RWQCP	Regional Water Quality Control Plant

San Jose Muni	City of San Jose Municipal Water System
SAT	Soil aquifer treatment
SB	Senate Bill
SBA	South Bay Aqueduct
SBWR	South Bay Water Recycling
SCCWRP	Southern California Coastal Water Research Project
SCVWD	Santa Clara Valley Water District
SFPUC	San Francisco Public Utilities District
SIP	State Implementation Policy
SJ/SC RWF	San Jose/Santa Clara Regional Wastewater Facility
SJWC	San Jose Water Company
SNMP	Salt Nutrient Management Plan
SRF	State Revolving Fund
Strategic Plan	Strategic and Master Plan
SVAWPC	Silicon Valley Advanced Water Purification Center
SVCW	Silicon Valley Clean Water
SWRCB	State Water Resources Control Board
TASC	Task Advisory Steering Committee
TCEQ	Texas Commission on Environmental Quality
TDS	Total Dissolved Solids
TFC	Thin film composite
THM	Trihalomethanes
TMDL	Total Maximum Daily Load
TOC	Total Organic Carbon
TPAC	Technical Plant Advisory Committee
TPS	Transmission Pump Station
TRE	Toxicity Reduction Evaluation
TSS	Total suspended solids
TWDB	Texas Water Development Board
U.S.	United States
UF	Ultrafiltration
USBR	United States Bureau of Reclamation
USD	Union Sanitary District
USEPA	United States Environmental Protection Agency
UV	Ultra-violet
UWMP	Urban Water Management Plan
WBMWD	West Basin Municipal Water District
WDR	Waste Discharge Requirements
WET	Whole Effluent Toxicity
WOTUS	Waters of the United States
WPCP	Water Pollution Control Plant
WPDP	Water Purification Disinfection Project
WRD	Water Replenishment District of Southern California
WRFP	Water Recycling Fund Program
WRR	Water Recycling Requirements
WRRF	WateReuse Research Foundation
WSIMP	Water Supply and Infrastructure Master Plant
WTP	Water treatment plant
WVSD	West Valley Sanitation District
WWTP	Wastewater treatment plant
ZLD	Zero liquid discharge

1. Introduction

The City of San José(City), as administering agency for the San José/Santa Clara Regional Wastewater Facility (RWF), in partnership with the Santa Clara Valley Water District (SCVWD or District), led the preparation of this Strategic and Master Plan to evaluate recycled water produced from the RWF. The Strategic Plan has a 20-year planning horizon and identifies the purpose and future of recycled water produced from the RWF in terms of meeting the regulatory needs of the RWF as well as contributing to regional water supplies.

1.1 Project Sponsors

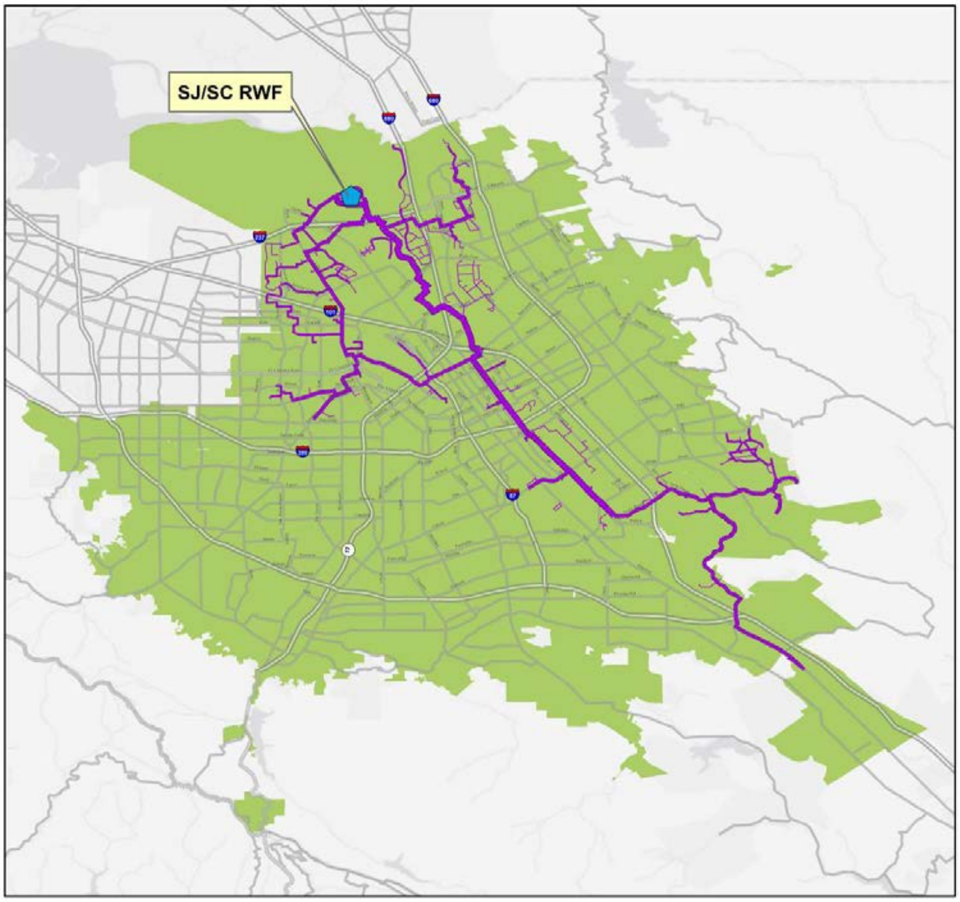
The City of San José and SCVWD have a long history of collaboration on recycled water related activities that dates back to the early 1990s, culminating in their partnership as the non-federal project sponsors for this Strategic Plan. The City and SCVWD have distinctly different interests in the production and use of recycled water, with the City representing the wastewater treatment and disposal participants and SCVWD representing water supply interests.

In addition to the City of San José and SCVWD, other stakeholders have played an active role in the development of the Strategic Plan. In 2012 representatives of the City, SCVWD, the City of Santa Clara (RWF co-owner), and the RWF tributary agencies formed the South Bay Water Recycling (SBWR) Task Advisory Steering Committee (TASC) as a forum to discuss the future of SBWR, to develop the Request for Proposals for the Strategic Plan and to provide input on the development of the Strategic Plan. The TASC consists of representatives from the Cities of San José and Santa Clara, West Valley Sanitation District (the tributary agencies' representative), and SCVWD.

1.2 Study Area

Figure 1 is a map illustrating the Strategic Plan study area and showing the current SBWR system.

Figure 1: Strategic Plan Study Area



1.3 Strategic Plan Visioning Process

The South Bay Water Recycling (SBWR) is a program operated by the City of San José and funded through a combination of RWF capital and operation budgets, and wholesale recycled water sales to local water retailers. SBWR facilities were originally built as a wastewater diversion program in response to a directive by the United States Environmental Protection Agency and the Regional Water Quality Control Board to reduce RWF discharge to San Francisco Bay in order to protect salt marsh habitat. The water supply benefits of SBWR were quickly realized and have now become the predominant driving force for expansion of water recycling in the study area.

Recognizing the importance of articulating a collective vision for the future of SBWR that represents both the wastewater and water supply interests, the TASC began the Strategic Plan with a visioning process to build upon work previously completed as part of the SBWR program and establish the context for development of the institutional and technical components necessary to complete the Strategic Plan.

The visioning process was based on discussions during three TASC workshops held between October 2012 and February 2013. The visioning workshops resulted in the following guidelines/expectations that helped set the development of the Strategic Plan:

- Near-Term (2015-2020)
    - Recognize there is no longer a wastewater-driven need to expand SBWR
    - Achieve cost recovery as soon as practical
    - Maintain the system as a reliable supply to support existing customers
- Long Term (2020-2035)
    - Alternatives must balance needs of wastewater management and water supply perspectives
    - Costs should be shared proportionally across all who benefit
    - Master Planning will provide basis for identifying alternative governance frameworks and associated funding strategies for non-potable (NPR) and potable reuse

1.4 Planning Horizon and Targets

During the Visioning phase TASC participants, recognizing that expansion of water recycling would be driven by water supply needs, adopted recycled water targets for the Strategic Plan to be consistent with SCVWD's water supply planning.

SCVWD has a goal of expanding recycled water so that it supplies at least 10% of countywide water demands. This results in a goal of 40,000 AFY of recycled water use by 2025 and 50,000 AFY of use by 2035. In addition, SCVWD's 2012 Water Supply and Infrastructure Master Plan (WSIMP) calls for a total 50,000 AFY recycled water by 2035. A baseline countywide recycled water production of 15,000 AFY was chosen as a starting point, translating into a need to develop an additional 25,000 AFY of recycled water use by 2025 followed by an additional 10,000 AFY by 2035 (to reach a total additional use of 35,000 AFY by 2035).

These are county-wide water supply targets and include areas of the county outside the SBWR service area. However, for the sake of setting an aggressive goal for this Strategic Plan in terms of analyzing the full potential for recycled water originating from the RWF, the county-wide targets have been used as the targets for the Strategic Plan, i.e. the Strategic Plan's recycled water target is an additional 25,000 AFY of use by 2025 and 35,000 AFY of use by 2035, all with water originating from the RWF.

The Strategic Plan recycled water targets are as follows:

Table 1: Strategic Plan Recycled Water Planning Targets

Year	Baseline Use, AFY	Additional Strategic Plan Recycled Water Targets, AFY	Total Recycled Water Use, AFY
2025	15,000	**25,000**	40,000
2035	15,000	**35,000**	50,000

Note: The Strategic Plan targets are in addition to an assumed county-wide baseline use of 15,000 AFY (SCVWD 2010 Urban Water Management Plan rounded to the nearest thousand). Adding the baseline of 15,000 AFY to these targets reaches the overall 2012 WSIMP goal of 40,000 AFY by 2025 and 50,000 AFY by 2035.

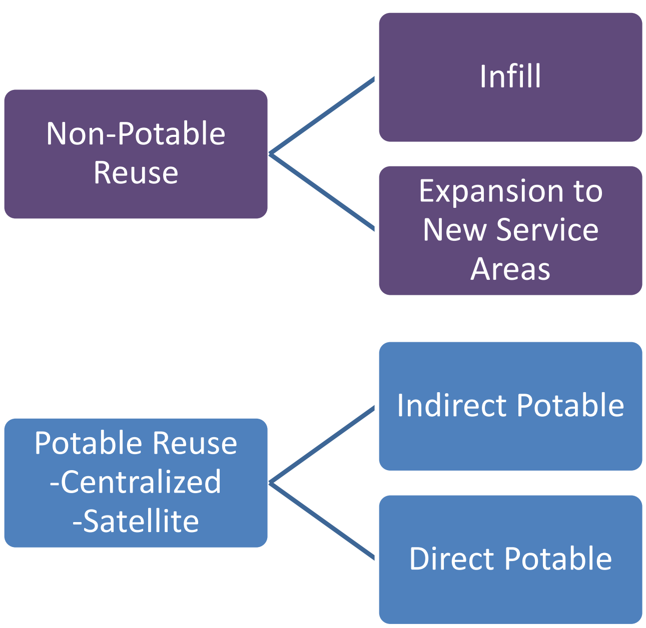
While the SCVWD plans to meet its recycled water targets with sources throughout the county, for planning purposes the SBWR master planning targets assume that SCVWD's additional recycled water needs will be met by the RWF. It is assumed that any near- or long-term wastewater flow diversion needs would be encompassed by the water demand needs.

1.5 Recycled Water Pathways

The Strategic Plan evaluated two framework pathways to achieve the recycled water targets.

- Maximize non-potable reuse
- Maximize potable reuse

The framework pathways were analyzed for both the near-term (2015-2020) and long-term (beyond 2020). Each framework alternative pathway had several sub-alternatives.



NPR can be met by infill in the existing service area or expansion to new service areas.

Potable reuse can be met through indirect potable reuse (IPR) or direct potable reuse (DPR), both of which can be accomplished through a centralized advanced treatment facility served directly from the RWF or satellite advanced treatment facilities served by the SBWR system.

IPR can be divided into groundwater recharge alternatives and surface water augmentation.

DPR can be divided into alternatives that connect to the raw water supply upstream of a water treatment plant and alternatives that connect directly to the potable distribution system. To date SCVWD has only considered

DPR via connection to the raw water system, and the Strategic Plan does not recommend consideration of direct connection to the potable distribution at this point.

2. Non-Potable Reuse Pathway

2.1 NPR Market Assessment

The NPR market assessment was organized into two time frames:

- Near-Term SBWR Recycled Water Use –those uses already in place plus additional recycled water uses that are expected to be in service circa 2015 to 2020.
- Long-Term SBWR Recycled Water Uses – additional NPR markets that have been identified by SBWR's retailers as potentially occurring beyond 2020.

There are six water retailers in the area served by the RWF: City of Milpitas, City of Santa Clara, City of San José Municipal Water System (San José Muni), San José Water Company (SJWC), California Water Service and Great Oaks Water Company. Of these retailers, four currently distribute recycled water from SBWR: City of Milpitas, City of Santa Clara, San José Muni, and SJWC. As SBWR has evolved from a wastewater diversion program to a growing component of water retailers' water supply portfolios, growth of the SBWR system has likewise shifted from RWF-driven extensions to water retailer-led efforts that focus on infill opportunities and strategic extensions. The NPR market potential is therefore based on information from interviews with the retailers conducted in the spring of 2013.

The NPR market assessment identified a total long-term potential of 25,000 AFY as shown in Table 2. The long-term NPR potential of 25,000 AFY is not enough to reach the Strategic Plan target of an additional 35,000 AFY by 2035. The breakdown of the long-term NPR demands by type of use is shown in Table 3. The long-term NPR demands shown represent the upper boundary of the "Maximize NPR Pathway" developed in the initial Visioning Process for the Strategic Plan.

Table 2: Total NPR Market

Retailer	Total Estimated Near-term, AFY	Additional Long-Term Demands, AFY	Total Potential NPR, AFY
City of Milpitas	1,100	1,100	2,200
City of Santa Clara	4,300	900	5,200
San José Municipal Water	6,200	1,150	7,400
San José Water Company	3,300	6,820	10,100
Total (rounded)	**15,000**	**10,000**	**25,000**

Table 3: Total Potential NPR Market by type of Use

Retailer	Irrigation, AFY	Industrial, AFY	Total Potential NPR, AFY
City of Milpitas	2,090	110	2,200
City of Santa Clara	2,780	2,420	5,200
San José Municipal Water	3,250	4,100	7,350
San José Water Company	10,020	100	10,120
Total)	**18,140**	**6,730**	**25,000 (rounded)**

2.2 Near-Term (2015-2020) SBWR Reliability Improvements

Alternatives for near-term improvements to the SBWR production and distribution system facilities were developed and evaluated to maintain reliability for meeting the near-term recycled water demands of 15,000 AFY. In addition to the NPR demands, there is a commitment to SCVWD to provide 5 mgd of recycled water for their Phase 1 indirect potable reuse (IPR) project as part of the Silver Creek Agreement between the City and SCVWD. [1] Since the 5 mgd flow would be conveyed through the SBWR distribution system, it was included in the analysis of SBWR infrastructure needs.

The reliability improvements are sized to meet the estimated near-term flows including the 5 mgd SCVWD commitment as shown below.

[1] "Agreement between the City of San José and the Santa Clara Valley Water District Relating to Management and Operation of the south Bay Water Recycling System, Including the Silver Creek Pipeline", January 22, 2002

Table 4: Near-term Recycled Water Flow Rates from Transmission Pump Station

	2015 Near-term w/o SCVWD	2015 Near-term w/ SCVWD [1]
Annual RW Flow, AFY	15,000	20,000
Daily Average, mgd	20.4	25.4
Peak Month, mgd	30.6	35.6
Peak Day, mgd	34.5	39.5
Peak Hour, mgd	48.3	53.3

[1] SCVWD has a 5 mgd commitment for their Phase 1 IPR project. It is assumed that the 5 mgd will be delivered at a constant flow rate so the additional 5 mgd was added to the near-term and long-term flow rates without applying peaking factors to the 5 mgd.

A number of reliability improvements were proposed for the production and distribution facilities. The projects were evaluated based on the vulnerabilities they addressed, the estimated costs of implementation, and any secondary benefits that might be provided. After preliminary evaluation by the consultant, the results were further prioritized at a workshop with staff from RWF, SBWR and the SCVWD. Based on the prioritization, the following table summarizes the reliability projects that are recommended for a 5 year SBWR Reliability CIP.

Table 5: Recommended SBWR 5 year CIP

Project Number	Project Name	Estimated Cost Range
Increase Production Capacity		
P6	TPS Capacity Upgrade	$1,000,000 - $1,300,000
P8a	Filter Flux Rate	$75,000
P8b	Free Chlorine Disinfection Studies/Implementation	$500,000 - $1,000,000
Improve Distribution System Stability		
D5	Upgrade Pump Station 5 Bypass	$300,000 - $500,000
D9	Zone 1 Storage	$40-$50 million
Restore/Rehabilitate Existing Condition-Related Deficiencies		
D1a-1	PS 5 VFDs	$60,000
D1a-2	Other Condition Assessment Projects (2014-2015 Projects)	$2 million
D2	Valve Exercising Program	<$100,000/year
D11	PS 5 and PS8/11 Electrical Room HVAC replacement	$150,000 – $250,000
Update Control Strategies/Equipment to Improve Operational Efficiency		
P9a	Filter Backwash Automation	$100,000 – $500,000
P9b	Distribution System Automation	$650,000 – $2,1500,000
D6	Automate Zone Bypass Valve at Pump Station 8/11	<$50,000
Provide Operations Support		
S5	Update SBWR Systems Operations Manual	$100,000 - $200,000
Total Cost of CIP		**$45 to $49 million**

During the course of reliability improvement analysis, it was noted that demand management could be used to complement the recommended reliability improvements. Strategies to manage the irrigation timing of large customers, and the potential for the District to operate the Ford Pond IPR project on an interruptible basis could provide SBWR with some flexibility in the timing and funding of these improvements.

2.3 Long-Term (Beyond 2020) NPR Alternatives

Expanding the NPR market to the long-term potential of 25,000 AFY identified in the NPR market assessment will require expansion of the SBWR distribution system to serve new customers. The estimated long-term recycled water flows from the Transmission Pump Station (TPS), including the 5 mgd SCVWD commitment are shown below.

Table 6: Long-Term Recycled Water Flow Rates from TPS

	Near-term w/SCVWD	Long-Term Additional NPR	Total Long-term NPR
Annual RW Flow, AFY	20,000	10,000	30,000
Daily Average, mgd	25.4	8.9	34.3
Peak Month, mgd	35.6	13.4	49.0
Peak Day, mgd	39.5	15.1	54.6
Peak Hour, mgd	53.3	21.1	74.4

Meeting these demands will require extensions of the existing distribution system, new pump stations, and new storage tanks. The location of the additional demands and the new infrastructure required to serve them are shown on Figure 2.

The incremental capital and operating costs for the expanded SBWR infrastructure needed to serve the additional 10,000 (25,000 AFY total) of long-term NPR demands are shown in Table 7. Note that the capital and O&M of the near-term system would be added to these costs to obtain the total blended cost of recycled water. The incremental long-term costs are separated here so they can be compared to the costs of the long-term potable reuse pathways

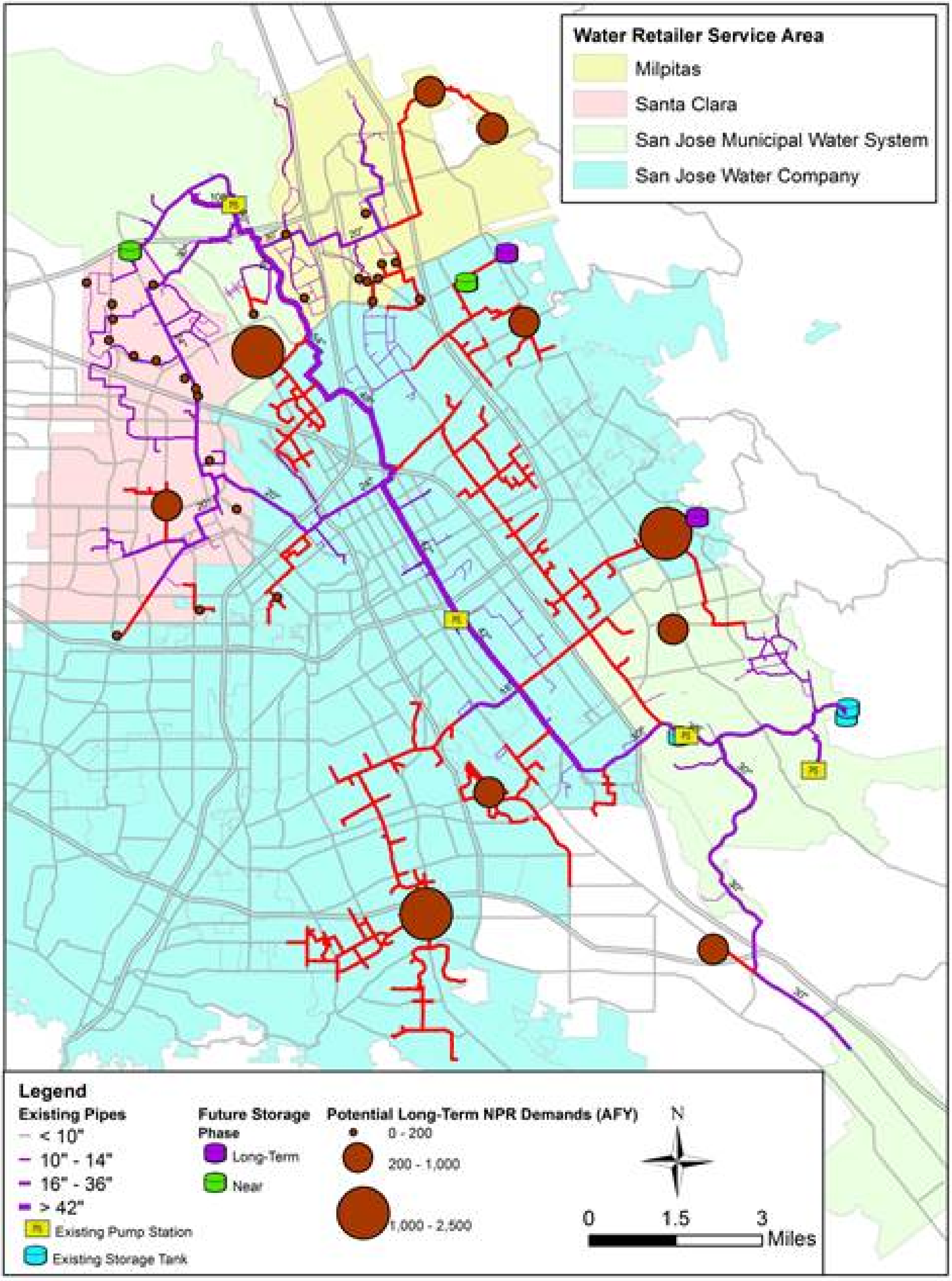
Table 7: Estimated Incremental Cost of Long-Term NPR Water

Component	Estimated Capital Cost
Pipelines	$129,600,000
Pump Stations	$13,600,000
Reservoirs	$27,000,000
Base Construction Cost	$170,200,000
Implementation Costs @30%	$51,000,000
Project Contingency @ 10%	$22,000,000
Total Capital Cost	**$243,200,000**
Annualized Capital Costs[1]	$12,400,000
Annual O&M Costs	$4,500,000
Total Annualized Cost	$16,900,000
Additional Long-Term Demands, AFY	10,000
Cost of Long-Term NPR Water, $/AF	**$1,690**
Cost of Long-Term NPR including Rehabilitation & Replacement Fund, $/AF[2]	*$2,030*

Notes:

1. *Capital costs are annualized over 30 years assuming financing rate of 5.5%, inflation rate of 2.5% for a net interest rate of 3%.*
2. *Annual O&M costs do not include an allowance for an R&R fund. Including an annual R&R fund equivalent to 1/50th of the base construction cost would increase the unit cost of water to $2,030/AF*

Figure 2: Long-Term NPR Demands and Infrastructure



3. Potable Reuse Pathway

Three potable reuse pathways were evaluated:

- Pathway 1: Groundwater recharge with Centralized Advanced Water Purification Facility (AWPF)
- Pathway 2: Groundwater recharge with Satellite AWPF
- Pathway 3: Direct Potable Reuse (DPR) with Centralized AWPF

Pathway 1 would consist of groundwater recharge (GWR) with centralized treatment at a new AWPF located adjacent to the Silicon Valley Advanced Water Purification Center (SVAWPC). The source water for the AWPF would be secondary effluent from the RWF. Purified recycled water from the AWPF would be conveyed to the Los Gatos recharge area and recharged to the groundwater through the existing recharge system.

Pathway 2 would consist of GWR with satellite treatment at new AWPFs located in Coyote, Penitencia, and Los Gatos. The source water for the satellite AWPF would be recycled water from an expanded SBWR distribution system. Purified recycled water from each AWPF would be recharged to the groundwater through the respective recharge systems

Pathway 3 would be similar to Pathway 1 in that it includes a centralized AWPF adjacent to the SVAWPC. Purified recycled water from the AWPF would be used for DPR through a connection to the raw water Central Pipeline.

3.1 Recommended Potable Reuse Plan

Several alternatives were developed for each of the potable pathways using different combinations of capacity, treatment process, and recharge locations. The potable pathway alternatives were evaluated by SCVWD based on a number of criteria including cost, yield, implementation complexity, regulatory complexity, and groundwater basin capacity. The long-term program is designed for flexibility with implementation. The Los Gatos Recharge Ponds IPR project is the anchor project for the long-term plan with the additional, smaller projects identified to meet the recycled water goals. The project phasing was based on geography and regulatory considerations. As the long-term program is advanced, the order of these projects may be adjusted based on a detailed reoperations evaluation for the recommended plan, the development of regulations, the availability of local and imported water supplies, and other factors.

The resulting recommended plan for the potable reuse pathway is documented in Table 8 and illustrated in Figure 3.

Table 8: Recommended Plan for Potable Reuse

Phase	Description	Capacity	Cumulative Capacity	Timing
Phase 1	Ford Recharge Ponds IPR	4,200 AFY	4,200 AFY	Near-term
Phase 2	Mid-Basin Injection Wells IPR	5,600 AFY	9,800 AFY	Long-term
Phase 3	Los Gatos Recharge Ponds IPR	20,200 AFY	30,000 AFY	Long-term
Phase 4	Westside Injection Wells IPR or Central Pipeline DPR	5,000 AFY	35,000 AFY	Long-term

As part of the next steps for developing the potable reuse program, a reoperations evaluation will be required for the near-term and long-term potable reuse program to assess the overall impacts to the District's existing local and imported supplies. The District completed a reoperations evaluation for the District's initial potable reuse concepts, which are identified for the potable reuse alternatives. As the District expands recycled water use, including implementing potable reuse projects, a policy discussion and decision will be needed regarding recycled water and how it will be utilized in the District's water supply plan, i.e., will recycled water be base loaded or only used as supplemental water during dry years. The economics for recycled water projects are more favorable if they are used as base water supply rather than a supplemental water supply. The reoperations study and policy decision will help guide the implementation of potable reuse projects.

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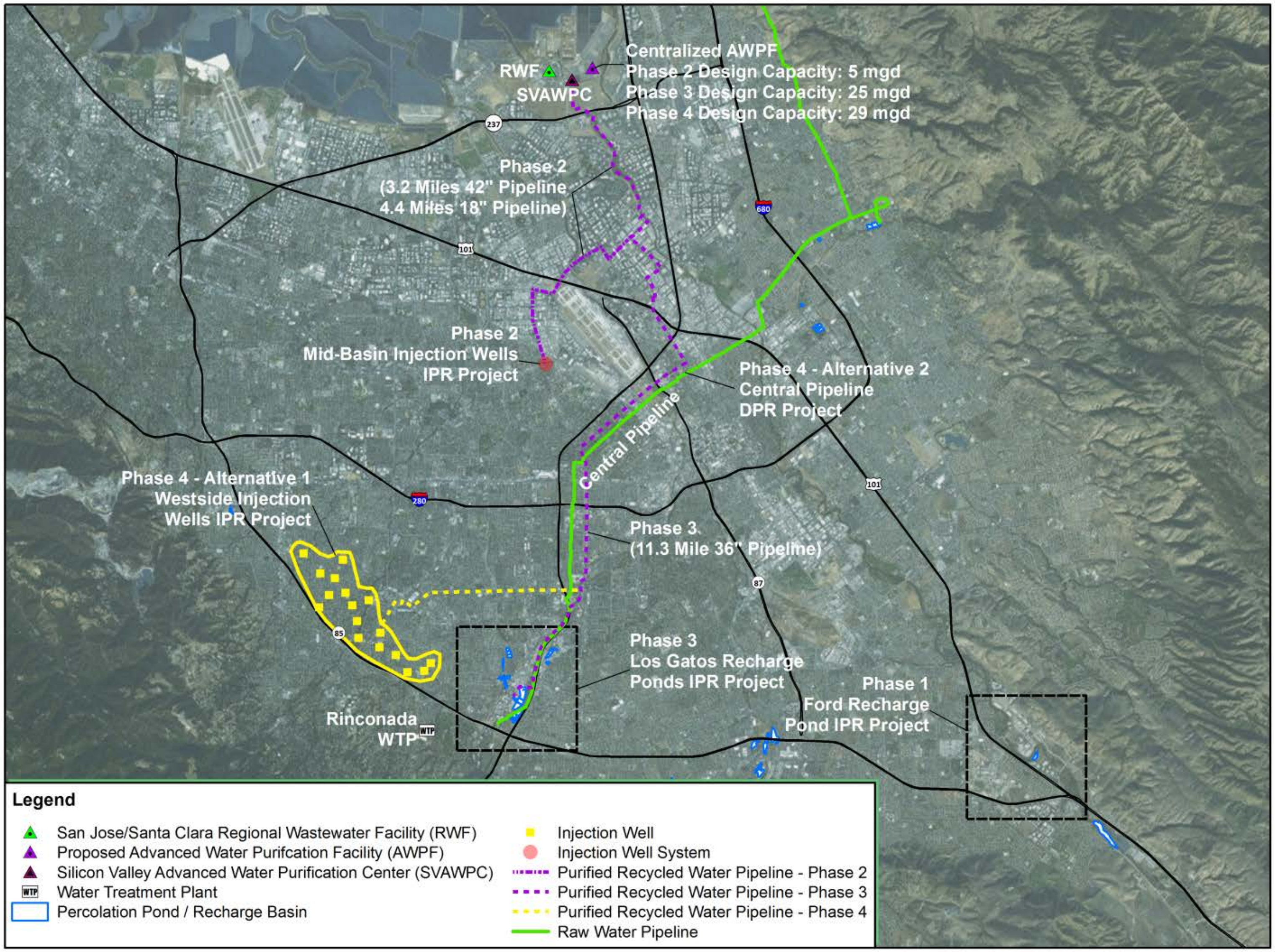
Figure 3: Potable Reuse Recommended Plan



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3.2 Near-Term (Phase 1) Potable Reuse Project

Based on the results of SCVWD's evaluation for the Phase 1 Capital Projects, the Ford Pond IPR project has been identified as the preferred near-term potable reuse project. The Ford Ponds IPR project will utilize the existing SBWR water allocation from the nearby Silver Creek Pipeline and maximize Phase 1 IPR recharge capacity while minimizing the size of centralized AWPF, associated conveyance, and North County raw water system re-operation in the long-term.

The Ford Pond IPR project includes additional treatment of 5 mgd of SBWR tertiary recycled water through a satellite AWPF located near the Ford Pond. At this time it is envisioned that the satellite AWPF would employ full advanced treatment (MF, RO, and AOP) to minimize diluent water requirements, which would produce an annual average 4,200 AFY. RO concentrate would be discharged through an industrial discharge permit to the SJ/SC RWF sewer system. The addition of brine to the RWF effluent would not result in any compliance problems at the projected brine flows, though the blended discharge should be monitored for chronic toxicity.

The conceptual cost estimate for the For Pond IPR project is presented in Table 9.

Table 9: Ford Pond IPR Estimated Costs

Parameter	Ford Pond IPR
Capital Cost ($M)	$64.4
Treatment ($M)	$40.4
Conveyance ($M)	$8.2
Recharge ($M)	$15.8
Annualized Capital Costs ($M)	$3.3
Annual O&M Costs ($M) [1,2]	$4.1
Total Annualized Cost ($M)	$7.4
Yield (AFY)	4,200
Unit Cost ($/AF)	**$1,750**

1 – Capital costs are annualized over 30 years assuming financing rate of 5.5%, inflation rate of 2.5% for a net interest rate of 3%.

2 – Does not include SBWR recycled water rate which needs to be determined. Unit cost will increase once this O&M cost element is included in the estimate.

3 - Includes a placeholder for the San José industrial sewer discharge fee, which was estimated using the Monitored Industrial Sewer Service and Use Charge unit rates from the City's website and estimated brine quality. The fees need to be coordinated and confirmed with the City during project implementation.

Opportunities to increase NPR and potable reuse in Coyote Valley were explored to identify NPR opportunities to provide an alternative water source to the Cinnabar Hills Golf Club, which is currently using surface water supplied from the District from the San Felipe project. The analysis identified conceptual project opportunities for NPR reuse and potable reuse, which could potentially be melded into the long-term implementation plan.

3.3 Long-Term Potable Reuse Projects

A series of long-term potable reuse projects have been identified to achieve the overall potable reuse goal of 35,000 AFY when combined with the near-term project. Purified recycled water would be supplied by a centralized AWPF and a pipeline that would be built in stages to deliver the water to the recharge areas.

The first step of the long-term plan (Phase 2 of the recommended plan) will be to use injection wells to recharge water in Santa Clara. At this time it is estimated that a mid-basin injection well IPR project would be about 5,600 AFY, which will be confirmed with groundwater modeling and an evaluation of other factors such as need for project. If groundwater modeling does not support implementation of an indirect potable reuse project using injection wells in Santa Clara, then the long-term plan could increase the size of the Phase 4 project and still meet the overall recycled water use goals presented in Table 1. The first increment of the centralized AWPF would be designed to produce 5.3 mgd of purified recycled water. The first increment of the pipeline would be constructed from the centralized AWPF to the mid-basin injection wells located west of the Norman Y. Mineta San José International Airport.

As part of an additional study, a concept was developed for a smaller-scale temporary injection well project to demonstrate the feasibility of IPR using injection wells in the mid-basin area and support the development of the long-term potable reuse program. The concept explored includes a short-term IPR project that would include a temporary 1-mgd satellite AWPF to produce purified recycled water that would be recharged to the groundwater basin through an injection well. This project would be developed as a temporary project since it would eventually be replaced by the larger, permanent mid-basin injection IPR project. Based on the concept-level engineering analysis the approach is feasible, but needs to be developed further if it will be pursued.

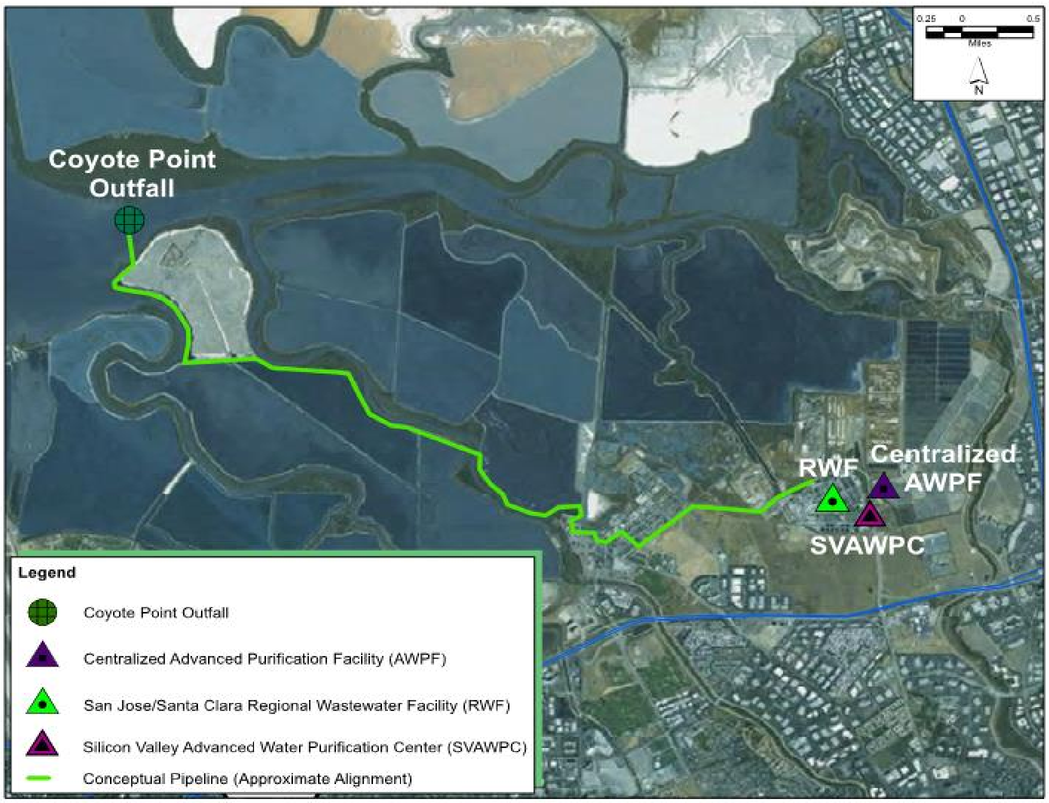
The Phase 3 of the recommended plan is to recharge recycled water at the Los Gatos recharge ponds. The off-stream recharge ponds would be used for GWR, which have a capacity of 20,200 AFY. The centralized AWPF would be expanded for an overall production capacity of 24.5 mgd and the pipeline would be extended to the Los Gatos recharge system. A fast-track project concept was developed to implement a temporary pipeline to transport up to 9 mgd of purified recycled water produced at the SVAWPC to recharge the groundwater basin through the Los Gatos ponds. This project would provide an emergency drought proof water supply, and would demonstrate the feasibility of IPR using the Los Gatos ponds for potable reuse in support the development of the long-term potable reuse program. This project would be developed as a temporary project since it would eventually be replaced by the larger, permanent potable reuse project at the Los Gatos ponds. If this project was pursued further, then the concept would need to be developed in more detail, including institutional, engineering, and regulatory elements.

Phase 4 of the recommended plan will be to either expand the IPR program to the Westside injection wells (Alternative 1) or connect to the Central Pipeline for DPR (Alternative 2). The decision between the two projects will be based on advances in DPR regulation in California and SCVWD’s desire to add purified water to its water treatment plant supply portfolio.

The long-term potable reuse alternatives include a new centralized AWPF that would be located near the SVAWPC. Concentrate management/disposal will be required to manage the brine produced from the reverse osmosis process at the AWPF. Several concentrate management/disposal options were evaluated in the Strategic Plan, including combining the brine with the SJ/SC RWF outfall, pumping the concentrate north to discharge to the EBDA outfall, and building a new concentrate-only outfall to Coyote Point (a South San Francisco Bay location that can provide a required 10:1 dilution). For the Strategic Plan a concentrate-only outfall to Coyote Point is assumed for the long-term project costs.

A conceptual layout for the Coyote Point concentrate outfall is shown on Figure 4.

Figure 4: Concentrate Outfall at Coyote Point



Long-Term Potable Costs

The conceptual cost estimates for the long-term potable reuse projects are presented in Table 10.

Table 10: Long-Term Potable Reuse Conceptual Cost Estimates

Cumulative Cost of All Long-Term Potable Reuse Phases	IPR[1]
Capital Cost ($M)	$522
Treatment ($M)	$271.8
Conveyance ($M)	$170.2
Recharge ($M)	$79.8
Annualized Capital Costs ($M)[2]	$26.6
Annual O&M Cost ($M)	$17.3
Total Annualized Cost ($M)	$43.9
Yield, AFY	30,800
Unit Cost ($/AF)	**$1,400**

Notes:

[1] The long-term plan with DPR in Phase 4 has a unit cost of $1,350/AF.

[2] Capital costs are annualized over 30 years assuming financing rate of 5.5%, inflation rate of 2.5% for a net interest rate of 3%.

4. Comparison of Long-Term Pathways

For the near-term, the Strategic Plan assumes that implementation of the NPR and IPR pathways will proceed concurrently using the same SBWR distribution system. Together the NPR and IPR projects will provide 20,000 AFY of recycled water and include the following sets of projects:

- SBWR reliability projects to meet 15,000 AFY of near-term NPR demands, and
- Phase 1 IPR project which will provide 4,200 AFY of groundwater recharge at the Ford Pond recharge ponds

For the long-term, implementing the NPR and IPR pathways will require construction of separate distribution and treatment infrastructure and the two pathways diverge in terms of costs and their ability to meet the long-term recycled water goals. Figure 5 shows the recycled water supplies for the long-term NPR and potable pathways versus the targets established for the Strategic Plan. Both pathways assume a baseline of 15,000 AFY of near-term NPR. For the NPR pathway, the additional long-term NPR supply is estimated at 10,000 AFY, bringing the total potential NPR pathway to 25,000 AFY, excluding SCVWD's Phase 1 IPR project at Ford Pond. The NPR pathway alone will not be adequate to meet either the 2025 target of 40,000 AFY or the 2035 target of 50,000 AFY. For the potable pathway, the near-term IPR project will provide 4,200 AFY with an additional long-term supply of 30,800 AFY, bringing the total potential potable pathway to 35,000 AFY.

Figure 5: Long-Term Pathways versus Recycled Water Targets

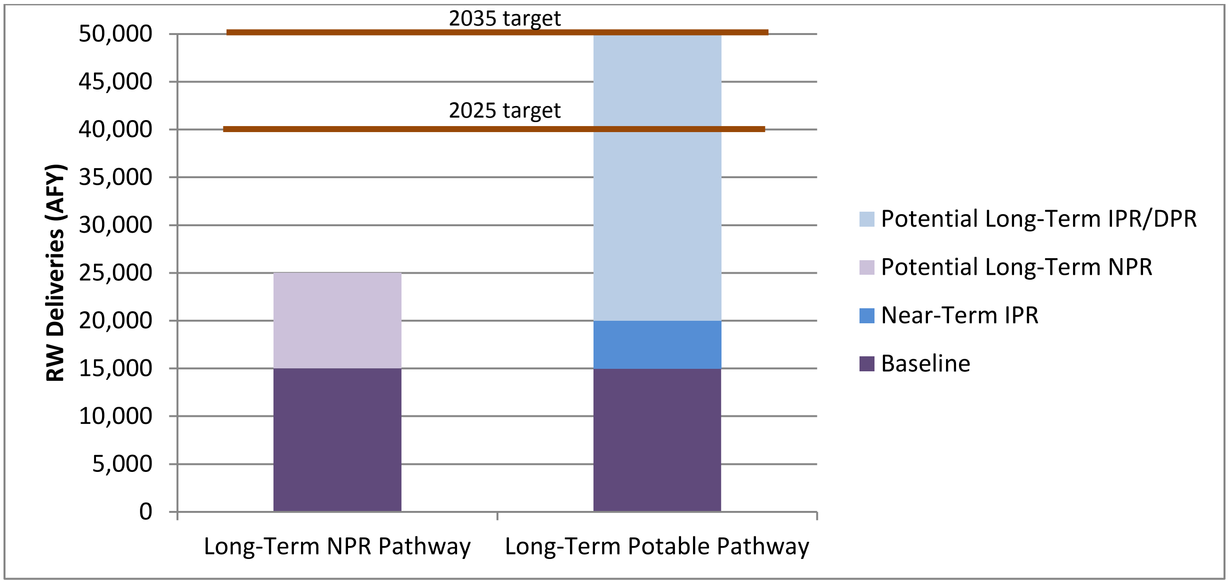


Table 11 compares the incremental estimated costs of water for the long-term NPR and potable pathways. Note that these costs do not include the near-term NPR or potable reuse projects, and consequently do not represent the total cost of recycled water. The incremental costs of the two long-term pathways are shown here for comparison purposes to each other.

Table 11: Comparative Costs of Long-Term Pathways

	Long-Term NPR [1]	Long-Term Potable
Total Capital Cost	$243,000,000	$522,000,000
Annual O&M Cost	$4,500,000	$17,300,000
Total Annualized Cost [2]	$16,900,000	$43,900,000
Incremental RW Deliveries, AFY	10,000	30,800
Unit Cost of Long-Term Projects, $/AF	**$1,690**	**$1,400**

Notes:

[1] *Costs shown do not include on-site retrofits or a rehabilitation and replacement fund.*

[2] *Capital costs are annualized over 30 years assuming financing rate of 5.5%, inflation rate of 2.5% for a net interest rate of 3%.*

Meeting the recycled water targets established in the Strategic Plan will require implementation of potable reuse in addition to NPR. As the recycled water program expands in the South Bay, the decision between NPR and IPR/DPR alternatives is one that needs to be made as part of an appropriate governance discussion. It is likely that expansion of NPR would proceed as a retailer-driven program based on retailer preferences and their ability to recover the costs of implementing an expanded program. It is likely that development of IPR/DPR would proceed as a wholesaler-driven program from a regional focus on potable reuse to achieve the county-wide 2025 and 2035 water supply targets.

Figure 6 summarizes the overall framework plan for recycling effluent from the RWF.

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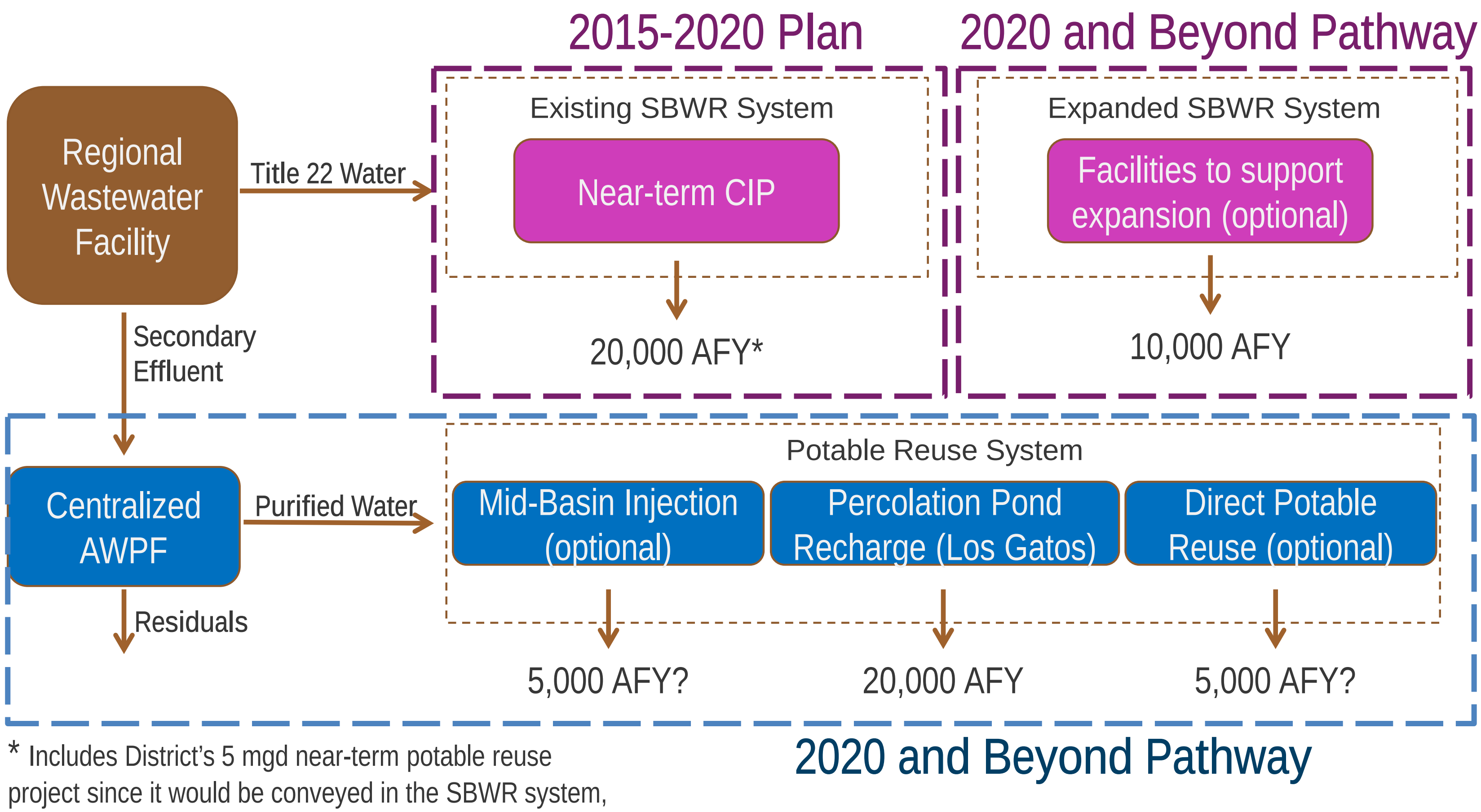
Figure 6: Framework Plan for Recycled Water Produced from the RWF



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5. Regional Opportunities

As a supplement to the core master planning and identification of future pathways for the RWF, potential synergies and partnership opportunities among the three north county water recycling programs were also noted in this strategic and master planning. As with the RWF, the Sunnyvale Water Pollution Control Plant (WPCP) and the Palo Alto Regional Water Quality Control Plant (RWQCP) support water recycling initiatives involving local retail water suppliers. Current and planned levels and types of water recycling were identified for the north county water recycling programs, and partnership opportunities in both NPR and potable reuse were noted.

5.1 Existing Recycled Water Facilities

The wastewater service in northern Santa Clara County is provided by three facilities: the Palo Alto RWQCP, the Sunnyvale WPCP, and the San José/Santa Clara RWF. The locations of these three wastewater treatment facilities, operated by the City of Palo Alto, the City of Sunnyvale, and the City of San José, respectively, are depicted in Figure 7. Figure 7 also depicts existing recycled water infrastructure and local water retailers.

Figure 7: South Bay Wastewater Treatment Plants and Recycled Water Pipelines

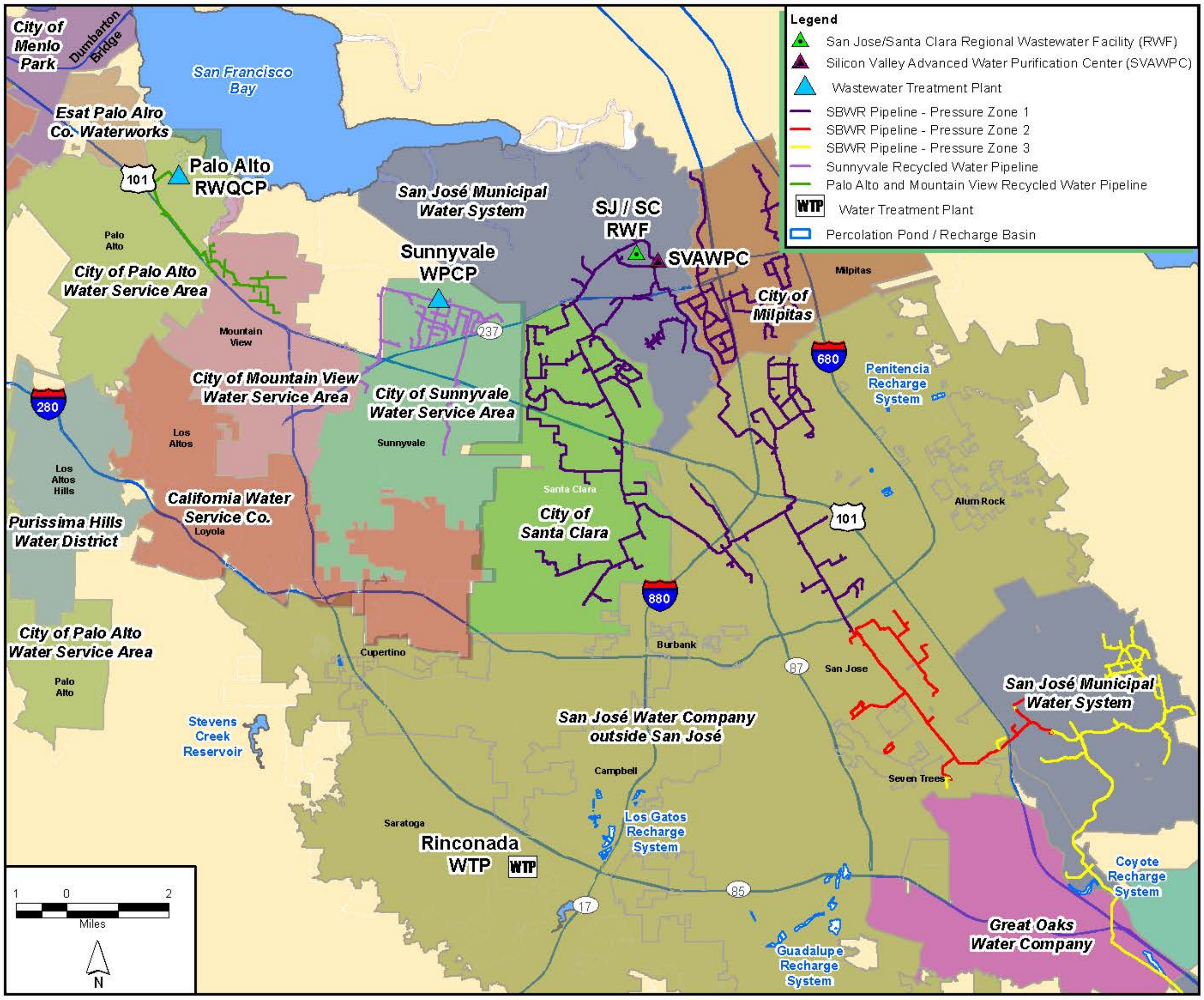


Table 12 provides a summary of the potable water sources, wastewater treatment plant flows, and NPR recycled water use estimates by each water retailers.

Table 12: Total Estimated Baseline Recycled Water Demands

Water Retailer	Potable Water Primary Water Supply	WWTP Facility	WWTP Average Flows (mgd)	Recycled Water Total Estimated Baseline (AFY)
City of Palo Alto	SFPUC	Palo Alto RWQCP	4.5	890
City of Mountain View	SFPUC			-[1]
City of Sunnyvale	SFPUC/SCVWD	Sunnyvale WPCP	15	1,062
City of Milpitas	SFPUC	SJ/SC RWF	110	1,100
City of Santa Clara	Groundwater			4,300
San José Muni	SCVWD			6,200
SJWC[2]	SCVWD			3,300
Great Oaks	Groundwater			0
Cal Water	SCVWD			0
			Total	**16,900[2] (rounded)**

Note:

1. *Included in Palo Alto demands.*
2. *Does not include 5,600 AFY commitment to SCVWD, which is currently envisioned to be used for potable reuse, but is treated as a non-potable demand since the water would be conveyed through the SBWR distribution system prior to any advanced treatment for IPR.*

5.2 Regional Non-potable Recycled Water Opportunities

Each of the regional water recycling agencies has planned additional NPR reuse. Table 13 provides a summary of the current baseline NPR demands as well as the potential long-term demands as identified in the individual city or agency plans.

Table 13: Potential Long-Term NPR Demands

Retailer	Baseline (AFY)	Potential Long-Term Demands (AFY)[1]	Total Potential NPR Market (AFY)
City of Palo Alto	890	2,800	3,690
City of Mountain View	-[2]	-[2]	-[2]
City of Sunnyvale	1,062	2,061	3,123
City of Milpitas	1,100	1,100	2,200
City of Santa Clara	4,300	900	5,200
San José Muni	6,200	1,150	7,400
SJWC	3,300	6,820	10,100
Great Oaks	0	0	0
Cal Water	0	0	0
Total	**16,900**	**14,800**	**31,700[3]**

Note:

1. *Does not include baseline demands.*
2. *Included in Palo Alto demands.*
3. *Does not include 5,600 AFY commitment to SCVWD, which is currently envisioned to be used for potable reuse, but is treated as a non-potable demand since the water would be conveyed through the SBWR distribution system prior to any advanced treatment for IPR.*

Potential interties between the SBWR, Sunnyvale, and Palo Alto/Mountain View systems have been discussed as both a production supplement and a reliability feature. Water quality differences and project funding issues have been identified as issue to be worked out. As these systems continue to evolve, intertie opportunities may increase and the regional agencies are encouraged to continue assessing these opportunities.

5.3 Regional Potable Reuse Opportunities

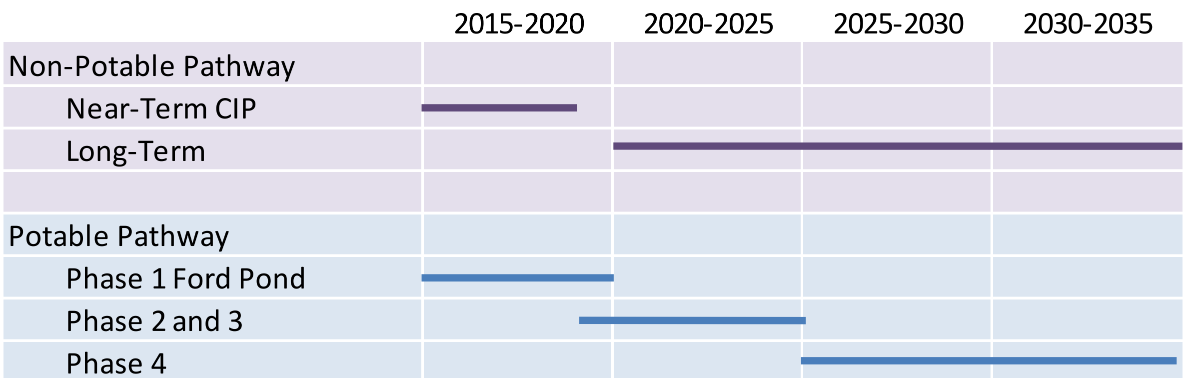
In addition to SBWR and the identified pathways to achieve up to 35,000 AFY of potable reuse, the City of Sunnyvale, working in partnership with the District, has identified concepts to deliver up to 10,000 AFY of potable reuse to a combination of mid-basin injection and spreading in the Los Gatos Recharge System. Although the sources and conveyance systems are distinct, the general potential recharge areas are similar. SBWR is expected to serve early phases of potable reuse, namely the Ford Pond IPR project and potentially an initial phase of mid-basin recharge, the Sunnyvale system could contribute to the District's longer-term potable reuse goals. As SBWR potable reuse pathways to mid-basin and Los Gatos Recharge systems are refined, a potential future intertie from Sunnyvale should be considered.

Coordination has already begun on RO concentrate management strategies from the two potential potable reuse systems. Facilitated by the District, a regional RO concentrate management discussion has begun and a workshop is being scheduled for early 2015 with regional regulators and policy makers. It is noted that to meet ultimate potable reuse targets, RO concentrate management strategies beyond simply blending the concentrate back into the regional wastewater agencies' outfalls will be required.

6. Implementation Plan

Implementation of the near and long-term recycled water projects will include numerous discrete projects that vary by costs and complexity. Some of the rehabilitation projects in the near-term NPR pathway are generally straightforward and can be implemented by staff or through relatively short duration design and construction efforts. The majority of the projects are large capital projects that will require additional study, partnering, permitting, financing, property acquisition, design, and construction. The figure below shows a conceptual schedule for implementation of the program components.

Figure 8: Conceptual Program Schedule



While the implementation schedule is based on meeting the 2025 and 2035 recycled water targets, the District is considering an accelerated time schedule for the NPR and potable reuse projects to provide recycled water supply before the target dates. The recommended plan and the implementation plan are flexible and projects can be implemented in a different order, or be implemented faster to achieve an earlier on-line date.

Implementation of the near-and long-term program will include multiple discrete projects that vary by costs and complexity. The detailed implementation steps will vary from project to project, but Table 14 shows implementation elements that will be common to many of the projects.

Table 14: Potable Reuse Implementation Steps

Categories	Implementation Items
Additional Studies	• Reoperations evaluation • Policy discussion/decision for recycled water supply • Conveyance pipeline alignment analyses • Siting analyses for reservoirs, injection wells, recharge ponds, AWPF • Regulatory and permitting approaches • Groundwater modeling/analyses • Impacts of increased flow diversion on RWF operation • Additional brine management studies
Environmental Documentation	• CEQA/NEPA
Permitting	• NPR and IPR permits • Phase 4 DPR (if selected) would require a separate permit • Brine discharge permits • Other resource agency permits such as Corps of Engineers, California Department of Fish and Game
Institutional	• Agreements, including those between City and retailers, SCVWD and retailers, and City and SCVWD • Land acquisition and/or rights of way
Public Outreach	• Public outreach plan and implementation
Funding/Financing	• Funding/financing plan and implementation
Design	• Preliminary Design Reports • Final Design
Construction	• Bid and Award • Construction • Startup

A key aspect of implementation will be addressing governance and financing issues. Implementation recommendations regarding these program aspects are discussed in the following section.

7. Governance and Financing

SBWR Strategic and Master Planning has verified the interest and opportunity of expanding SBWR as a regional water supply, including identification of pathways (NPR and potable) and cost implications. The SBWR Technical Advisory Steering Committee (TASC) recognizes that as SBWR evolves, its governance structure and financing strategies may need to evolve to maintain alignment with both the projected benefits and beneficiaries of water recycling and the breadth of issues and decisions associated with this evolution of RWF effluent reuse.

7.1 Governance

Although a rigorous assessment of future governance and financing strategies was not conducted as part of Strategic and Master Planning, a combination of technical analysis and stakeholder workshops were conducted as part of the Strategic and Master Planning to update past governance discussions and provide a basis for future consideration. It is noted that the City and the District have a substantial history of recycled water collaboration and partnering on both governance discussions and funding and financing of SBWR.

The RWF's governing structure, the Treatment Plant Advisory Committee (TPAC) and the City of San José (City) Council, make policy and budget decisions related to SBWR to prioritize the interests and needs of the RWF and sanitary sewer rate payers of San José, Santa Clara, and the Tributary Agencies. This governing structure served SBWR well when the primary driver for the system was linked to the NPDES permit condition regarding minimizing effluent flows during critical months to maintain salt marsh habitat. However, as water supply needs in the region are driving expanded use of recycled water from SBWR beyond what is needed for NPDES compliance, it has been recognized that this governing structure may need to be augmented.

Recognizing this, the City (on behalf of the RWF) and the District commenced in February 2002 on a ten-month collaborative stakeholder process—the South Bay Water Recycling Collaborative—to develop recommendations for an institutional framework for long-term ownership, operation, maintenance and future expansion of SBWR, including review and suggestions on water quality and cost issues. The goal of the Collaborative effort was to recommend an institutional framework that would most effectively meet the long-term water supply and wastewater discharge needs of the community now and in the future. The key conclusion was that only two options for institutional arrangement beyond the status quo met the goals of the Collaborative with sufficient likelihood of success to be explored in further depth:

a) Development of a new Joint Powers Authority responsible for the recycled water system; and

b) Development of a long-term comprehensive agreement between the RWF and the District for managing and enhancing the SBWR system.

It was acknowledged in the Collaborative that, in order to make final recommendations and develop the necessary institutional and financial framework, additional details on these options needed to be developed. Follow-up discussion and coordination between the RWF and the District led ultimately to the 2010 Integration Agreement between the City and District which provided a framework for the City and District to financially and administratively support the SVAWPC and the production and use of recycled water in Santa Clara County consistent with each party's separate and distinct interests: wastewater treatment and disposal for the City, and water quality and supply for the District.

It also provides a framework to coordinate and cooperate to achieve the most cost effective, environmentally beneficial use of recycled water to meet both water supply and wastewater treatment and disposal needs. The Integration Agreement was a significant step toward establishing a partnership between the City and District to support the burgeoning water supply interest in SBWR. The provisions of this agreement need to be aligned with SBWR's existing oversight structure with TPAC. This institutional complexity is one of the drivers for consideration of alternative governance structures as SBWR evolves as a predominantly water supply-driven initiative.

To complement this previous body of work on governance, a review of existing regional water recycling initiatives involving both non-potable reuse and potable reuse was conducted as part of this Strategic and Master Planning. This review identified operating structures and revenue-generating strategies used by agencies to achieve broad implementation of water recycling. Among this list of operating regional systems was Orange County, where a partnership between the Orange County Water District and the Orange County Sanitation District has led to the industry-leading Groundwater Replenishment System, a 100 mgd potable reuse program. Prior to the implementation of potable reuse, the two Orange County special districts partnered to implement a non-potable reuse program called Green Acres Project. This partnership in particular illustrates the potential relationship between regional wastewater and water supply agencies that enables achievement of both mutual and individual goals.

Areas of coordination concerning ownership, financing, regulatory, and other operating issues need to be recognized to support governance discussions. Table 15 summarizes some of these areas of coordination identified in this Strategic and Master Planning.

Table 15: Governance Coordination Issues

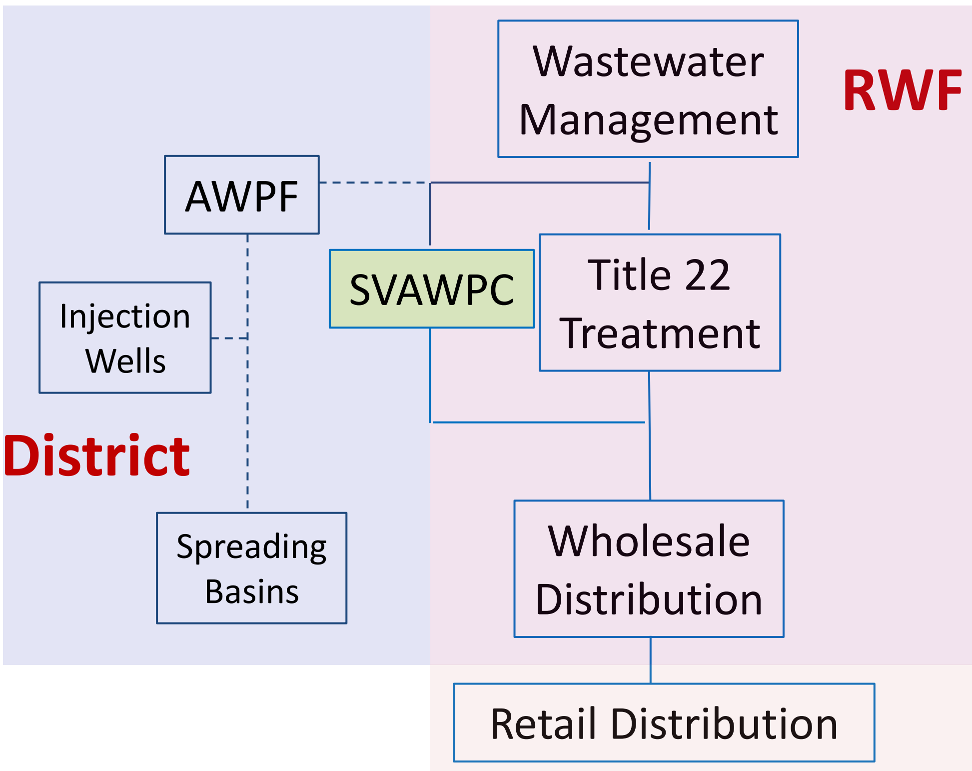
Topic	Issue/Decision	Comment
NPR Wholesale / Retail system interface	Establish ownership and funding of future extensions to the NPR system.	Current SBWR setting is hybrid. Some retailers own/operate extensions; others are included in wholesale system.
Wholesale Recycled Water Rate	Establish methodology and basis for establishing future NPR wholesale rate structure.	Dependent on ownership (above) and regional interest in facilitating expansion of NPR versus potable reuse.
Residuals Management (especially RO Concentrate)	Identify opportunity for residuals management through existing RWF NPDES permit and develop additional/alternative residuals management strategies as needed to support achieving potable reuse goals.	A suite of options were identified during master planning and will need to continue to be assessed based on analysis of SVAWPC RO concentrate testing, evolution of NPDES permit conditions, and conversations with regulators, South San Francisco (SF) Bay environmental interests, and adjacent Bay dischargers.
RWF Discharge to South SF Bay	Develop strategy for maintaining RWF discharge considering South SF Bay environment (water quality, Endangered Species Act) and regional water supply benefits and implications.	The environmental benefits/tradeoffs of establishing a robust regional recycled water supply and maintaining a healthy South SF Bay environment needs to be established to provide the basis for a regional strategy governing discharges to the South SF Bay.
RWF effluent allocation plan	Develop procedure for allocating RWF effluent to alternative market sectors (NPR and potable reuse).	This is predominantly a water entity decision on how recycled water supports local water supply reliability: through water conservation (non-potable) or raw water supply augmentation (potable reuse).

Governance workshops were conducted with senior staff from the City, District, City of Santa Clara, and TASC members to refresh the governance discussions and to identify topics to be coordinated as recommendations of the Strategic and Master Planning are implemented. Two key governance topics emerged during these workshops:

- Evolution of the existing SBWR governance (combination of RWF (partners and tributary agencies) and Integration Agreement (City and District)) into a long-term structure that best supports SBWR as a regional water supply initiative
- Future roles and relationship between the existing SBWR structure and water retailers

Regarding the evolution of SBWR to a regional water supply initiative, it was acknowledged that the existing SBWR governance structure, a combination of RWF (San José/Santa Clara partnership with input by tributary agencies) and the Integration Agreement (City of San José/District), provides a means to move forward to implement near-term recommendations coming out of this Strategic Plan, but is not necessarily an optimum structure to accommodate strategies to achieve the long-term SBWR recycled water targets. Figure 9 below represents a potential operational structure of SBWR that could be achieved through augmentation of the existing Integration Agreement to include a separate potable reuse system operated by the District.

Figure 9: Potential Operational Structure of SBWR

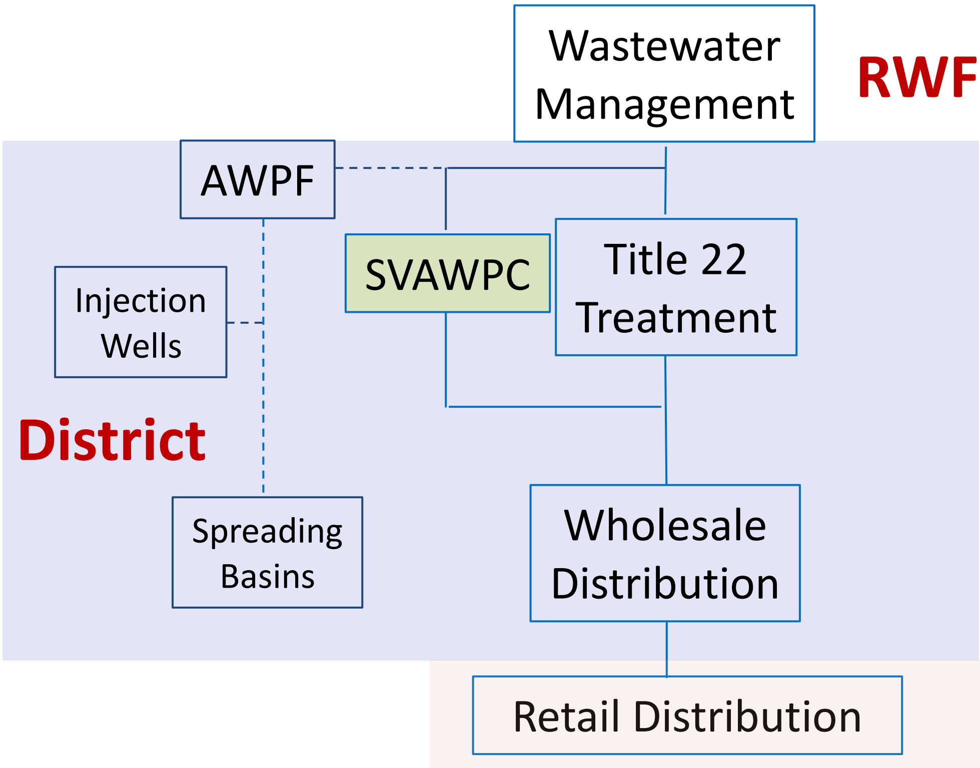


Advantages of using the Integration Agreement as a pathway to govern SBWR include:

- Maintains RWF control to assure continued water recycling and associated diversion
- Simplifies handling of SBWR legacy debt
- Integration Agreement provides appropriate structure

As noted in the discussion of operating regional water recycling systems, each example setting is led by either a regional water wholesaler or a groundwater basin manager. In all cases, the lead entity is a special district. The general observation is that a regional water supply agency, operating as a special district (such as the District), best fits SBWR's future long-term infrastructure and operational needs. This structure is illustrated in Figure 10.

Figure 10: Potential Operational Structure of SBWR as a Special District



Advantages of this structure include:

- Provides maximum assurance that Regional RW targets are met
- Supports tailoring RW options into regional water supply strategy
- Enables spreading RW costs across water supply spectrum

The other key area of governance discussion concerned the future roles and relationship between the existing SBWR structure and water retailers. Currently, SBWR is responsible for all delivery infrastructure up to the customer meter, including TPS, and remote pump stations and operational storage. Supplemental system extensions have been added over the years through partnership funding and construction arrangements between SBWR and that particular retailer. SBWR maintains wholesale agreements with each retailer, with varying provisions and cost-share arrangements. As SBWR evolves, the relationship and roles of SBWR as a wholesale entity relative to the retailers may evolve. In the West Basin and City of Los Angeles operating structures noted previously, retailers maintain conveyance infrastructure distinct from the wholesale system. San Jose Water Company is an example of a retailer that has taken on more responsibility for funding and implementation of its distinct recycled water conveyance infrastructure, and provides an example of how future extensions on the SBWR system could be handled. The relationship and relative roles/responsibilities of SBWR and the retailer is an area that will need to be addressed as the non-potable reuse system evolves.

Through the governance discussion conducted as part of the Strategic and Master Planning include, it was acknowledged that an amended Integration Agreement could support the recommended pathways of this Strategic and Master Plan, but that one special district operating SBWR NPR and Potable Reuse is a potential pathway that aligns with other regional system examples. It is recommended that an ad hoc committee comprising SBWR, the District and retailers be established to continue assessing long-term governance options, with a focus on 1) consideration of evolving the core non-potable and potable reuse systems to a special district (such as the District) operation, and 2) assessing the relationship and roles/responsibilities of SBWR versus retailers in the funding and operating future NPR extensions. It is noted that no matter what governance structure evolves for SBWR, supporting the RWF in meeting its permit conditions would be central to that entity's mission.

7.2 Financing

As financing strategies for an evolving SBWR are established, benefits and beneficiaries of the program need to be recognized. Table 16 illustrates these benefits and beneficiaries.

Table 16: Benefits and Beneficiaries of Water Recycling

Benefit Category	Sub-category	Beneficiaries	Comment
Effluent Diversion	n/a	RWF and Tributary agencies	Lessen value as effluent projections decrease and net environmental benefit conversation emerges
Pollution Reduction	n/a	RWF and Tributary agencies	This category is appropriate for NPR and Potable Reuse to the extent that RO concentrate would be "conditioned" (organics, nitrogen, metals removed) prior to discharge.
Water Supply	Baseline	District and Retail water agencies and associated customers	Provides a direct offset of imported water purchase (and for NPR) treatment/delivery, offsetting associated costs.
Water Supply	Reliability	District and Retail water agencies and associated customers	Value associated with reliable production of local supply.
Infrastructure Savings	Water	District and Retail water agencies and associated customers	Avoided cost of expansion and O&M of District water treatment and conveyance facilities; associated with NPR and IPR (though not DPR)
Infrastructure Savings	Wastewater Treatment	RWF and Tributary agencies	Substantial diversion of secondary flow to AWPF could save RWF filters and associated infrastructure capital (replacement) and O&M
Groundwater Quality Protection	n/a	District and GW pumpers	IPR would provide a substantial groundwater quality improvement (TDS) thanks to full RO treatment
Water Supply Quality Improvement	n/a	District and Retail water agencies and associated customers	Potable reuse (IPR and DPR) would improve domestic water supply quality (TDS)
Energy Conservation	n/a	Global	Greenhouse gas emission reduction associated with avoided future imported supply pumping to the valley (NPR only). Potable reuse (and RO concentrate management) implications need to be assessed.

Although SBWR is expected to evolve through an expansion of non-potable reuse and an addition of potable reuse, financing strategies for various aspects of the system may be different. To illustrate this point, financing strategies for the following future SBWR system improvement categories are considered:

- Near-term Reliability CIP
- Long-term Extensions to the Non-Potable System
- Centralized Potable Reuse Pathway

Near-Term Reliability CIP

Near term improvements recommended as part of this Strategic and Master Planning support the ongoing operation of SBWR non-potable system, and provide benefits to both the wastewater partners and tributary agencies by supporting NPDES recycled water commitments and flow diversion, and to the water retailers by enabling them to continue serving recycled water customers. Although these improvements have historically been covered by a combination of wholesale recycled water rates and RWF funding, SBWR desires to escalate wholesale recycled water rates to cover the full cost of O&M and this near term capital investment.

A wholesale recycled water rate model was developed as part of the Strategic and Master Plan, and alternative strategies to achieve this “cost recovery” through wholesale recycled water rates were tested by this model. This rate model was used as a tool to facilitate a rate workshop conducted with senior staff and TASC members.

Long-term Extensions to the Non-Potable System

As discussed previously in the governance section, future extensions to the non-potable system could either be implemented by SBWR as a wholesale entity, or by a particular retailer. If these extensions are funded by SBWR as a wholesale entity, then the full cost of these improvements would need to be covered predominantly through wholesale rates. One concern of SBWR if this strategy were used is the assurance of ongoing recycled water sales sufficient to justify investments in the system to support expansion. One strategy that could be employed, similar to SFPUC, is a take or pay provision.

If extensions are implemented by the retailers, then they would need to establish retail recycled water rates sufficient to cover the cost of these improvements and the wholesale cost of recycled water.

As a component of regional water supply reliability, the District could play a role in funding system expansions in either of these settings.

Centralized Potable Reuse Pathways

A major component of a recommended future expansion of SBWR is a centralized potable reuse system, consisting of an advanced water purification facility (that draws secondary effluent from the RWF) and a dedicated purified water pipeline to a variety of injection wells and District percolation ponds. Since this is a direct replenishment of the main groundwater basin, system operation would need to be under the direct control of the District. Example southern California settings with IPR groundwater replenishment systems used some form of groundwater replenishment charge to provide both the capital and O&M funding for these activities. The District has a similar groundwater charge for pumpers, which would provide an appropriate and straight-forward means of funding direct replenishment projects. To the extent that the development of non-potable reuse systems provides an in-lieu means of recharging the groundwater basin, this groundwater charge could be used to support the long-term non-potable extensions alluded to above. Another funding strategy that the District has used successfully to cover capital investments is a land use- and property size-based fee levied via the annual property tax.

Financing strategies to be employed to support the expansion of SBWR through both non-potable and potable reuse pathways will need to be assessed concurrent with future governance strategies. As noted previously in the governance discussion, it is recommended that an ad hoc committee of SBWR, District and retailers be established to continue discussions on governance and financing in support of the evolution of SBWR.

8. Funding Options

A variety of funding opportunities are available to offset the cost of implementing NPR and potable reuse (including IPR and DPR) projects. In addition to customary financing methods, including pay-as-you-go (cash reserves and operating revenues) and traditional bond financing, funding methods such as grant and low-interest loan programs are administered by various state and federal agencies. The following opportunities could be viable for NPR and potable reuse:

- U.S. Bureau of Reclamation (USBR) Title XVI Program grants or low-interest loans
- DWR IRWM grant program
- State Water Resources Control Board (SWRCB) grant and loan programs
- California Infrastructure and Economic Development Bank (I-Bank) Infrastructure SRF Program, which provides loans for projects with an economic benefit.

For the near-term projects there would be advantages to have the City and SCVWD pursue funding together as partners. Characterizing the near-term program as a combination of projects that together will enhance security for future water reliability within the southern Bay Area region will enhance the attractiveness of each project relative to the potential funding opportunity by expanding the geographic scope and impact and adding a multi-agency collaboration component. Moving quickly to secure funding will enhance the chances of receiving funding made available by Proposition 1 which was passed by California voters on November 4, 2014. This partnership and collaborative planning approach establishes the proposed projects as attractive targets for outside funding.

For the long-term NPR projects, which will require additional storage tanks, pump stations and backbone pipeline to serve projected NPR water needs of member agencies, it is anticipated that the additional infrastructure will be funded by the member agencies.

For the long-term potable reuse projects a combination of SWRCB Facilities Grants and Loans under the CWSRF and WRPF program could provide the funding to plan, implement, and eventually construct the projects. Proposition 1 will make available $725 million statewide for recycled water projects and may be available as construction grants or low interest loans. Although, the details have not yet been determined, it is anticipated that funding opportunities may be announced within 2015. Alternative loan options for future long term funding include I-Bank.

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1. Introduction

The City of San José (City), in partnership with the Santa Clara Valley Water District (SCVWD or District), led the preparation of this Strategic and Master Plan (Strategic Plan or Plan) for the South Bay Water Recycling (SBWR) system. The Strategic Plan is funded in part by a Bureau of Reclamation Title XVI Feasibility Study grant. This Plan has a 20-year planning horizon and identifies the purpose and future for SBWR, how SBWR will continue to address the regulatory needs of the San José/Santa Clara Regional Wastewater Facility (RWF or Plant), and evaluates alternative pathways for recycled water as it plays an increasingly important part of the water supply portfolio for northern Santa Clara County.

1.1 Project Sponsors

The City of San José and SCVWD have a long history of collaboration on recycled water related activities dating back to the early 1990s and are partners as the non-federal project sponsors for this Strategic Plan. The City and SCVWD have distinctly different interests in the production and use of recycled water. The City represents the perspective of those responsible for wastewater treatment and disposal at the RWF. The SCVWD represents the perspective of the water supply agencies including the various water retailers within the study area.

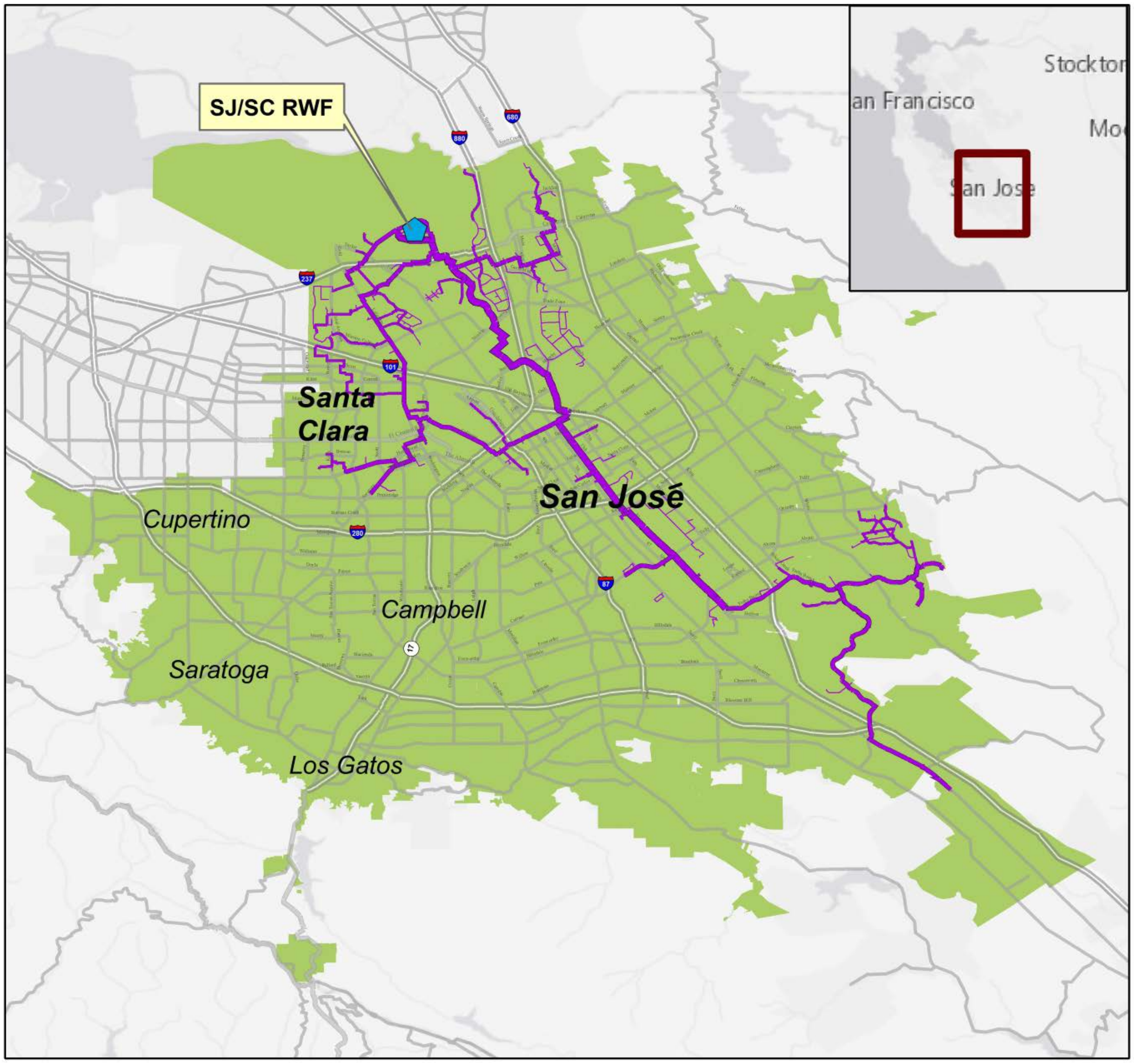
In addition to the City of San José and SCVWD, other stakeholders have played an active role in the development of the Strategic Plan. In 2012 representatives of the City, SCVWD, and the RWF tributary agencies formed the SBWR Recycled Water Master Plan Task Advisory Steering Committee (TASC) as a forum to discuss the future of SBWR and to provide input on the development of the Strategic Plan. The TASC consists of representatives from the Cities of San José and Santa Clara (Plant co-owners), West Valley Sanitation District (the tributary agencies' representative), and SCVWD. Additionally during development of this plan, the City of San José and SCVWD have met with other water suppliers and wastewater agencies to explore additional partnerships.

1.2 Study Area

SBWR is a division within the City of San José's Environmental Services Department (an authorized Reclamation Title XVI project partner) responsible for the distribution and wholesale of recycled water generated by the RWF. The RWF serves the cities of San José and Santa Clara, the Plant's co-owners, and the cities of Milpitas, Campbell, Cupertino, Los Gatos, Saratoga, and Monte Sereno, who are represented by the Plant's tributary agencies that include the City of Milpitas, West Valley Sanitation District, Cupertino Sanitary District, County Sanitation District 2-3, and the Burbank Sanitary District.

Figure 1-1 is a map illustrating the SBWR study area and showing the current SBWR system.

Figure 1-1: SBWR Setting



1.3 Strategic Plan Visioning Process

Recognizing the importance of articulating a collective vision for the future of SBWR, the TASC determined that the Plan's first Service Order would focus on refining the vision for the Strategic Plan. The visioning process builds upon the work previously completed by the TASC and sets the stage for development of the institutional and technical components necessary to complete the Strategic Plan.

The visioning process was based on discussions during three TASC workshops held between October 2012 and February 2013. The information and discussions from the workshops were summarized and analyzed for areas of agreement and divergence between wastewater and water supply interests. The Visioning Report (included as Appendix 1-A) summarizes the work completed and the decisions made through the visioning workshop and sets the framework for the decisions that have been made in the Strategic Plan.

1.3.1 Wastewater Perspective

The original driving force for developing the SBWR system was SJ/SC RWF's NPDES permit which limited the volume of effluent discharge during the summer due to concerns over conversion of salt marsh habitat to fresh water habitat. The current NPDES permit has flow triggers starting at 115 mgd of effluent flow; at 120 mgd the permit requires completion of additional studies. At the time when the flow trigger was added to the NPDES requirements the City of San José had a strong desire to grow and not be encumbered by flow limitations. That was the original impetus for SBWR and the RWF agencies' investment in SBWR, although the water supply benefits of the system were also recognized.

The importance of the NPDES flow limits as a driver for SBWR expansion has decreased in recent years due to:

- The SBWR program has successfully implemented approximately 11,000 AFY of recycled water use, which decreases the volume of water discharged to the Bay, and
- The RWF influent flows have decreased due to conservation and the exodus of some high water use industries.

The Cities of San José and Santa Clara have been advised that there is no legal driver for continued expansion of SBWR from the perspective of wastewater diversion.

1.3.2 Water Supply Perspective

SCVWD has sufficient water supplies through 2035 under normal conditions. However, in drought years water supply reliability is challenged, and recycled water serves a key role in ensuring a reliable water supply. SCVWD has a goal of expanding non-potable and potable water recycling to meet at least 10% of the countywide demand by 2025 and beyond. In addition to the SBWR Strategic Plan SCVWD is evaluating regional recycling with the South County Regional Wastewater Authority and have begun conversations with the City of Sunnyvale on both non-potable expansion opportunities and potable reuse.

1.3.3 Master Planning Expectations

The visioning workshops resulted in the following guidelines/expectations that were considered during development of the Strategic Plan

1. Recognize that there is no legal driver for continued expansion of SBWR.
    - From the Plant's perspective there is no need to expand the SBWR system. The RWF's interest is in maintaining the non-potable (NPR) system as needed to meet current NPDES permit (e.g. flow and mass limits) and to expand only if the NPDES permit changes or if there is revenue generation potential. The SBWR cannot be expanded at Plant rate payers' expense.
2. The Plan should eliminate SBWR operating losses.

- The Cities of San José and Santa Clara and the RWF Treatment Plant Advisory Committee (TPAC) adopted findings of the City of San José's audit, which included a recommendation to bring SBWR to a financial breakeven point. The RWF had already implemented a no expansion policy in the fall of 2012; the audit merely confirmed the policy already in place. Only SBWR (not the RWF) is operating at a loss, and there is concern over Proposition 218 implications. The Plant can charge for cost recovery but cannot subsidize a water recycling program with rates from people who do not benefit. Options for addressing the audit findings are being reviewed by the Cities of San José and Santa Clara outside of the Strategic Plan.

3. The cost of recycled water should be shared proportionally across all who benefit.
   - The definition of benefits is something that will be developed through the master planning work, and allocation of costs will be developed through the financing strategies work.
4. From the water supply perspective, the goal is to meet at least 10% of the countywide demand through water recycling by the year 2025.
   - Expansion of the non-potable system alone is unlikely to fulfill that goal; indirect potable reuse is expected to be a significant factor in meeting the 10% goal by 2025.
5. The alternatives that are developed must balance the needs of both the water supply and wastewater treatment perspectives.
   - System expansion should occur in a way to meet both the Plant and SCVWD's timelines, minimizing the combined capital investment and creating an economically competitive commodity for industry and residents.
6. The Strategic Plan should provide a basis for identifying alternative governance frameworks and associated funding strategies for both NPR and potable reuse pathways.

1.4 Recycled Water Targets and Planning Horizon

During the Visioning phase TASC participants, recognizing that expansion of water recycling would be driven by water supply needs rather than wastewater diversion requirements, adopted recycled water targets for the Strategic Plan to be consistent with SCVWD's water supply planning. This results in a goal of 40,000 AFY of recycled water use by 2025 and 50,000 AFY of use by 2035. In addition, SCVWD's 2012 Water Supply and Infrastructure Master Plan (WSIMP) calls for a total 50,000 AFY recycled water by 2035. A baseline countywide recycled water production of 15,000 AFY was chosen as a starting point, translating into a need to develop an additional 25,000 AFY of recycled water use by 2025 followed by an additional 10,000 AFY by 2035 (to reach a total additional use of 35,000 AFY by 2035).

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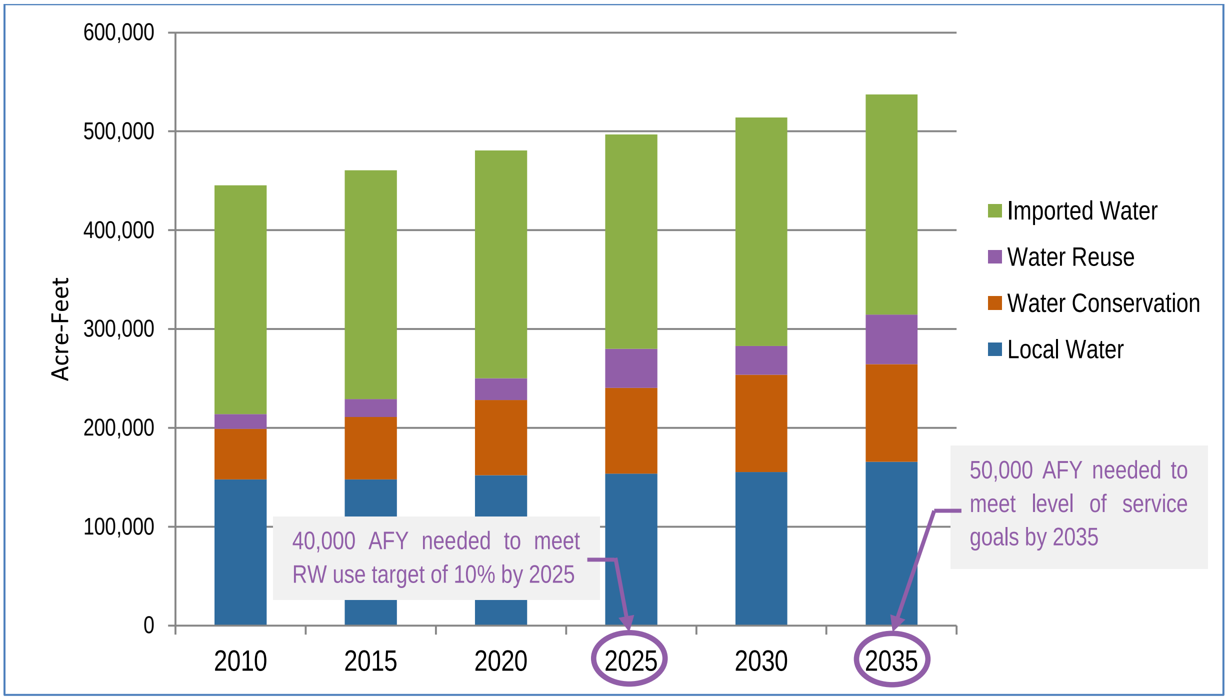
Figure 1-2: Recycled Water Targets from Water Supply Perspective



These are county-wide water supply targets and include areas of the county outside the SBWR service area. However, for the sake of setting an aggressive goal for this Strategic Plan in terms of analyzing the full potential for recycled water originating from the RWF, the TASC agreed that the county-wide targets would be used as the targets for the Strategic Plan, i.e. the Strategic Plan's recycled water target is an additional 25,000 AFY of use by 2025 and 35,000 AFY of use by 2035, all with water originating from the RWF. It is assumed that any near- or long-term wastewater flow diversion needs would be encompassed by the water demand needs.

The SBWR Strategic Plan recycled water targets and planning horizons are as follows:

Table 1-1: Strategic Plan Recycled Water Targets and Planning Horizons

Year	Baseline Use, AFY	Additional Strategic Plan Recycled Water Targets, AFY	Total Recycled Water Use, AFY
2025	15,000	**25,000**	40,000
2035	15,000	**35,000**	50,000

Note: The Strategic Plan targets are in addition to an assumed county-wide baseline use of 15,000 AFY (SCVWD 2010 Urban Water Management Plan rounded to the nearest thousand). Adding the baseline of 15,000 AFY to these targets reaches the overall 2012 WSIMP goal of 40,000 AFY by 2025 and 50,000 AFY by 2035.

1.5 Recycled Water Pathways

The Strategic Plan will evaluate the following two pathways to achieve the recycled water targets.

- Maximize non-potable reuse
- Maximize potable reuse

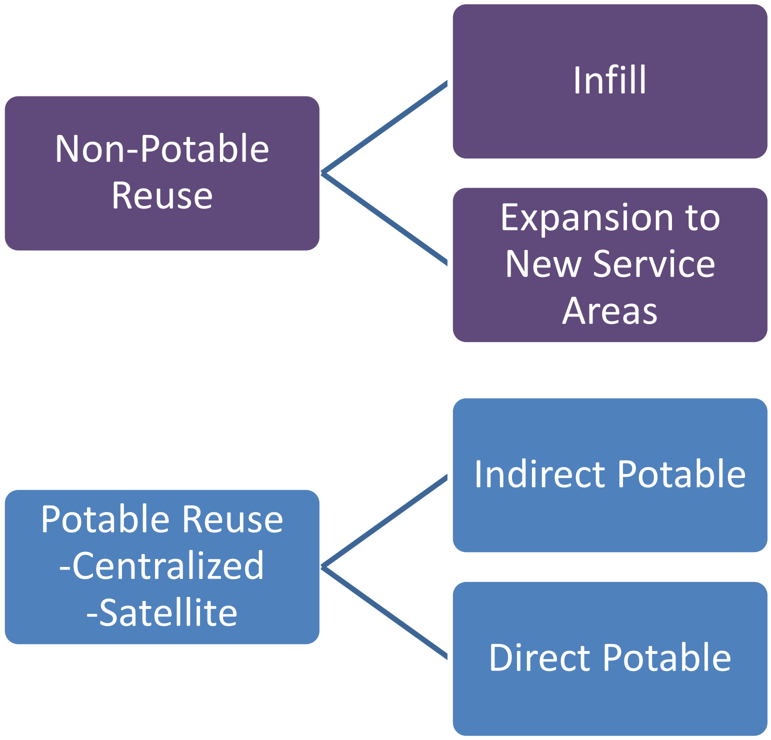
2. Each framework alternative pathway has several subalternatives.
   - Non-potable reuse can be met by infill in the existing service area or expansion to new service areas[2].
   - Potable reuse can be met through indirect potable reuse (IPR) or direct potable reuse (DPR), both of which can be accomplished through a centralized treatment facility or satellite treatment facilities.
   - IPR can be divided into groundwater recharge alternatives and surface water augmentation[3].
   - DPR can be divided into alternatives that connect to the raw water supply upstream of a water treatment plant and alternatives that connect directly to the potable distribution system. To date SCVWD has only considered DPR via connection to the raw water system, and the consultant team is not recommending consideration of direct connection to the potable distribution at this point.

The framework pathways and subalternatives to be investigated in the Strategic Plan are depicted in Figure 1-3. Alternatives are developed for near-term and for long-term. Near-term projects are defined as those projects implemented between 2015 and 2020 while long-term projects are defined as those being implemented after 2020.

1. [2] The NPR pathway was originally envisioned to include a regional intertie alternative. However the TASC expressed reservations about the concept of regional interties. It should be considered only if a) it increases the county-wide water supply as opposed to just serving the same customers with a different source of recycled water, b) there was no degradation in SBWR water quality as a result and c) there was a clear allocation of costs in proportion to benefits, i.e. adjoining areas shouldn't benefit from the investment the WPCP has made in SBWR. Due to these concerns, a regional intertie of the NPR systems was not considered as part of the Strategic Plan.

2. [3] Streamflow and surface water augmentation will be considered since that alternative is included in the USBR agreement which is funding a portion of the Strategic Plan, but it is expected that these alternatives will not be viable due to the regulatory burdens associated with surface water discharges.

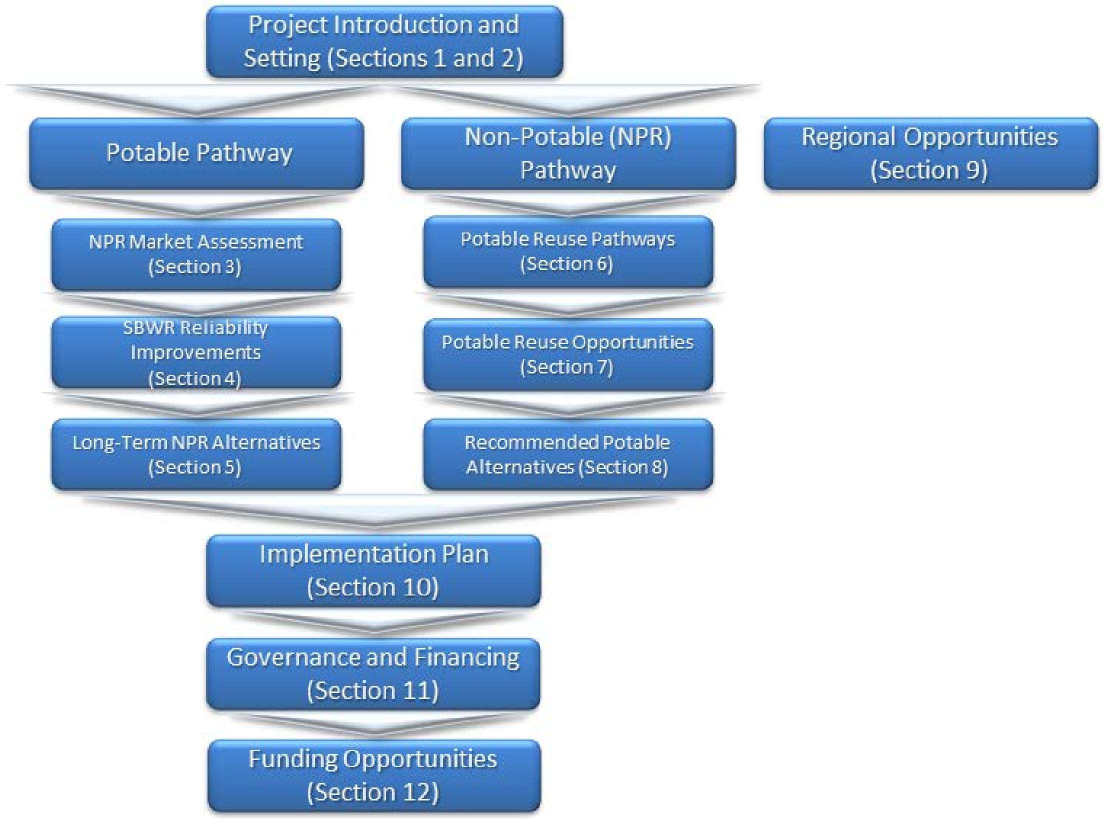
Figure 1-3: Strategic Plan Pathways



1.6 Report Organization

This report is structured around the two pathways described in Section 1.5. Section 2 will explain the SBWR setting and then Sections 3 through 5 will describe the potable pathway, while Sections 6 through 8 will describe the non-potable pathway. Sections 10 through 12 bring the two pathways back together with a discussion of implementation, governance, finance and funding. Section 9 looks at broader regional opportunities that may contribute to the development of recycled water use within the County. The report structure is illustrated in Figure 1-4.

Figure 1-4: Report Organization



2. SBWR Setting

This section describes the local setting for the study area including the wastewater facilities, the current and projected water supplies, and the existing recycled water program and facilities.

2.1 Wastewater Facilities

The City of San José built the original wastewater facility in 1956, with primary treatment facilities treating flow prior to discharge to the South San Francisco Bay. The City of San José continues to administer and operate the facility. In 1959 the City of Santa Clara helped to fund a plant upgrade to secondary treatment in exchange for 20% ownership of the facility. By 1979, with the passing of the Clean Water Act, the RWF had expanded to tertiary treatment.

Other cities in the South Bay contract directly or through sanitary districts for service. Collectively, the RWF serves 1.4 million residents and 17,000 main business connections across eight cities and unincorporated areas including:

- Cities of San José and Santa Clara (co-owners)
- Tributary Agencies
    - City of Milpitas
    - Cupertino Sanitary District (City of Cupertino, nearby unincorporated area)
    - West Valley Sanitation District (cities of Campbell, Los Gatos, Monte Sereno, and Saratoga)
    - County Sanitation District No. 2-3 (unincorporated area)
    - Burbank Sanitary District (unincorporated area)

The RWF currently treats an average of 110 million gallons per day (mgd) of wastewater, and has the capacity to treat up to 167 mgd. The City of San José embarked on a Plant Master Plan in 2007 to identify alternatives to upgrade aging infrastructure at the SJ/SC RWF. Implementation of the $2 billion Master Plan will take place over 30 years and is among the Bay Area's largest infrastructure projects.

As part of the Strategic Plan, the wastewater influent flow projections developed in the 2007 Master Plan were updated to project the wastewater influent flows at the RWF through 2035 to coincide with the recycled water planning horizon. The flow projections also verified whether increased wastewater diversion would be needed within the planning horizon in response to 115 and 120 million gallons per day (mgd) effluent flow triggers currently included in the RWF NPDES discharge permit, provided an indication of the maximum amount of wastewater available for recycling purposes through 2035, and provided input to flow balance calculations to calculate how much flow will be discharged to the Bay under each of the various recycled water alternatives. A memorandum on the influent flow projections is included as Appendix 2A.

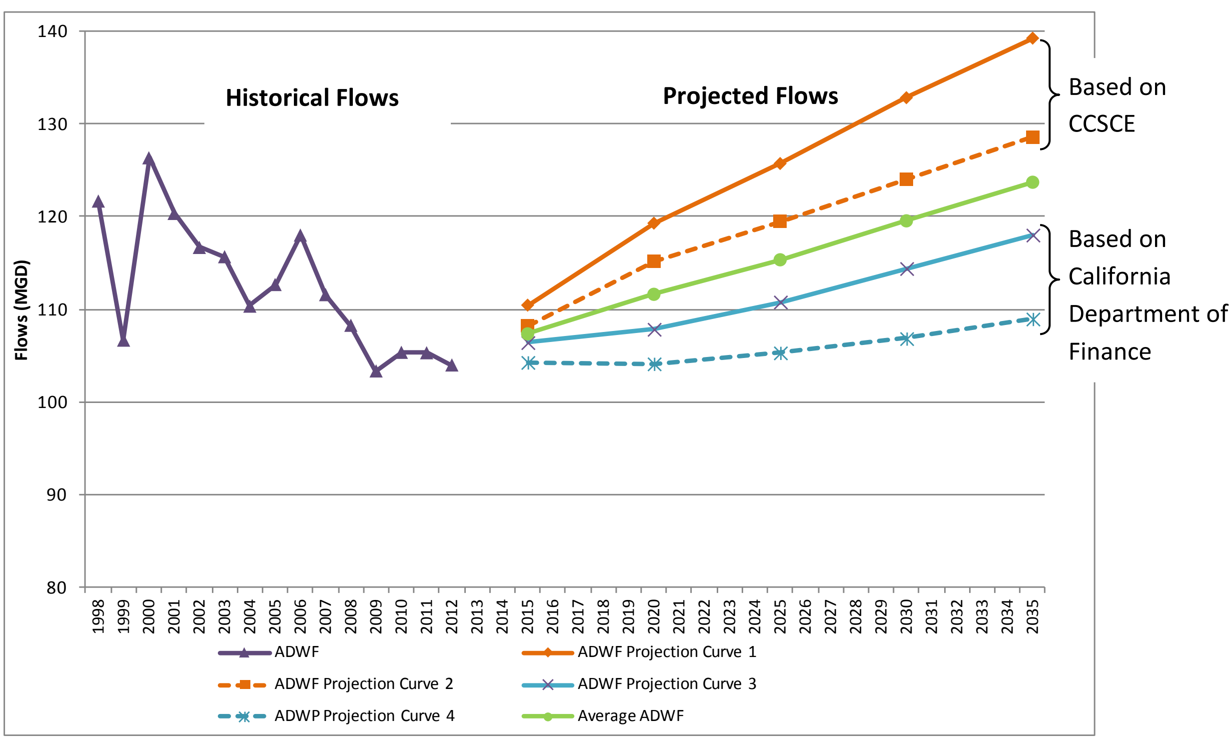
A set of four wastewater influent projections were developed based on two sets of population projections for Santa Clara County and two levels of conservation through 2035. A fifth wastewater influent projection that represents the average of the four other sets is also shown for reference.

The first set of population projections is based on Center for the Continuing Study of the California Economy (CCSCE)'s Projections of Jobs, Population and Households for the City of San José prepared for The Envision San José 2040 General Plan Update. The second set of population projections is based on the California Department of Finance Demographic Research Unit's Report P-1 State and County Population Projections. Population projections were modified by the percent of population in Santa Clara County estimated to be served by the RWF in order to develop projections of the population within the RWF service area.

In addition, two sets of per capita average dry weather flow (ADWF) that assume different conservation levels were developed. The first set of per capita ADWF assumes that the per capita wastewater production attained in 2012 (74.7 gallons per capita per day (gpcd)) remains constant through 2035. The second set of per capita ADWF assumes increased conservation in alignment with the SCVWD 2010 Urban Management Plan. The second set of per capita ADWF shows a decrease in the per capita ADWF from 74.7 gpcd in 2012 to 69.0 gpcd in 2035.

The two sets of population projections and two sets of per capita ADWF were combined to create four different projected ADWF curves through 2035. The four ADWF curves are shown in Figure 2-1; an additional curve that depicts the average ADWF of the four ADWF curves is also shown in Figure 2-1.

Figure 2-1: Historic and Projected Water Use and Population



2.2 Water Supplies and Demands

2.2.1 Water Supplies

SCVWD is the primary water wholesaler for the study area. SCVWD's water supply system is comprised of storage, conveyance, recharge, treatment and distribution facilities that include local reservoirs, groundwater basins, groundwater recharge facilities, treatment plants, imported supplies, and raw and treated water conveyance facilities. Figure 2-2 shows SCVWD's raw water and treated water conveyance system, treatment facilities, reservoirs, and recharge facilities. SCVWD manages groundwater and surface water supplies. Most of the local surface water supply is recharged into the groundwater basin either through natural stream channels, canals, or in-stream and off-stream ponds, though some may be sent to drinking water treatment plants. Imported water can also be directed to groundwater recharge facilities via turnouts on the raw water conveyance system. In wet years, SCVWD also has the ability to bank excess imported water with Semitropic Groundwater Bank in Kern County for use in dry years. This integrated system of supplies and facilities helps SCVWD manage natural variations in rainfall and the associated variations in water supply availability.

Other agencies and organizations also contribute to water supply reliability in Santa Clara County. The San Francisco Public Utilities Commission (SFPUC) delivers water to retailers in northern Santa Clara County. Stanford University and San José Water Company hold their own surface water rights. All four of the county's wastewater treatment plants produce recycled water for non-potable uses such as irrigation and cooling towers.

SCVWD prepared a Water Supply and Infrastructure Master Plan (WSIMP) in 2012 to analyze strategies to meet the county's future water supply needs with different combinations of water supplies. Upon its completion, the WSIMP became the adopted water supply strategy of the Board, calling for 30,000 AFY of non-potable reuse and 20,000 AFY of potable reuse. The WSIMP documented the county water supplies under different hydrologic conditions, as illustrated in Figure 2-4 and Table 2-2. These figures and tables do not include the WSIMP water supply strategy which, upon its implementation, should be able to meet normal year demands and 90% of drought year demands.

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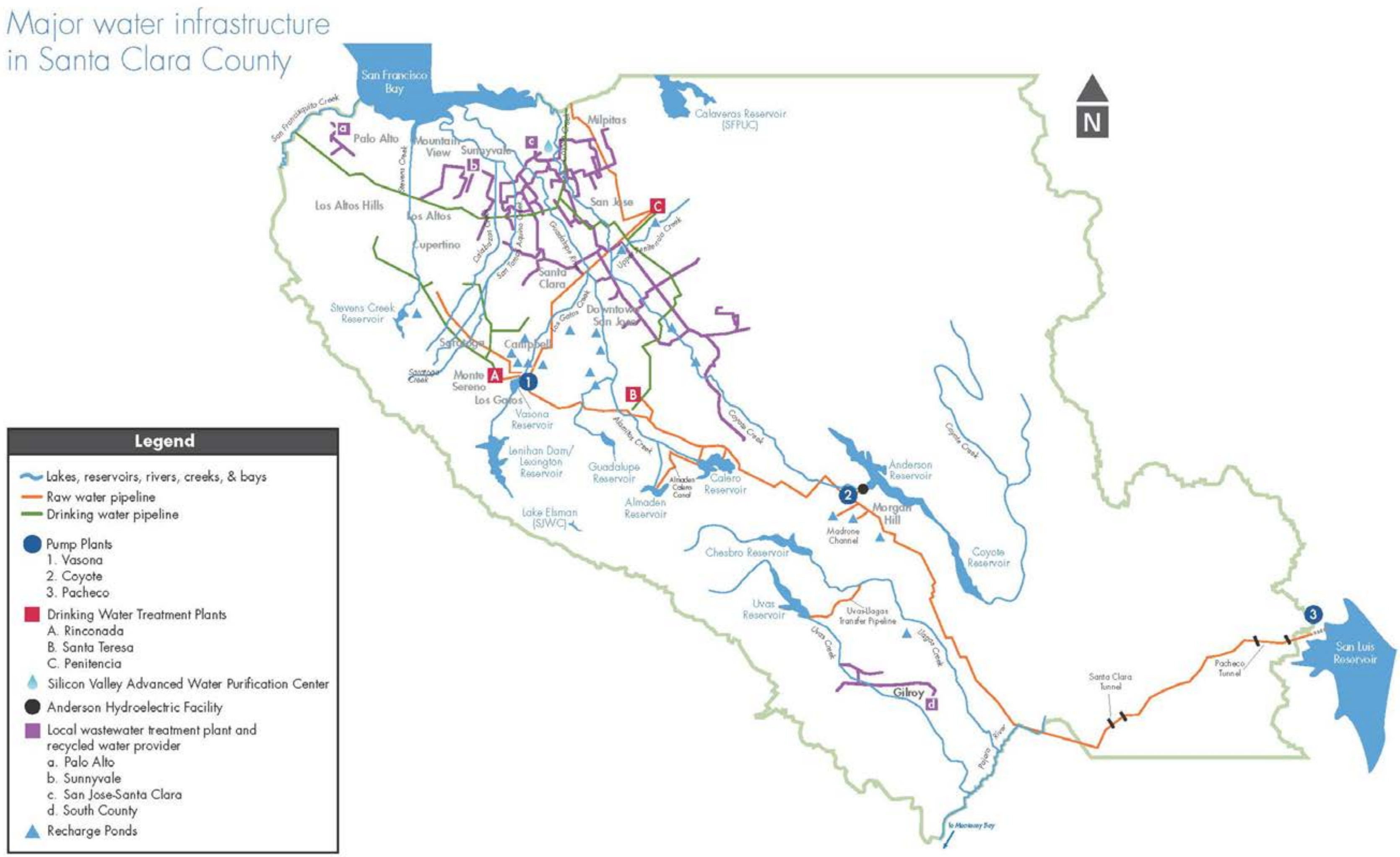
Figure 2-2: Santa Clara County Water Supply Treatment and Distribution Facilities



Source: Santa Clara Valley Water District 2012 Water Supply and Infrastructure Master Plan

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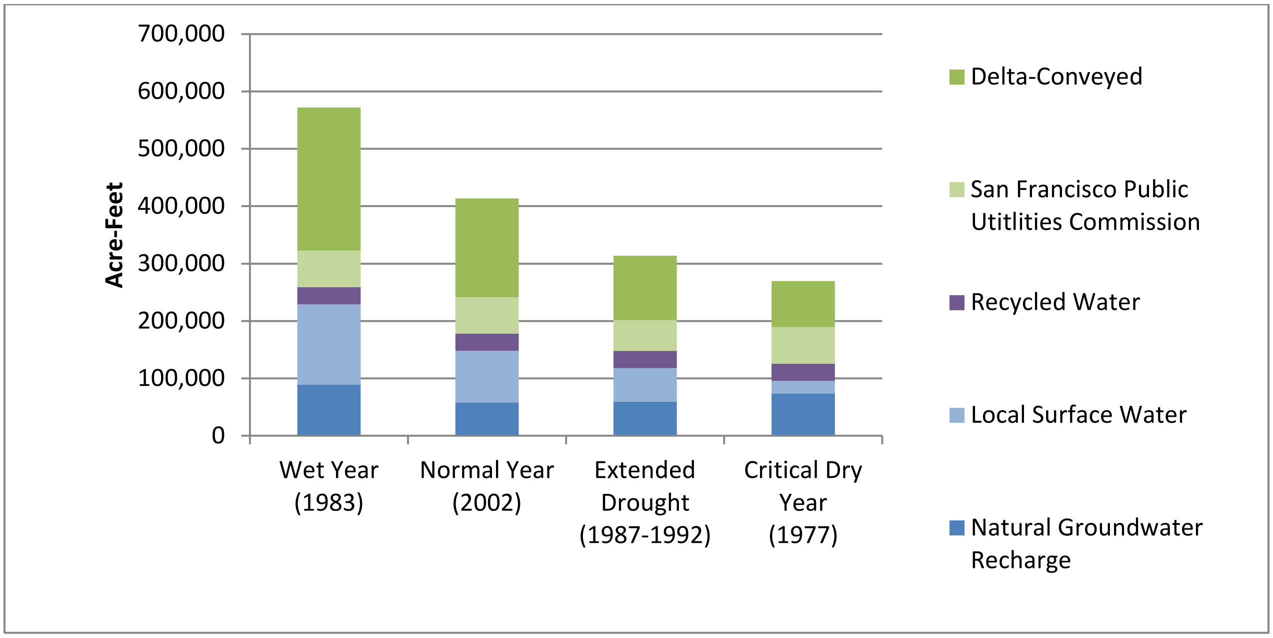
Figure 2-3: Water Supplies under Different Hydrologic Conditions



Note: The supplies shown do not include the use of reserves, which will lessen any shortfalls.
The extended drought supplies are the average over a six-year drought period. Some years are less dry than others, so the average is higher than in a single critical dry year. Also, natural groundwater recharge is higher than average in a critical dry year due to increased seepage into the groundwater sub-basins as groundwater levels decline.
Source: Santa Clara Valley Water District 2012 Water Supply and Infrastructure Master Plan

Table 2-1: Water Supplies under Different Hydrologic Conditions

Source of Supply (Acre-Feet)	Wet Year (1983)	Normal Year (2002)	Extended Drought (1987–1992)	Critical Dry Year (1977)
Natural Groundwater Recharge	89,000	58,000	59,000	74,000
Local Surface Water	140,000	90,000	58,000	22,000
Recycled Water	30,000	30,000	30,000	30,000
SFPUC	63,000	63,000	54,000	63,000
Delta-Conveyed	249,000	172,000	112,000	80,000
Total Supply (Acre-Feet)	571,000	413,000	313,000	269,000

Source: Santa Clara Valley Water District 2012 Water Supply and Infrastructure Master Plan

2.2.2 Water Demands

As noted in SCVWD's 2010 Urban Water Management Plan, the Association of Bay Area Governments projects that the population in Santa Clara County will increase from about 1.8 million in 2010 to about 2.4 million by 2035. Jobs are projected to increase from about 0.9 million in 2010 to about 1.4 million in 2035. Even though per capita water use continues to decline, SCVWD estimates that increases in population and jobs will result in increased water demands from about 329,000 AF in 2010 to about 423,000 AF by 2035. Most increase in water demand will occur in North County.

The District estimates that water demand should have been about 51,000 AF higher in 2010 and would be higher by about 98,500 AF in 2035, if not for the community's efforts to conserve water. Table 2-3 summarizes the demands through 2035 assuming conservation savings.

Table 2-2: Projected Water Demand through 2035 with Conservation Savings

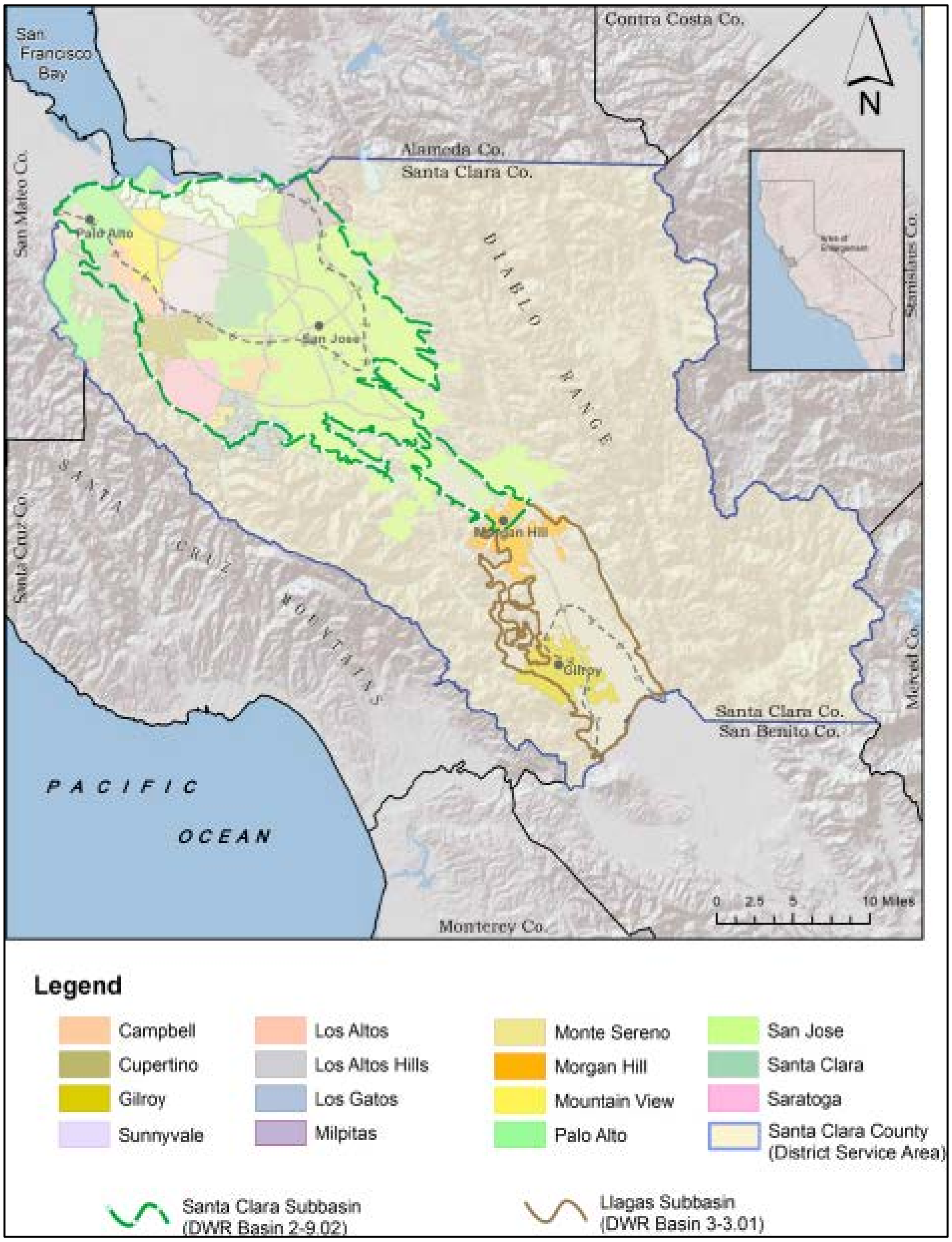
	2010 (Actual)	2015	2020	2025	2030	2035
Total Demand (AF)	333,000	376,000	385,000	396,000	409,000	423,000

Source: Santa Clara Valley Water District 2012 Water Supply and Infrastructure Master Plan

2.2.3 Basin Management

The District is responsible for managing two water supply groundwater basins: the Santa Clara Valley basin and the Gilroy-Hollister Valley basin. In 2012, SCVWD completed a Groundwater Management Plan for the Santa Clara sub-basin and the Llagas sub-basin, depicted in Figure 2-4. The Santa Clara sub-basin is further divided into the Santa Clara Plain and the Coyote Valley.

Figure 2-4: Santa Clara and Llagas Sub-basins



Source: Santa Clara Valley Water District 2012 Groundwater Management Plan

The Santa Clara Plain sub-basin is bounded to the north by the San Francisco Bay, to the south by Metcalf Road, to the west by the Santa Cruz Mountains, and to the east by the Diablo Range. An unconfined section of the aquifer along the valley edge is the primary location of natural groundwater recharge. Both the confined and unconfined aquifer provides water to meet local demands. Per studies conducted by SCVWD, the operational storage capacity of the sub-basin is approximately 350,000 AF. SCVWD completed groundwater quality monitoring most recently in 2013[4] and a Water Quality Sampling Program for the Silicon Valley Advanced Water Purification Center (SVAWPC) in 2003. These

[4] Santa Clara Valley Water District. 2013. *Annual Groundwater Report.*

studies revealed potential seawater intrusion (evidenced by elevated Total Dissolved Solids (TDS)) near the San Francisco Bay and notably low concentrations of Total Organic Carbon (TOC) at 0.42 mg/L.

The unconfined Coyote Valley sub-basin is bounded to the north by the Metcalf Road, to the south by Cochrane Road, to the west by the Santa Cruz Mountains, and to the east by the Diablo Range. The aquifer is generally recharged by Coyote Creek, Fisher Creek and tributary runoff. Per a 1997 SCVWD study, the sub-basin operational storage capacity is approximately 33,000 AF. Water quality results from the 2013 District study revealed average TDS concentrations (330 mg/L) and low TOC concentration (0.2 mg/L).

The Llagas sub-basin is bounded to the north by Cochrane Road and to the south by the Pajaro River. It ranges from three miles wide at Cochrane Road to six miles wide at the Pajaro River. The aquifer has confined and unconfined sections, with an approximate operational storage capacity of up to 165,000 AF. Results from SCVWD's 2013 study reveal higher concentrations of nitrate (22 mg/L as N) than any other District aquifer. The TDS concentrations are average (360 mg/L) and TOC concentrations are low (0.2 mg/L for the lower aquifer and 0.5 mg/L for the upper aquifer).

As part of SCVWD's Groundwater Management Plan, two groundwater basin management objectives were established:

1. Groundwater supplies are managed to optimize water supply reliability and minimize land subsidence.
2. Groundwater is protected from existing and potential contamination, including salt water intrusion.

To that end, four strategies were developed to achieve groundwater basin management goals:

1. Manage groundwater in conjunction with surface water through direct and in-lieu recharge programs to sustain groundwater supplies and to minimize salt water intrusion and land subsidence.
2. Implement programs to protect or promote groundwater quality to support beneficial uses.
3. Maintain and develop adequate groundwater models and monitoring systems.
4. Work with regulatory and land use agencies to protect recharge areas, promote natural recharge, and prevent groundwater contamination.

The District has developed four outcome measures, as reported in the 2012 Groundwater Management Plan, to analyze success of groundwater management programs. The outcome measures are:

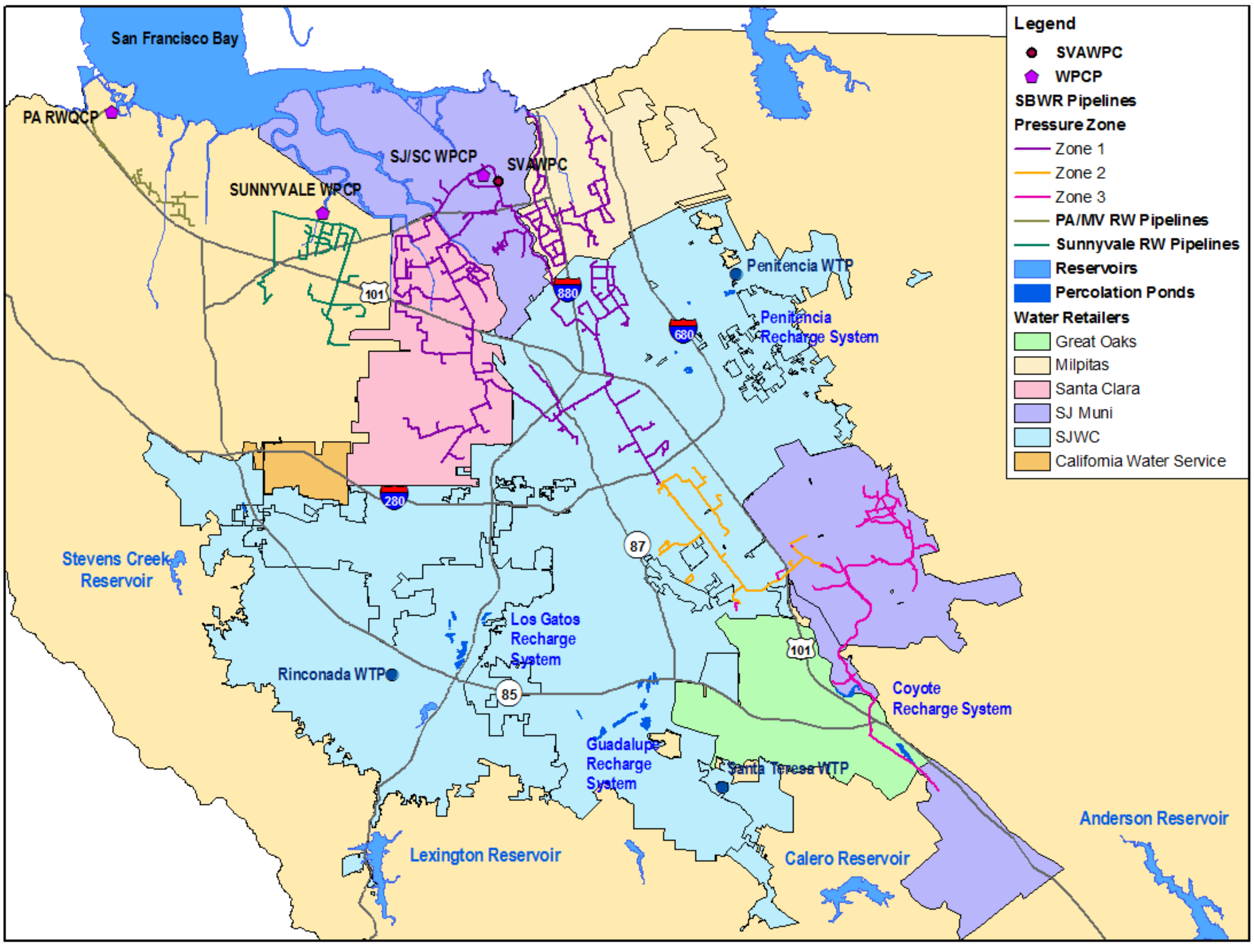
1. Projected end of year groundwater storage is greater than 278,000 AF in the Santa Clara Plain, 5,000 AF in the Coyote Valley, and 17,000 AF in the Llagas sub-basin.
2. Groundwater levels are above subsidence thresholds at the subsidence index wells.
3. At least 95% of countywide water supply wells meet primary drinking water standards and at least 90% of South County wells meet Basin Plan agricultural objectives.

4. At least 90% of wells in both the shallow and principal aquifer zones have stable or decreasing concentration of nitrate, chloride and TDS.

2.2.4 Water Wholesaler and Retailers

There are six water retailers in the area served by the SJ/SC RWF: City of Milpitas, City of Santa Clara, City of San José Municipal Water System (San José Muni), San José Water Company (SJWC), California Water Service and Great Oaks Water Company. Figure 2-6 illustrates the retailers' service areas with respect to the existing SBWR system.

Figure 2-5: Water Retailers within the Area Served by SJ/SC RWF



Of these retailers, four currently distribute recycled water from SBWR: City of Milpitas, City of Santa Clara, San José Muni, and SJWC.

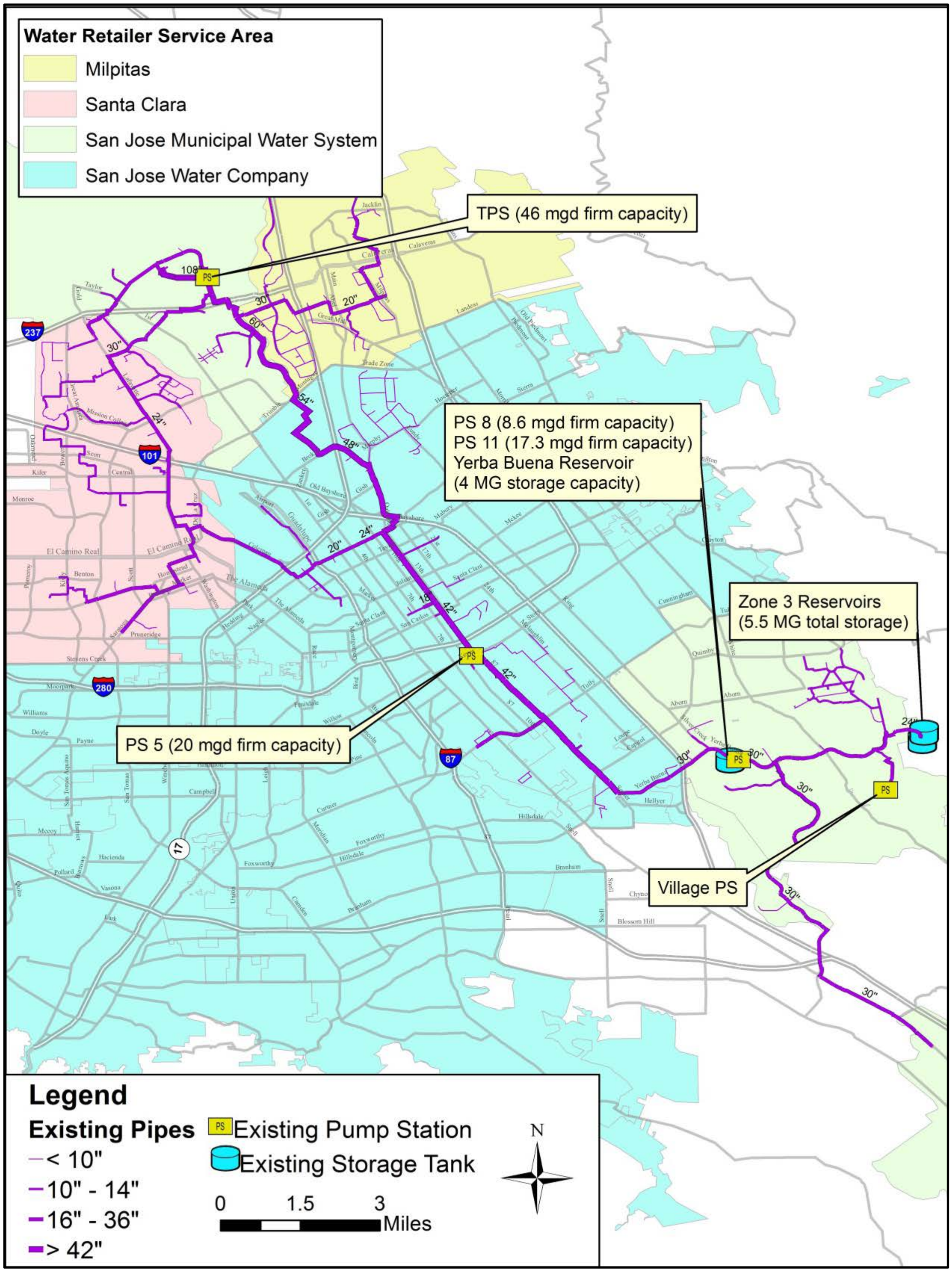
2.3 South Bay Water Recycling

In 1989, the United States Environmental Protection Agency and the Regional Water Quality Control Board issued a Cease and Desist Order (No. 89-013) to the SJ/SC RWF to limit dry weather discharge to the Bay due to concerns over potential conversion of salt marsh habitats of the South San Francisco Bay. The RWF's NPDES permit limits the dry weather effluent discharge to the Bay to 120 mgd. Should the

RWF exceed this maximum effluent flow trigger, the City of San José, the City of Santa Clara, and the tributary agencies could be subject to a sewer hookup moratorium, which would effectively stop growth in the South Bay cities.

SBWR, along with water conservation and reduction in infiltration and inflow, was a remedy prescribed in the South Bay Action Plan to reduce RWF effluent flows in response to the Cease and Desist Order. Construction of the SBWR was funded by the City of San José, the City of Santa Clara, and the tributary agencies as a wastewater diversion program in compliance with the RWF's NPFES permit. SBWR is administered through the City of San José's Environmental Services Division. To date, the parties have invested $250 million in the SBWR facilities to comply with the flow trigger and create an effective diversion of effluent during the dry weather season. SBWR has expanded to serve over 750 customers through a regional system consisting of 4 pump stations, 9.5 million gallons of reservoir supply, and 140 miles of nonpotable water distribution pipeline ("purple pipes"). Figure 2-7 shows the existing SBWR system.

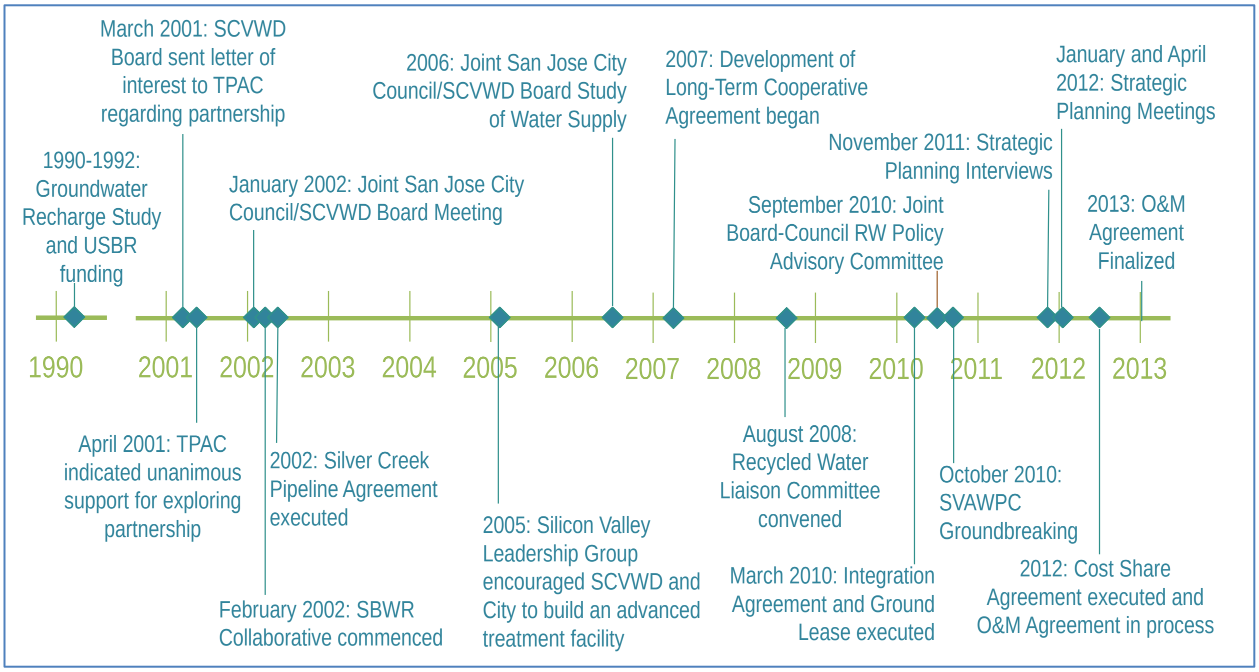
Figure 2-6: Existing SBWR Distribution System



2.3.1 Review of Past Collaborative Efforts

While the SBWR program was built as a water diversion project for the RWF, a secondary benefit was realized in the development of a drought-proof non-potable water supply. Recycled water has become a major component of SCVWD's water supply portfolio. The RWF and Santa Clara Valley Water District have a history of recycled water collaboration and the current Strategic Plan is a continuation of those efforts. As shown in Figure 2-8, collaborative efforts date back to the early 1990s and have continued throughout this Strategic Plan.

Figure 2-7: History of Recycled Water Collaboration



One of the key outcomes of this collaborate effort occurred in 2010 when the City and SCVWD executed the Integration Agreement and Ground Lease and Property Use Agreement.

- Key terms of the Integration Agreement are the formation of a Recycled Water Policy Advisory Committee (RWPAC) that meets in April of each year to discuss budget and operations, cost sharing, grant opportunities, expansion opportunities for non-potable and advanced treatment facilities, and changes to wholesale and retail of recycled water; the formation of a Technical Working Group comprised of staff from the Cities of San José and Santa Clara and SCVWD as needed to advise the RWPAC; the RWF's contribution to the Silicon Valley Advanced Water Purification Center (SVAWPC) and SCVWD's contributions to SBWR operations.
- Key terms of the Ground Lease and Property Use Agreement are the reservation of land at the RWF for the SVAWPC, the sizing of the SVAWPC at 10 mgd of microfiltration and 8 mgd of reverse osmosis, water quality provision of 500 mg/L TDS, and a 40 year term of agreement.

3. Non- Potable Reuse Opportunities

This section focuses on the “Maximize Non-Potable Reuse” pathway identified in the Visioning Process. It documents existing recycled water use, additional non-potable reuse (NPR) opportunities uses that water retailers within the SJ/SC RWF service area expect to add in the near-term (2015 to 2020) and potential long-term NPR markets (beyond 2020). The specific alternatives and costs to serve the identified markets will be discussed in Section 4.

As SBWR has evolved from a wastewater diversion program to a growing component of water retailers’ water supply portfolios, growth of the SBWR system has likewise shifted from RWF-driven extensions to water retailer-led efforts that focus on infill opportunities and strategic extensions. Much of the NPR market potential is therefore based on information from interviews with the retailers; the interviews were conducted in the spring of 2013.

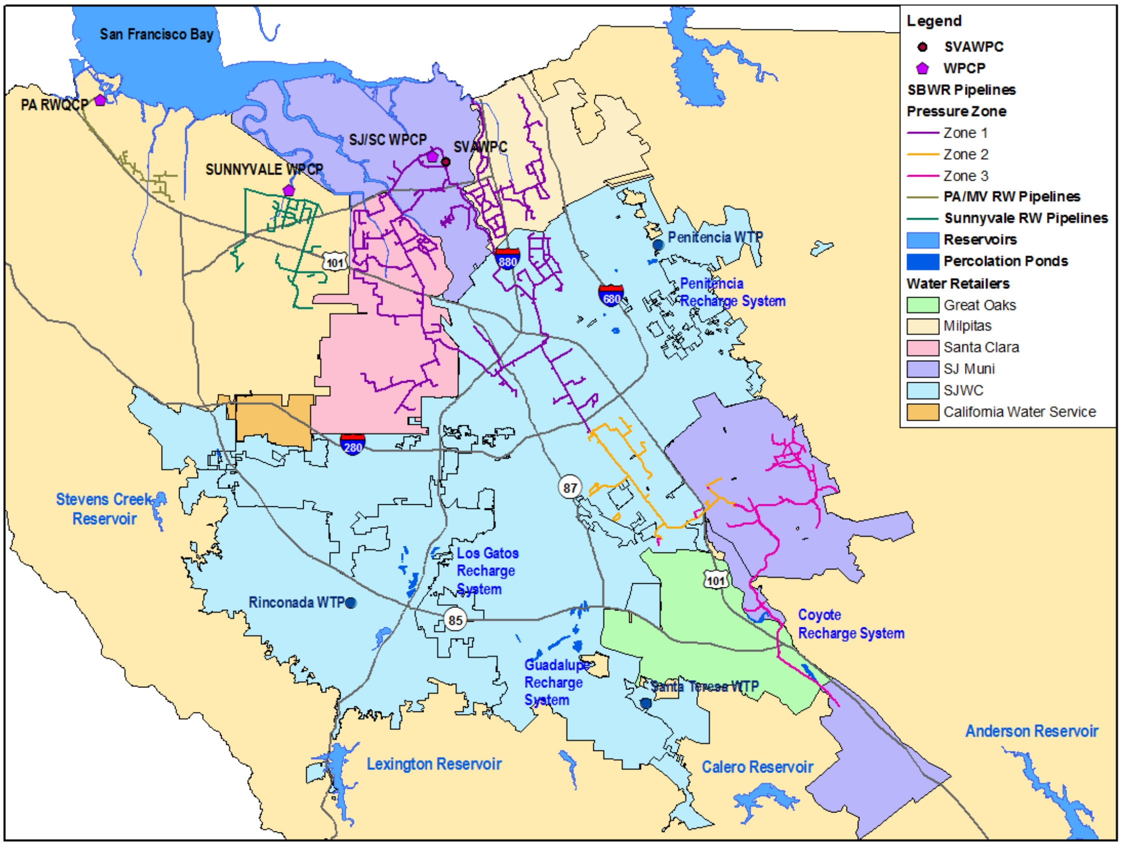
This non-potable market assessment is organized into the following main sections:

- Near-term SBWR Recycled Water Use – This section establishes the near-term recycled water use in SBWR’s service area. For the sake of the Strategic Plan purposes, the near-term use is defined as those uses already in place as of 2013 plus additional recycled water uses that are expected to be in service circa 2015 to 2020.
- Long-Term SBWR Recycled Water Uses – This section documents non-potable markets that have been identified by SBWR’s retailers as potentially occurring beyond 2020 as well as additional industrial demands identified as part of SBWR’s Cooling Tower Initiative.

3.1 Near-term SBWR Recycled Water Use

For the Strategic Plan purposes, the near-term use is defined as the sum of the existing uses already in place as of 2013 plus the additional recycled water uses that water retailers expect to be in service circa 2015 to 2020. There are six water retailers in the area served by the SJ/SC RWF: the City of Milpitas, the City of Santa Clara, the City of San José Municipal Water System (San José Muni), San José Water Company (SJWC), California Water Service and Great Oaks Water Company. Figure 3-1 illustrates the retailers’ service areas with respect to the existing SBWR system.

Figure 3-1: Water Retailers within the Area Served by SJ/SC RWF



Of these retailers, four currently distribute recycled water from SBWR: the City of Milpitas, the City of Santa Clara, San José Muni, and SJWC.

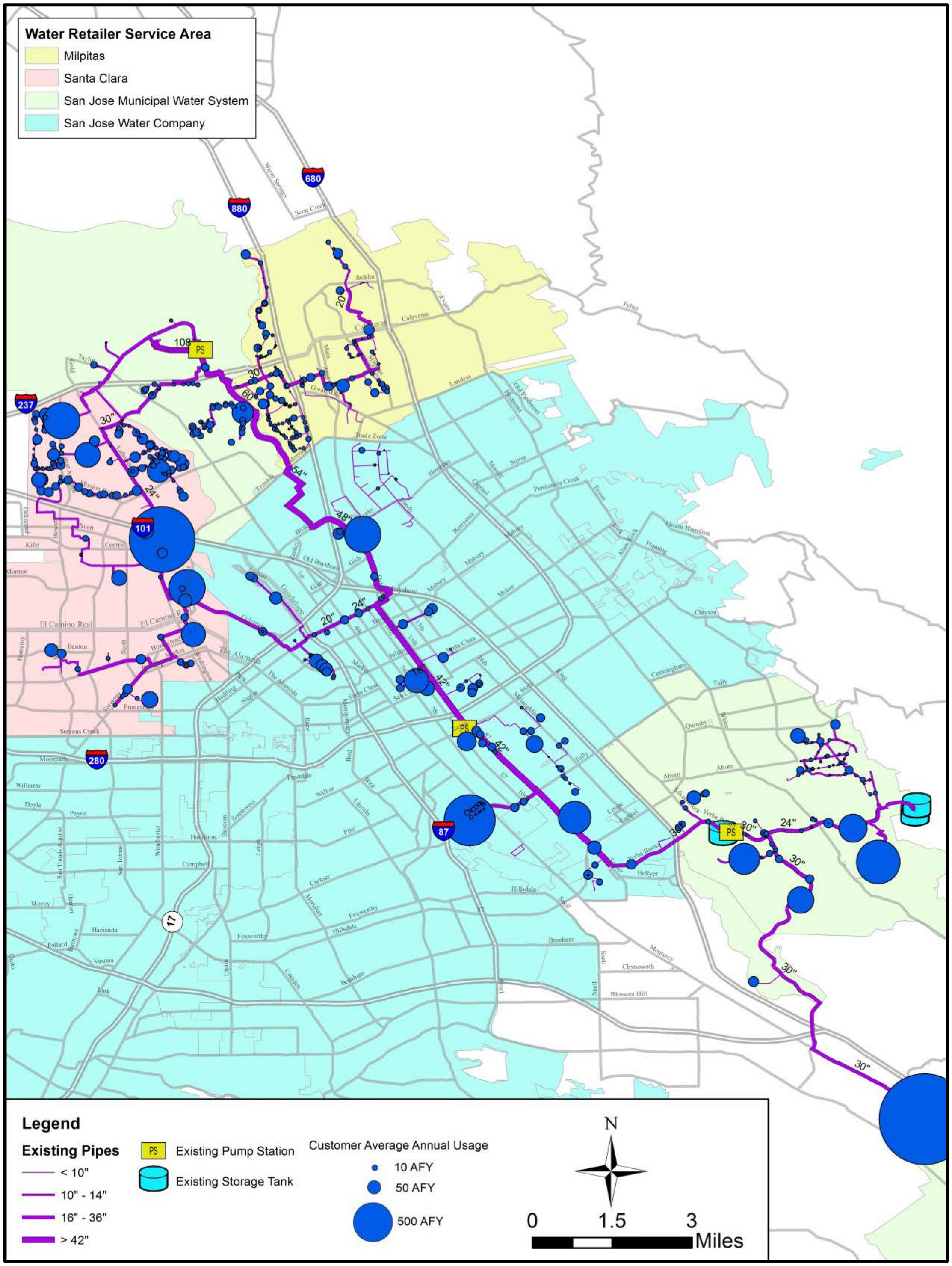
3.1.1 Existing Use

Table 3-1 summarizes the existing recycled water use for 2013, based on data from the retailers and rounded up to the nearest 10 AFY. Figure 3-2 illustrates the geographic distribution of the existing demands.

Table 3-1: 2013 SBWR Recycled Water Use (based on Retailer Reporting)

Retailer	Irrigation Use (AFY)	Industrial Use (AFY)	Total Use (rounded) (AFY)
City of Milpitas	990	10	1000
City of Santa Clara	2,000	1,200	3,200
San José Municipal Water	2,100	2,600	4,700
San José Water Company	2,000	100	2,100
Total	**7,090**	**3,910**	**11,000**

Figure 3-2: Existing SBWR Recycled Water Use



3.1.2 Recycled Water Uses to be added by 2020

The near-term demand will include the existing recycled water uses identified in the previous section plus the retailers' estimates of new recycled water demands associated with new alignments and customer connections slated for construction by 2020 and anticipated increases in demand from existing customers within the service areas of the four retailers currently using recycled water. The additional demands are described below by retailer.

City of Milpitas

Several development projects in the vicinity of the existing SBWR system have been approved for development and will likely use recycled water for irrigation. Developers for two of these developments– Coyote Creek Production Tract 10087 and Harmony Phases 1 and 2 – have submitted recycled water permit applications to SBWR indicating their intent to use recycled water and both these developments are currently under construction. In addition, the severe drought of 2014 has caused increased interest in developing new recycled water uses within Milpitas. The City of Milpitas does not have an estimate for the demand for these developments, so, for Strategic Planning purposes, it is estimated that an additional 100 AFY of recycled water will be implemented by 2015.

City of Santa Clara

The City of Santa Clara recently completed recycled water extensions funded through the American Recovery and Reinvestment Act (ARRA) to serve the majority of Santa Clara's industrial areas. As such, the City of Santa Clara is not planning to extend the recycled water system further in the near-term. Increases in recycled water use within the City of Santa Clara will be achieved through a combination of conversion of potable customers along existing recycled water alignments and requirements for new developments to use recycled water. Expected increases in recycled water use in the City of Santa Clara's service area by 2015 are based on recycled water projections prepared as part of the Santa Clara 2010 Urban Water Management Plan (UWMP) and water supply assessments completed for newly approved developments.

The expected additional recycled water customers by 2015 include:

- New industrial and irrigation customers along the ARRA extensions
- Irrigation and cooling tower usage at the new Levi Stadium
- Irrigation at new developments along Scott Boulevard and Great America Parkway

Together the recycled water uses described above would result in an increase of 680 AFY of irrigation use and 420 AFY of industrial use for a rounded total of 1,100 AFY of additional use by 2015.

San José Municipal Water System

New demand in San José Muni's service area is dominated by the expansion of the Los Esteros power plant. This expansion which came online in the summer of 2013 is anticipated to increase the plant's recycled water demand to between 1,000 AFY and 2,000 AFY. For purposes of this Strategic Plan, an additional 1,500 AFY is assumed over the 2013 demands.

San José Water Company

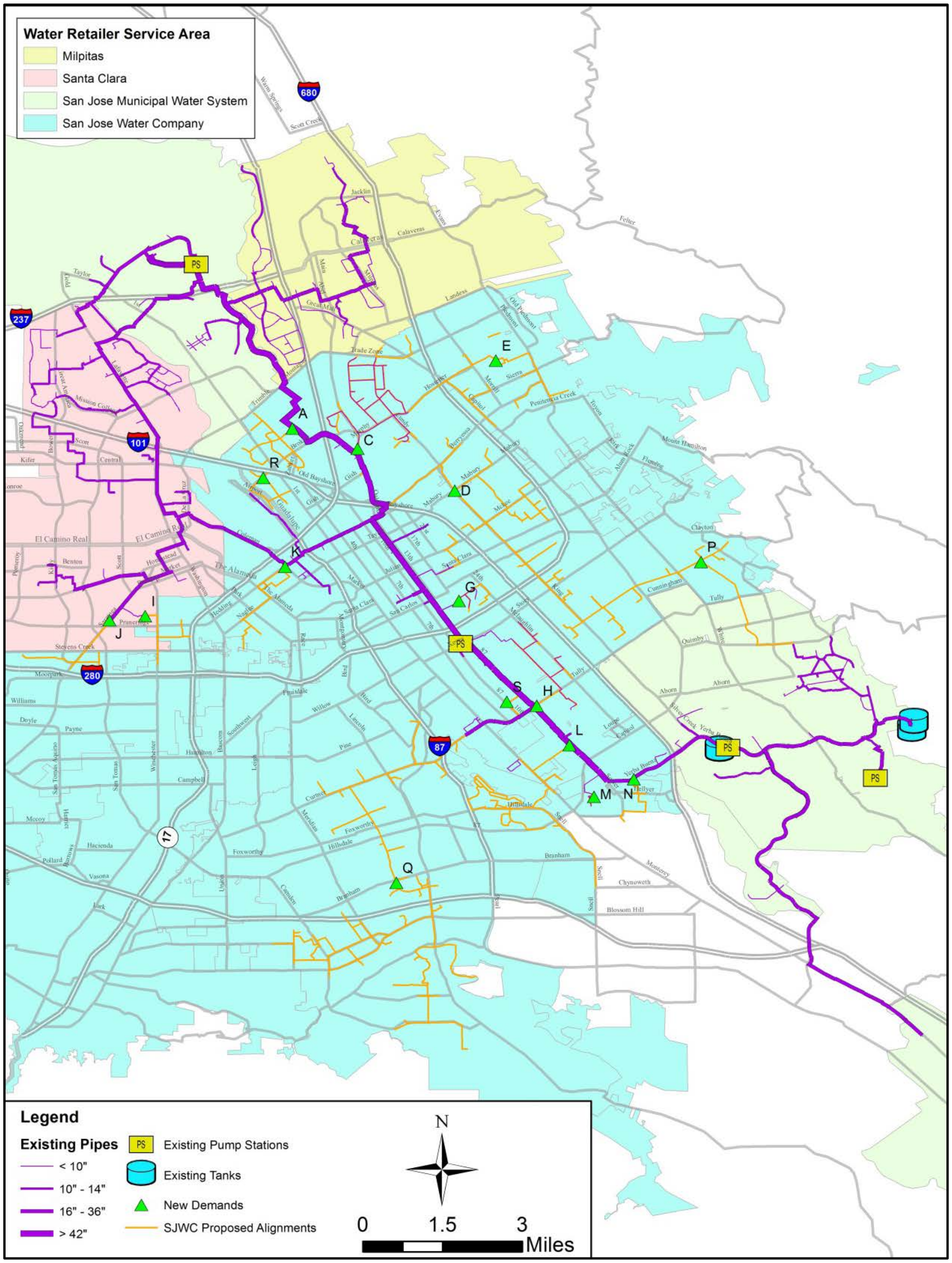
The 2011 Update to the SJWC Recycled Water Master Plan (RWMP) represents SJWC's latest planning related to growth of the recycled water system. The SJWC RWMP identifies extensions from the SBWR system which SJWC believed were reasonable to construct given cost and estimated customer demand. Table 3-2 presents the demands originally estimated for each of these alignments, and Figure 3-3 illustrates the alignments proposed in the SJWC RWMP. The WMP demands are irrigation demands.

Table 3-2: SJWC Recycled Water Master Plan Estimated Demands by Alignment1

SJWC Alignment	Estimated Demand (AFY)	SJWC Alignment	Estimated Demand (AFY)
A	232	K	184
C	610	L	589
D	879	M	16
E	515	N	51
G	116	P	1,730
H	381	Q	2,421
I	70	R	99
J	97	S	30
Total Estimated Demands, all Alignments:			8,020 AFY

Note: 1. Estimated demands were taken from the 2011 Update to the SJWC RWMP, with the exception of the demands for Alignments C, G and H, which were under construction by 2011. The demands for Alignments C, G and H were taken from the 2009 SJWC RWMP

Figure 3-3: SJWC Potential Extensions



The SBWR has a contractual commitment to provide 1,200 AFY in near-term demands from extensions of recycled water infrastructure. These demands are anticipated to be added to the system as soon as funding is approved, and these demands are therefore included in the near-term demands. The remaining 6,810 AFY of demand shown in Table 3-2 will be included as potential long-term demands. Table 3-3 summarizes how the 8,021 AFY of potential SJWC demands are categorized for this report.

Table 3-3: SJWC Recycled Water Uses

Timing of Demands	Recycled Water Usage (AFY)
Near-term Demands	1,200
Long-Term Demands	6,820
Total Demands	**8,020**

Total Additional Near-Term Uses

Table 3-4 summarizes the total additional uses identified by the retailers to be added between2015 and 2020.

Table 3-4: Summary of Additional Recycled Water Uses to be Added by 2020

Retailer	Irrigation Use (AFY)	Industrial Use (AFY)	Total Use (AFY)
City of Milpitas	100	-	100
City of Santa Clara	680	420	1,100
San José Municipal Water		1,500	1,500
San José Water Company	1,200	-	1,200
Total	**1,980**	**1,920**	**3,900**

3.1.3 Total Near-term Recycled Water Use

The near-term recycled water use is defined for this report as the sum of the 2013 recycled water uses identified in Section 3.1.1 and the new uses to be added by 2020 identified in Section 3.1.2. The following table summarizes the expected 2020 demand by type of use and retailer service area.

Table 3-5: Total Estimated Near-term Recycled Water Use by 2020

Retailer	Irrigation Usage, AFY			Industrial Usage, AFY			Total Estimated Near-term, AFY
	2013 Use	New Near-Term Uses	Total Use	2013 Use	New Near-Term Uses	Total Use	
City of Milpitas	990	100	1,090	10	-	10	1,100
City of Santa Clara	2,000	680	2,680	1,200	420	1,620	4,300
San José Municipal Water	2,100		2,100	2,600	1,500	4,100	6,200
San José Water Company	2,000	1,200	3,200	100	-	100	3,300
Total	**7,090**	**1,980**	**9,070**	**3,910**	**1,920**	**5,830**	**15,000** (rounded)

3.2 Long-Term Potential SBWR Recycled Water Demands

This section documents potential recycled water markets that have been identified by either the retailers or by SBWR, but which are not associated with firm retailer or customer commitments.

3.2.1 Long-Term Demands Identified by Retailers

Each of the six retailers in the area served by the SJ/SC RWF was contacted in the spring of 2013 to discuss NPR markets that could be served past 2015. Two of the agencies, California Water Service and Great Oaks Water Company, noted that they have no plans for extension of recycled water service into their jurisdiction. This section documents potential recycled water markets that have been identified by Milpitas, Santa Clara, San José Muni and SJWC but which are not associated with firm retailer or customer commitments.

City of Milpitas

The City of Milpitas's plans for increased non-potable use focus on the Milpitas Transit Area, which is being developed around the proposed Milpitas BART station extension and VTA Light Rail system. The City of Milpitas conducted a recycled water analysis for this area and determined that an estimated 122 AFY of recycled water could be applied to meet irrigation demands and 61 AFY of recycled water could be used for dual plumbing for new commercial and industrial customers. The Milpitas Transit Area Specific Plan Implementation plan shows the timeframe for implementation of the recycled water pipelines as 2008-2030. Given this long timeframe, these demands are considered potential long-term demand.

In addition to the Milpitas Transit Area recycled water demands, the SCVWD has expressed interest in moving some irrigation customers currently using raw water from the SCVWD surface water supply over to using recycled water. Two of those customers are golf courses located within Milpitas. For the purpose of estimating long-term NPR demands, it is assumed that these golf courses will be converted to recycled water use with estimated demands of 400 AFY per golf course.

Another potential long-term demand is conversion of existing cooling towers to recycled water use. To identify these potential demands, SBWR previously embarked upon a Cooling Tower Initiative to promote recycled water use for new cooling towers and to encourage existing cooling towers to convert to recycled water use. Through this work, SBWR identified a number of industrial users within close proximity to the existing system that could convert to recycled water. In Milpitas, the Cooling Tower Initiative identified potentially 100 AFY of new potential cooling tower uses.

The rounded, total long-term additional recycled water demand for Milpitas is estimated at 1,100 AFY. Milpitas updated their recycled water plans in the fall of 2014 and developed a map of future recycled water extension shown in Appendix 3A. The extension show potential alignments for deliver to the golf course plus service to irrigation on the east side of I680.

City of Santa Clara

Potential future recycled water demands in the City of Santa Clara are based on the Santa Clara 2010 UWMP recycled water projections. The projections beyond 2015 are attributed to new development and redevelopment along existing recycled water pipelines and increased use by current recycled water customers. As areas are redeveloped, some existing recycled water uses may be lost while new uses are added. The anticipated net effect of the development, redevelopment and increased customer use is an increase in recycled water demand of roughly 500 AFY, with landscape irrigation accounting for 75 AFY and cooling towers in data centers accounting for 425 AFY. In addition, the Cooling Tower Initiative identified a potential additional demand of 355 AFY for cooling tower conversions.

The rounded, total long-term additional recycled water demand for Santa Clara is estimated at 900 AFY.

San José Municipal Water System

Potential future recycled water demands in the San José Muni service area are based on the water supply assessment performed for the Envision San José 2040 General Plan Update. Water projections for various job and housing growth scenarios were developed based on maximizing the amount of recycled water that could be supplied, and using this approach, it was determined that between 6,720 AFY to 7,350 AFY of total demand could be met with recycled water depending on the growth scenario. The preferred scenario selected by the City of San José corresponds to a total recycled water use of 7,350 AFY by 2040. This total assumes that all new parkland irrigation, irrigation for new commercial development and outdoor uses in new multi-family developments are met with recycled water. The recycled water projection from the water supply assessment does not account for conversion of existing landscape irrigation uses that could be converted to recycled water or industrial uses that could be satisfied with recycled water.

Comparing the long-term projected use of 7,350 AFY with the near-term use of 6,200 AFY, suggests that approximately 1,150 AFY of potential future demand could be added within San José Muni within the North San José, Evergreen and Edenvale service areas.

San José Water Company

As previously discussed (see Section 3.1), recycled water projections for SJWC are based on the SJWC RWMP which estimated a total additional demand of 8,020 AFY along SBWR extensions. The SBWR near-term commitments of 1,200 AFY are already included in the near-term of recycled water use. The remaining 6,820 AFY of potential demands are considered long-term potential future demands.

3.2.2 Long-Term Potential Non-Potable Markets

The sum of the potential uses identified by SBWR retailers and additional cooling tower conversions identified by SBWR are presented in Table 3-6.

Table 3-6: Potential Additional Long-Term Recycled Water Demands

Retailer	Irrigation, AFY	Industrial, AFY	Total Additional Potential NPR, AFY
City of Milpitas	1,000	100	1,100
City of Santa Clara	100	800	900
San José Muni	1,150	-	1,150
SJWC	6,820	-	6,820
Total	**9,070**	**900**	**10,000** (rounded)

3.3 Summary of Non-Potable Market

The question of how much additional NPR market could be achieved is answered by securing the retailers' near-term demands, capturing all the potential markets identified by the retailers, and converting the existing industrial sites previously targeted by SBWR. Together these demands total nearly 25,000 AFY, with approximately 18,000 representing irrigation demands and 7,000 representing industrial demands. The breakdown of the total potential NPR market by area is summarized in the following Table 3-7.

Note that the long-term demands are based in part on theoretical developments and not on specific identified recycled water customers. Achieving that level of long-term recycled water deliveries will likely require financing assistance or other incentives. The total potential uses identified in Table 3-7 therefore represent the upper bounds of what could be achieved in a "Maximize Non-Potable Reuse" scenario. Actual long-term non-potable recycled water use will likely be lower than this theoretical demand.

Table 3-7: Total Non-Potable Market

Retailer	Total Estimated Near-term, AFY	Additional Long-Term Demands, AFY	Total Potential NPR, AFY
City of Milpitas	1,100	1,100	2,200
City of Santa Clara	4,300	900	5,200
San José Municipal Water	6,200	1,150	7,400
San José Water Company	3,300	6,820	10,100
Total (rounded)	**15,000**	**10,000**	**25,000**

The breakdown of the potential NPR market by type of usage is shown below in Table 3-8.

Table 3-8: Total Potential NPR Market by type of Use

Retailer	Irrigation, AFY	Industrial, AFY	Total Potential NPR, AFY
City of Milpitas	2,090	110	2,200
City of Santa Clara	2,780	2,420	5,200
San José Municipal Water	3,250	4,100	7,350
San José Water Company	10,020	100	10,120
Total	**18,140**	**6,730**	**25,000 (rounded)**

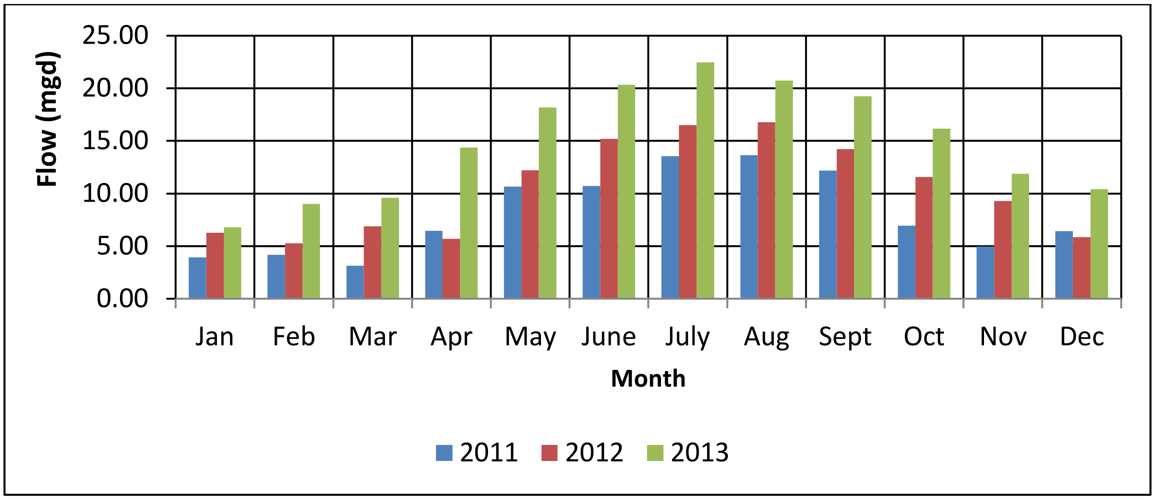
3.4 Calculation of Recycled Water Flow Rates

3.4.1 Peak Month and Peak Day Factors

This section evaluates the seasonal flow rates associated with meeting the near-and long-term demands of 15,000 AFY and 25,000 AFY. The recycled water flow rates developed here will be used in the next two sections of the report to analyze the treatment and distribution system modifications needed to reliably meet the near-term demands and then to identify the system expansions needed to meet the long-term demands.

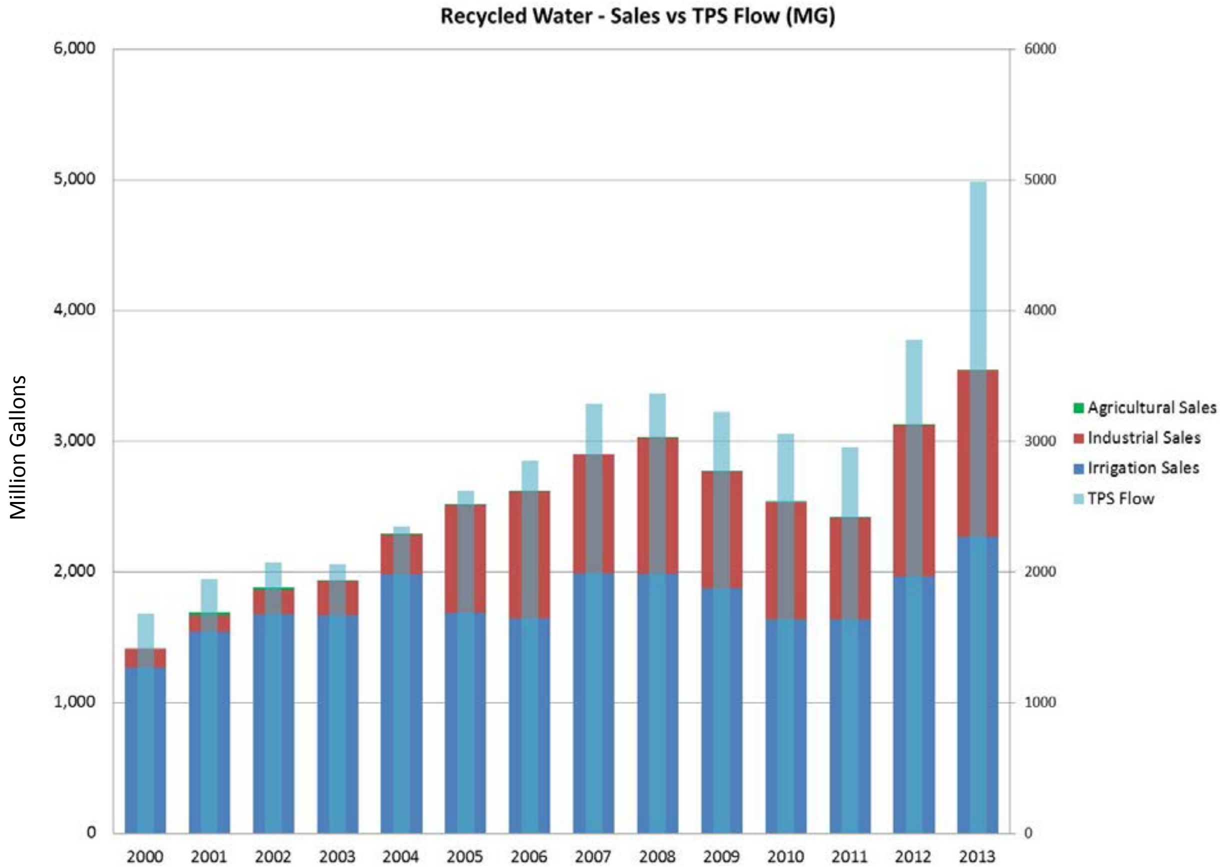
The recycled water deliveries through the SBWR system follow a typical recycled water seasonal pattern with the highest demands in the summer time. Figure 3-4 shows the SBWR average flow by month through the SBWR Transmission Pump Station (TPS) for the years 2011 through 2013.

Figure 3-4: SBWR Average Flow by Month



There is a discrepancy between the recycled water flows measured at the TPS flow meter versus the recycled water use reported by the retailers. As shown in Figure 3-5 the total annual flow measured at the TPS in 2013 was approximately 1,450 MG more than the total recycled water demand reported by the retailers. The difference in flow is approximately 4 mgd. Per the results of an evaluation by RWF staff, approximately 2 mgd of this water is being returned to the RWF for process and irrigation uses used within the RWF. The remaining discrepancy is likely due to lost water in the distribution system or discrepancies between flow meters. For the purpose of evaluating infrastructure needs, the TPS records have been used as the basis of estimating system flow rates.

Figure 3-5: SBWR Retail Sales versus Net Recycled Water Flow Measured at TPS



The TPS flow meter records for 2013 were analyzed to determine the peaking factors for maximum month and maximum day flows as compared to the average annual flow rate. The results are shown in Table 3-9 and will be used to calculate the maximum month and day flows for recycled water uses.

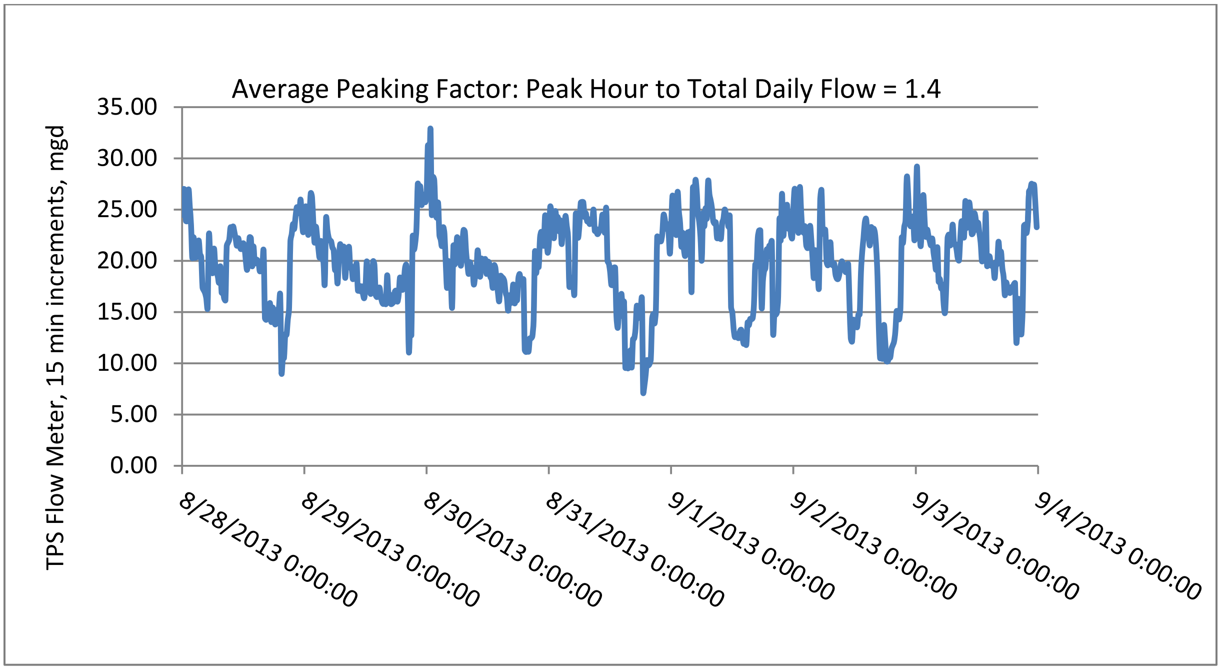
Table 3-9: Peaking Factors based on TPS Flow Meter

	2013 RW Flows from TPS (mg)	Peaking Factor
Daily Average	15.0	1
Peak Month to Average	22.5	1.5
Peak Day to Average	25.3	1.7

3.4.2 Peak Hour Factors

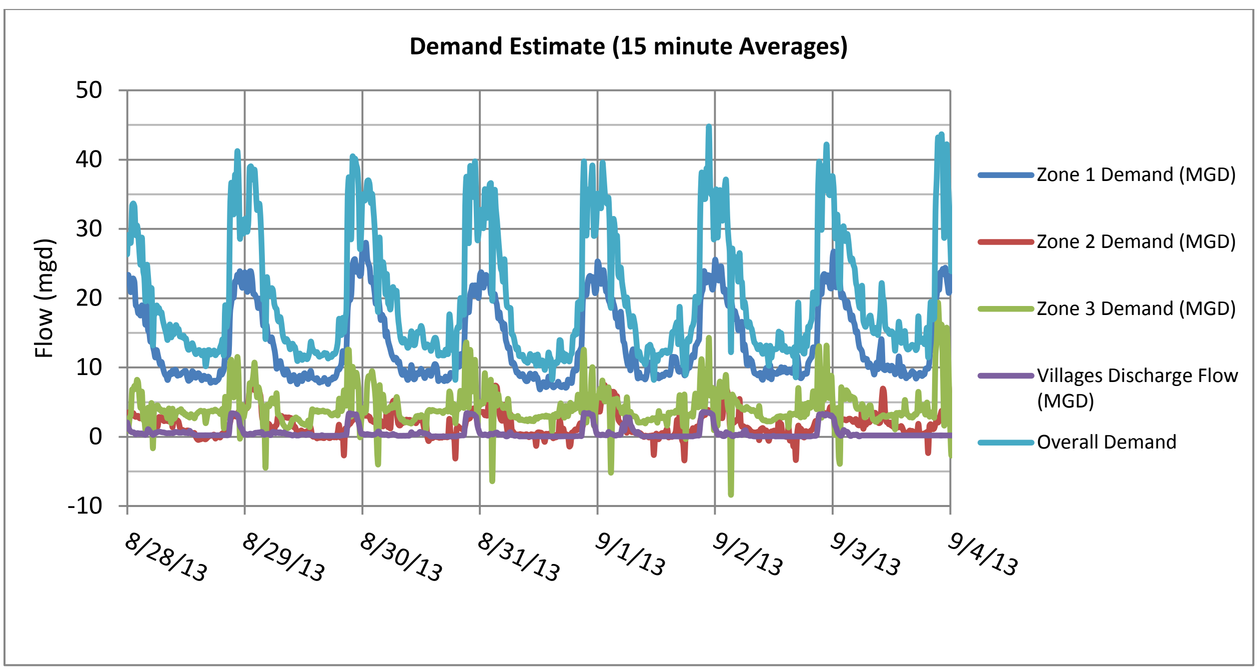
Diurnal flow variations at the TPS are illustrated in Figure 3-6 which shows 15 minute incremental flow readings at TPS over a representative period in summer of 2013. The peaking factors for peak hour average 1.4 over the period shown. A peaking factor of 1.4 (peak hour to peak day) will be used to calculate the peak hour flows delivered from TPS.

Figure 3-6: SBWR Diurnal Demand Pattern



The peak hour variations seen at TPS are dampened because during peak demand periods some of the recycled water to the various pressure zones is supplied by storage reservoirs rather than by the TPS alone. Figure 3-7 shows the hourly demand patterns for each of the four distribution zones within SBWR and the system as a whole including the recycled water supplied by the reservoirs.

Figure 3-7: Hourly System Demand



3.4.3 Near and Long-Term Recycled Water Flow Rates

Using the peaking factors calculated in this Section, the recycled water flow rates associated with the near-term NPR demand of 15,000 AFY and the long-term NPR demand of 25,000 AFY are shown below in Table 3-9. These are the flow rates that will be used to assess the treatment and distribution system modifications needed to reliably meet the near-term demands as well as the system expansions needed to meet the long-term demands.

Note that the calculations of the flow rates in Table 3-9 include a commitment to deliver 5 mgd for SCVWD. This commitment was made as was part of the Silver Creek Agreement between the City and SCVWD in which the District provided cost-sharing to increase the size of the Silver Creek pipeline from 24-inch to 30-inch in exchange for at least 5 mgd of recycled water capacity in the pipeline .[5] SCVWD will likely use this 5 mgd to supply water to its Phase 1 potable reuse project described in Section 8. Although the 5 mgd commitment to SCVWD is not a non-potable demand, it is included in this table because it is conveyed in the SBWR system and therefore represents a demand on the TPS and the NPR distribution system. This Report assumes the additional 5 mgd will be delivered at a constant rate and is therefore not subject to the peaking factors.

Table 3-10: Recycled Water Flow Rates from TPS

	2013	Peaking Factor (4)	Nar-Term w/o SCVWD (1)	Near-Term w/ SCVWD (2)	Long-Term Additional NPR (3)	Total Long-term NPR w/ SCVWD (2)
Annual RW Flow, AFY	11,000		15,000	20,000	10,000	30,000
Daily Average, mgd	15.0	1	20.4	25.4	8.9	34.3
Peak Month, mgd	22.5	1.5	30.6	35.6	13.4	49.0
Peak Day, mgd	25.3	1.7	34.5	39.5	15.1	54.6
Peak Hour, mgd	35.4	1.4	48.3	53.3	21.1	74.4

Notes for Table 3-9:

1. *The average annual TPS flow rate associated with the 11,000 AFY delivered in 2013 was 15.0 mgd. The average flow from 2013 was scaled up by a factor of 15,000/11,000 to estimate the average flow rate associated with the 2015 demand of 15,000 AFY.*
2. *SCVWD has a 5 mgd commitment for their Phase 1 IPR project. It is assumed that the 5 mgd will be delivered at a constant flow rate so the additional 5 mgd was added to the near-term and long-term flow rates without applying peaking factors to the 5 mgd.*
3. *The additional long-term NPR market is estimated to be 10,000 AFY which equates to an average flow of 8.9 mgd. This value was used as the additional average flow rather than prorating the 2013 flow upwards because it is assumed that the discrepancies between the TPS flow meters and the retail sales records will be resolved by the time the long-term demands occur.*
4. *Peaking factors are in relationship to the daily average flows, with the exception of the peak hour peaking factor which is in terms of peak hour to peak day.*

[5] "Agreement between the City of San José and the Santa Clara Valley Water District Relating to Management and Operation of the south Bay Water Recycling System, Including the Silver Creek Pipeline", January 22, 2002

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4. Near Term SBWR Reliability Improvements

This section describes recommended improvements to the SBWR production and distribution system facilities to improve reliability for meeting the near-term recycled water demands of 15,000 AFY as described in Section 3 plus the 5 mgd SCVWD commitment as shown below.

Table 4-1: Recycled Water Flow Rates from Transmission Pump Station

	Near-term w/o SCVWD[1]	Near-term w/ SCVWD [1]
Annual RW Flow, AFY	15,000	20,000
Daily Average, mgd	20.4	25.4
Peak Month, mgd	30.6	35.6
Peak Day, mgd	34.5	39.5
Peak Hour, mgd	48.3	53.3

[2] The Silver Creek Agreement between SCVWD and the City includes a commitment to deliver 5 mgd for SCVWD uses. For the sake of calculating flow rates it is assumed that this 5 mgd will be delivered at a constant flow rate, therefore the additional 5 mgd was added to the near-term and long-term flow rates without applying peaking factors to the 5 mgd.

The following information is included in this section:

- Description of existing SBWR production and distribution facilities
- Potential system vulnerabilities
- Proposed SBWR reliability projects that address potential system vulnerabilities, maintain ongoing SBWR system operations and customer service, and meet near-term demands
- Preliminary prioritization of the proposed reliability projects conducted by RWF, SBWR, and SCVWD staff

4.1 Existing SBWR Facilities

The SBWR system has been in operation since the late 1990's and currently delivers about 11,000 AFY of unrestricted disinfected tertiary recycled water to landscape irrigation and industrial customers. The SBWR system was initially designed and constructed to serve as a treated effluent diversion system, with a primary purpose of reducing the dry weather effluent discharges to South San Francisco Bay in compliance with Regional Water Quality Control Board (RWQCB) orders. The customer profile of the original SBWR system was primarily landscape irrigators, including golf courses, cemeteries, business parks, road medians, parks and schools.

Since its initial commissioning, the SBWR system has evolved into a valuable resource and asset for the Cities of San José, Santa Clara and Milpitas. The recycled water supply has served to offset potable water use through non-potable reuse in landscape irrigation and as industrial feed water, primarily for cooling tower applications. The SBWR system has undergone several phases of expansion and improvements, including extension of recycled water pipelines to serve new non-potable reuse customers, addition of system storage in Zone 3, and construction of reliability improvements at SBWR pump stations.

The treated water produced by the RWF is blended with advanced treated water supplied by the SCVWD's Silicon Valley Advanced Water Purification Center (SVAWPC), which was commissioned in 2014. See Appendix 4-A for more information about the SVAWPC.

The SBWR system is composed of the following components:

- Tertiary treatment processes
- Disinfection processes
- In-plant conveyance pipelines
- Distribution pump stations
- Distribution pipelines
- Distribution system reservoirs
- Customer services
- SCADA and controls
- Operations and maintenance assets
- Utility management

This section includes an assessment of the system and facility condition, operations, vulnerabilities, risk of failure and consequence of failure. The facility and asset condition assessments are based on two previous reports prepared for the City of San José; the RWF Condition Assessment and the SBWR Condition Assessment reports[6]. To supplement this information, interviews were conducted with current and former SBWR and RWF operations staff to provide perspective on the various system assets, how they are operated, vulnerabilities that affect the overall system, and thoughts on needed reliability improvements. Also, operations manuals, record drawings and operational data were reviewed in developing an understanding of the system, its components and their operation.

4.1.1 SBWR Production Facilities

Tertiary disinfected recycled water production begins at the Filter Influent Pump Station, which supplies secondary effluent to sixteen media filter cells. Four filter cells are dedicated to recycled water production and effluent from these filters flows into chlorine contact channel (CCC) #4 (see Figure 4-1 for flow schematic). Effluent from CCC #4 is conveyed to the TPS, where recycled water is boosted into the SBWR distribution system.

[6] San José – Santa Clara WPCP Infrastructure Condition Assessment Final Report, prepared for the City of San José Environmental Services Department by CH2M-HILL, May 2007 (RWF Condition Assessment)
South Bay Water Recycling System Condition Assessment Final Report, prepared for the City of San José Environmental Services Department by CH2M-HILL, July 2010 (SBWR Condition Assessment)

This section summarizes each component in the existing recycled water production process from the Filter Influent Pump Station to the Transmission Pump Station. An annotated aerial image of the existing facilities is shown in Figure 4-2.

The SBWR production system at the RWF consists of granular media filters, a chlorine contact channel, pipelines, and pumps, as summarized in Table 4-2.

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Figure 4-1: Existing Filtration and Disinfection Flow Schematic

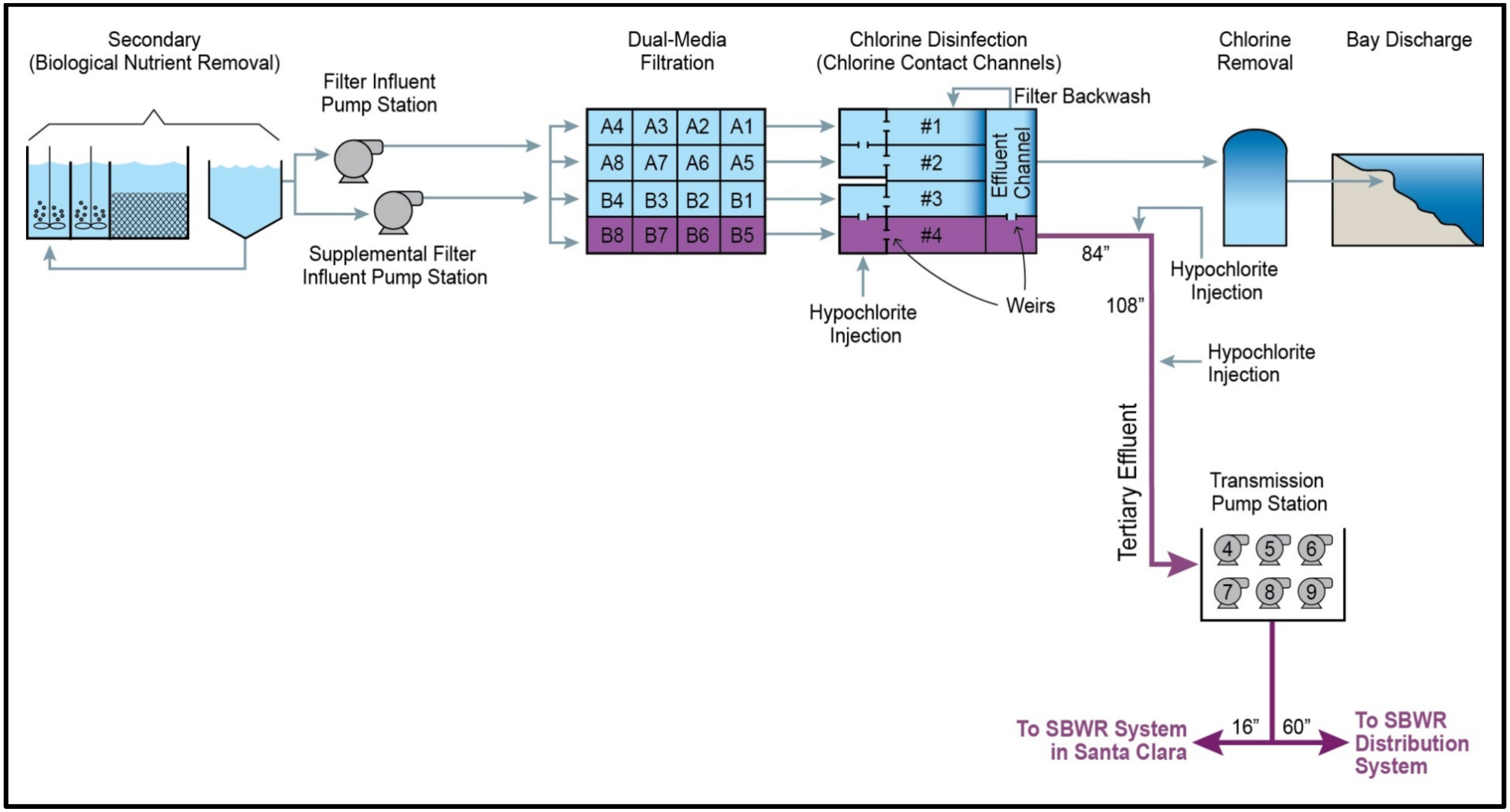
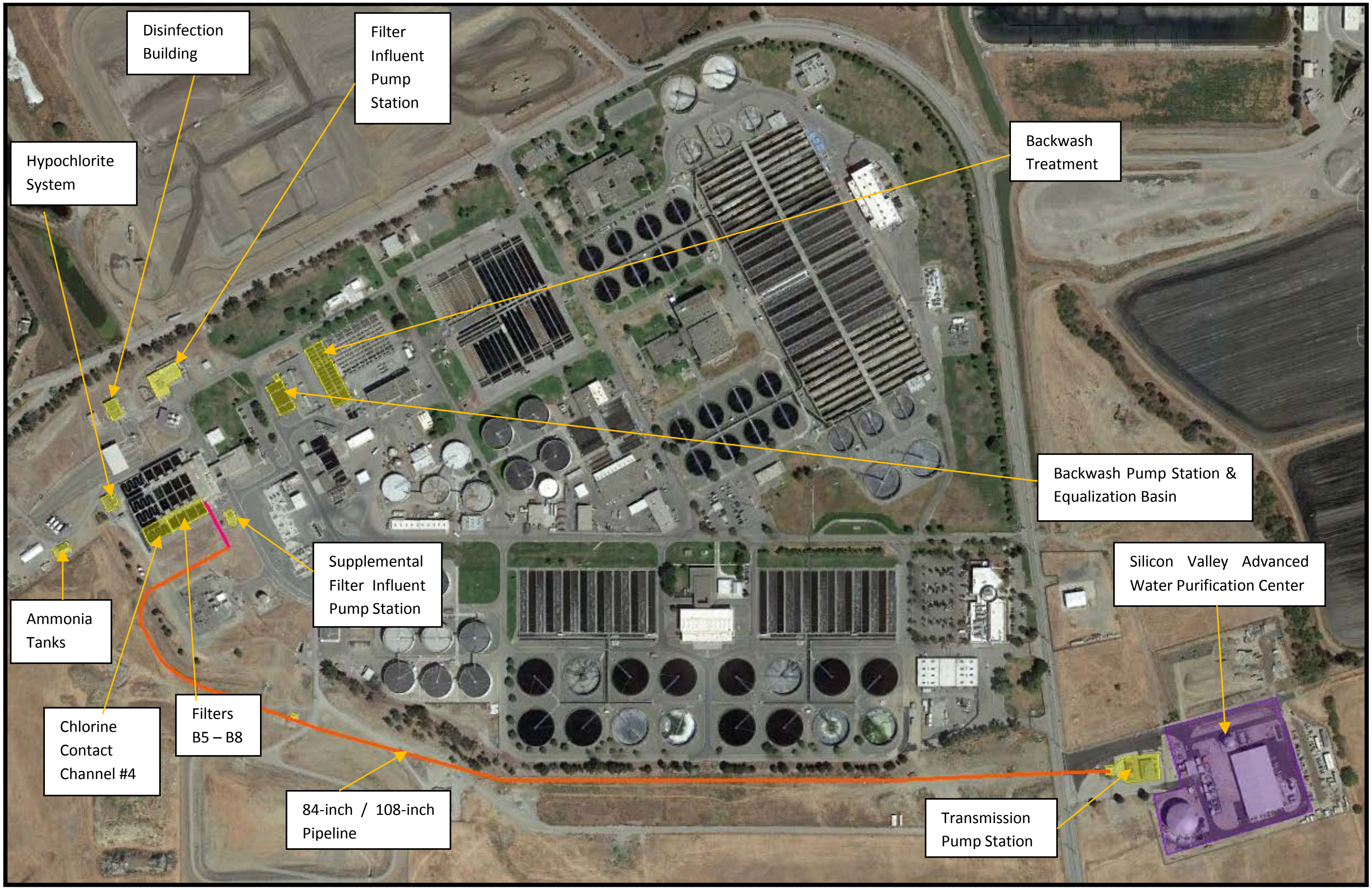


Figure 4-2: SJ/SC RWF – Existing Recycled Water Production Facilities



Source: Google Earth

Table 4-2: Summary of Existing SBWR Production System Assets

Asset Type	Key Statistics
Filter Influent Pump Station *	Four 85 mgd, 400 hp variable frequency drive pumps One 50 mgd, 400 hp constant frequency drive pump
Supplemental Filter Influent Pump Station *	Two 50 mgd pumps at 33 ft TDH
Granular Media Filters	Four 30ft x 46ft filter cells 5.0 gpm/SF maximum loading rate 38.1 mgd theoretical maximum daily production with all filters in service and one backwash per day
Filter Backwash *	One 18,000 gpm, 400 hp duty pump Two standby pumps 18 minute active backwash per cell
Filter Backwash Treatment *	Two low speed vertical mechanical mixers Four vertical turbine pumps Concrete backwash flow equalization tank Wet-well
Chlorination	One 1.1 MG serpentine channel 84 and 108-inch, 4,310-foot long RCP pipeline Three sodium hypochlorite dosing points 44.3 mgd maximum capacity at 90 minute modal contact time for channel and pipe combined, assuming baffling efficiency of 79% in the channel and 95% in the pipe (from SBWR Operations Manual)
Hypochlorite System *	Three sodium hypochlorite dosing points for RW treatment Two day tanks Three storage tanks One duty pump Two standby pumps
Ammonia System (for chloramination) *	Two Polyethylene tanks in a concrete basin Five diaphragm pumps with dedicated pumps to each CCC One standby pump Vent scrubbers
Transmission Pump Station (TPS)	Two wet well bays Two 14.7 mgd, 1,000 hp variable speed drive pumps Two 11.4 mgd, 900 hp variable speed drive pumps Two 4 mgd, 350 hp constant speed drive pumps 60-inch discharge header pipeline to distribution system 16-inch pipeline to Santa Clara distribution service area 110 to 145 psig required system pressure Total firm capacity of 41.5 mgd with one 14.7 mgd pump on stand by and one 4 mgd pump out of service
Electrical System *	Two PG&E electrical feeds to SJ/SC RWF One PG&E electrical feed to TPS

** Denotes facilities used for both effluent discharge to the Bay as well as recycled water production*

Source: South Bay Water Recycling System Condition Assessment Final Report, CH2M-HILL, July 2010

4.1.2 SBWR Distribution System Facilities

The SBWR distribution system downstream of TPS consists of pipeline, pump station and storage assets as summarized in Table 4-3.

Table 4-3: Summary of Existing SBWR Distribution System Assets

Asset Type	Key Statistics	
Pipelines	4" to 60" Diameter	Total 102.6 miles
	DIP	26.0 miles
	HDPE	0.9 miles
	PCCP	3.1 miles
	PVC	39.8 miles
	RCPP	3.5 miles
	Steel	26.3 miles
	Yellomine	3.0 miles
Pump Stations		
Pump Station No. 5	Three pumps @ 250-hp and 7,000-gpm In-Line between TPS and Yerba Buena Reservoir	
Pump Station No. 8	Four pumps @ 75-hp and 2,000-gpm Feed from Yerba Buena Reservoir Serves Zone 2 demands and provides feed to PS 11	
Pump Station No. 11	Three pumps @ 500-hp and 4,300-gpm One pump @ 350-hp and 2,300-gpm One pump @ 125-hp and 900-gpm Serves Zone 3, Zone 3 tank and MEC	
Villages Pump Station	Serves small hydropneumatic zone at Villages development	
Reservoirs		
Yerba Buena	One pre-stressed concrete tank @ 4 MG Serves as wet well for PS 8 and PS 11	
Zone 3 Reservoirs	Two pre-stressed concrete tanks @ 2.8 MG Serves Zone 3 and Villages PS	

Source: South Bay Water Recycling System Condition Assessment Final Report, CH2M-HILL, July 2010

4.2 Potential SBWR Reliability Issues

Table 4-4 is a summary of the SBWR components and/or functions, the corresponding system vulnerabilities, and potential consequences of failure as identified through interviews with current and former SBWR staff and review of operating data and operating practices. Together, these vulnerabilities and the correlating consequence of failure form the basis for the reliability improvement projects presented in the next section. Addressing the identified vulnerabilities and risk areas has the effect of reducing or eliminating the consequence of failure, thus maintaining and enhancing overall SBWR system reliability and customer service.

The SBWR system has historically provided a high level of service (LOS) to its customers. There have been no formal LOS guidelines developed for SBWR. The recycled water system, although categorized as an interruptible supply, has consistently met the peak hourly demands of the customers and delivered water meeting regulatory requirements; it has established de-facto high LOS expectations. A pervasive issue across all the SBWR facilities is that the recycled water demands are reaching the maximum capacity of the SBWR system. The operational effort to meet peak day and peak month demands is expected to be significant. The manual nature of the SBWR system controls, system production capacity, close-coupled tertiary production and TPS pumping, and limited elevated storage will require the operators to carefully plan TPS operations, filter backwash cycles, storage tanks fill and draining at optimal times, and turn PS 11 on and off at appropriate times. The current distribution system, while marginally capable of meeting near-term demands, is not considered reliable due to the manual control required and the careful planning necessary to meet demand.

Table 4-4: SBWR System and Component Vulnerabilities

Component/Function	Area of Risk/Vulnerability	Potential Consequence of Failure
System Wide: Communication	Customer perception of inconsistent communications with SBWR and retailers	• Incomplete information available for system problem solving, making trouble-shooting more difficult • Communication improvements needed between customers, SBWR, and retailers • Customer confusion and aggravation
System Wide: Asset Management	Unknown System performance after a significant seismic event	• Unknown ranging from no consequence to extended system outage depending on component type failure
System Wide: Operations	Distribution system controls, control logic and data telemetry are old and approaching obsolescence	• Inefficient system and component operation • Incomplete remote operating capabilities • Limited ability to expand • Some components may be obsolete and not serviceable • Requires manual operation, which impacts staffing
System Wide: Operations	Significantly outdated Operations & Maintenance manual.	• Inconsistent/inefficient operations of production and distribution systems. • Effectively reduced operating and maintenance budget • Supply disruptions
System Wide: Operations	Insufficient system monitoring data for operators	• Difficult troubleshooting to correct system problems • Difficult to detect distribution system lost water or metering accuracy problems • Reduced recycled water revenues
System Wide: Operations	System configuration is not optimized for lower cost operations	• Inconsistent operating approach • Reduced operational flexibility
System Wide: Utility Management	Sufficiency of investment in System Renewal and Replacement	• System assets degrade over time • System operational efficiency degrades over time
System Wide: Utility Management	Funding of ongoing O&M Needs	• Reduced expected service life of system assets • System operational efficiency degrades over time

Component/Function	Area of Risk/Vulnerability	Potential Consequence of Failure
System Wide: Utility Management	Discrepancy between TPS flow meters and retailers' water meters	• Contradictory information results in uncertainties over actual flow being delivered and when additional capacity will be needed. • Potential for reduced revenues from recycled water sales if retailer meters are under-reporting the actual deliveries.
System Wide: Supply Reliability	Inadequate back up supply in the event of a plant upset or outage	• Customers change to back up supply • SBWR and retailers would manage customer demand and operate system to stretch available back up supply and storage • System could shut down
Production: Condition Assessment / Asset Management	Degraded conditions of existing RWF infrastructure would cause unscheduled shut down of recycled water treatment processes.	• Filtration, chlorination, and/or TPS interruption.
Production: Single Point of Failure	Filter backwash pipeline, chlorination, and TPS electrical supply are single points of failure vulnerabilities.	• Filtration, chlorination, and/or TPS interruption resulting in loss of recycled water supply.
Production: Capacity / Regulatory	Filtration, chlorination and transmission infrastructure do not have sufficient capacity to meet future demands.	• Lack of supply during peak demand periods.
Distribution: Pipelines	Valve failures are a current problem	• Reduced operational flexibility as a result of inoperable isolation valves • Risk of pipeline failure and extended service outage in the event of an air valve failure • Longer system outages where line isolation and dewatering is required for maintenance and/or repair of pipeline facilities
Distribution: Pipelines	Inadequate number of line isolation valves	• Reduced operational flexibility as a result of longer distance between isolation valves • Longer system outages where line isolation and dewatering is required for maintenance and/or repair of pipeline facilities
Distribution: Pipelines	Single pipeline conveyance within backbone system	• Single point of failure would cause outage of entire sections of SBWR system

Component/Function	Area of Risk/Vulnerability	Potential Consequence of Failure
Distribution: Pump Stations	Transients between PS 5 and PS 8 may weaken system over time	• Fatigue failures of pressurized components • Significant time and cost to repair/replace failed components
Distribution: Pump Stations	Pump station bypasses lack second isolation valve	• Prevents taking pump station out of service for repairs and maintenance and keeping system operating
Distribution: Storage	Inadequate storage capacity	• Limits operational flexibility • Limits operational capacity on maximum demand days • Limits ability to optimize operations and reduce operating costs
Distribution: Capacity	There is marginal capacity available to convey the expected near-term flows. The operational effort to meet max day and max month demands is expected to be significant. The manual nature of the SBWR system controls, system production capacity, coupled tertiary production and TPS pumping, and limited elevated storage will require the operators to careful plan TPS operations, filter backwash cycles, storage tanks fill and draining at optimal times, and turn PS 11 on and off at appropriate times.	• Lack of supply during peak demand periods. •

4.3 Proposed Projects

This section describes various reliability improvement projects that have been identified to address the vulnerabilities and risk areas identified in Table 4-4. Each project is demarcated by an alphanumeric label, with an S (system-wide), P (production), or D (distribution), followed by a serial number (e.g. Project P1).

Each project described in this section includes the following:

- Description of the current reliability issue being addressed
- Description of the project and its elements
- Benefit provided by the project

Each reliability improvement project has been put into one of several categories:

- Customer Service
- Asset Management
- System Operations
- Utility Management
- Improvements to Existing Infrastructure
- New Infrastructure

4.3.1 System-Wide Reliability Projects

System reliability projects are intended to benefit both production and distribution system reliability. These projects can include utility management activities (projects) that are not considered capital improvement projects. The following have been identified as projects to improve System-Wide Reliability.

Table 4-5: Summary of Potential System-Wide Reliability Projects

Project Number	Project Name	Purpose
Customer Service Improvement Projects		
S1	Streamline Communication Protocols and Procedures	Update communications protocols and procedures and assign roles and responsibilities for SBWR and its retailers to reduce RWF staff time spent responding to customer issues
System Asset Management Projects		
S2	Implement next phase of Asset Management Program	Actively managing the existing and future assets of the SBWR system, the remaining useful life of system assets can be extended while also providing justification for planning and funding of asset maintenance and replacement.
S3	Seismic Reliability Assessment	Addresses a current gap in knowledge related to the seismic vulnerabilities of the SBWR system and provides a basis for developing projects to address critical vulnerabilities that have a large consequence of failure related to LOS.
SBWR System Operations Projects		
S4	Obtain Program Support Equipment	Obtain vehicles, radios, tools, etc. needed to respond to pump station assignments and eliminate need for staff to use their own vehicles for these assignments.
S5	Update SBWR Systems Operations Manual	Update O&M Manual to provide standardization in system operating procedures and eliminate inconsistent system operations.
S6	Additional SBWR Distribution System Monitoring Stations	Evaluate locations and types of monitoring devices that could be added to the SBWR system to allow for better day-to-day control of the system as well as provide early detection of system trouble
Utility Management Planning and Budgeting Projects		
S7	Investigate Additional Backup Supplies	investigate potential sources and the feasibility of implementing a significant back up water supply that would allow SBWR to operate during a process upset or outage at the RWF

4.3.2 SBWR Production Reliability Improvement Projects

Production reliability projects are intended to improve the reliability of the recycled water production facilities. The proposed projects include improvements to the existing infrastructure as well as construction of the new infrastructure. The following have been identified as potential projects to improve SBWR Production Reliability.

Table 4-6: Summary of Potential SBWR Production Reliability Projects

Project Number	Project Name	Purpose
Improvements to Existing Infrastructure		
P1 [1]	Address Condition Issues from Condition Assessments Reports	Address existing deficiencies outlined in the RWF Condition Assessment reports including code compliance, seismic upgrades, electrical upgrades, equipment replacements.
New Infrastructure		
P2	Parallel Backwash Pipeline	Add a parallel backwash pipeline to support inspection, maintenance and rehabilitation without the need to shut down the filter process.
P3	Filter Capacity Upgrade	Convert four additional filtration cells for recycled water production to increase filter production capacity.
P4	Parallel Pipeline to TPS	Retrofit CCC#3 for recycled water treatment and designing and construct a parallel pipeline from the filter building/CCCs to TPS to increase disinfection capacity.
P5	Recycled Water Storage at TPS	Construct recycled water storage tank at TPS to decouple production facilities from TPS distribution and to improve salinity control of the blended permeate/recycled water.
P6	TPS Capacity Upgrade	Provide additional TPS pumps/capacity to ensure that there is unit redundancy (i.e. standby pumps) in the event of a pump failure. This will require an update to the electrical power supply and gears as well as additional building space.
P7	TPS Electrical Redundancy	Install backup electrical supply at TPS that will allow the site to maintain normal operations in the event of damage or interruption of electrical service on the existing single feed.
P8	Filtration and Chlorination Studies	Increase production capacity by completing the studies/pilot work needed to increase the allowable filtration rate and decrease the required disinfection Ct. Add remote ammonia dosing point for downstream chloramination
P9	SCADA and Controls Upgrade	Upgrade the current control system to meet current and projected future operational needs of the SBWR production and distribution systems

Notes

[1] Condition Assessment projects address existing deficiencies in the RWF treatment infrastructure needed for normal plant operation and discharge of effluent and will be addressed as part of the RWF Master Plan. The condition assessment improvements are not for the primary purpose of recycled water production.

4.3.3 SBWR Distribution System Reliability Improvement Projects

The projects described in this section would improve reliability within the SBWR distribution system. The proposed projects include improvements to the existing infrastructure as well as construction of new infrastructure. Note that some of the system projects described previously under System Reliability Projects will benefit the distribution system, but have further positive impacts. The following have been identified as potential projects to improve SBWR Distribution Reliability.

Table 4-7: Summary of Potential SBWR Distribution Reliability Projects

Project Number	Project Name	Purpose
D1	Condition Assessment Projects	Implement recommendations from the 2010 SBWR Condition Assessment report to address existing deficiencies.
D2	Valve Exercising Program	Develop and implement comprehensive valve exercising program targeting most critical valves on the backbone pipeline system
D3	Valve Installation	Install additional line isolation valves such that the system outages for maintenance and repair work can be reduced to a reasonable time
D4	Address Transients between Pump Station 5 and Pump Station 8	Investigate and implement surge control improvements to address transients and vulnerabilities caused by pressure spikes,
D5	Upgrade Pump Station 5 Bypass	Construct new 42-inch diameter bypass pipe bridging between the upstream and downstream 42-inch backbone pipeline to and from Pump Station 5 to provide redundancy for taking P.S. 5 out of service for maintenance.
D6	Automate Zone Bypass Valve at Pump Station 8/11	Add control solenoid to allow remote operation of the bypass valve to deliver recycled water into Zones 1 and 2 from Zone 3 storage
D7	Calibrate Existing Meters	Implement a systematic customer and SBWR production meter inspection and calibration program to reduce mismatch between customer meter use and the TPS metered volumes. These calibrations will serve as a guide for future Master Meter installations.
D8	Additional Pipeline Looping	Add distribution pipe looping to improve the conveyance reliability through the system. Eight separate pipeline projects are included under this project description
D9a	Zone 1 Storage	Add 6 MG of additional Zone 1 storage.
D9b	Elevated Zone 2 Storage	Add 6 MG of new Zone 2 storage to reconfigure the SBWR pumping and storage facilities to align with the pressure zones and improve operational efficiency.
D10	Health and Safety Facilities at Pump Stations	Build appropriate health and safety facilities at pump stations (for example, a toilet and sink at Station 5)
D11[7]	HVAC Upgrades at PS 5 and PS 8/11	Upgrade HVAC in electrical rooms to prevent VFD shutdowns due to high heat

[7] This project was added based on later discussions with SBWR staff and was not part of the original projects discussed at the Reliability Workshop.

4.4 Prioritization of Proposed Projects

The projects were evaluated based on the vulnerabilities they address, the estimated costs of implementation, and any secondary benefits they might provide. After preliminary evaluation by the consultant, the results were presented at a Reliability Workshop held with staff from RWF, SBWR and SCVWD. The purpose of the workshop was to obtain staff input on the recommended prioritization of the reliability projects. The prioritization results presented in this Section represent the combined efforts of the consultant team, the RWF/SBWR staff, and ESD management.

The prioritization uses a 1 to 4 rating system as follows:

> Priority 1: Single Point of failure on critical system/component that affects ability to produce or deliver recycled water
>
> Priority 2: Project is considered critical and implementation should begin as soon as possible.
>
> Priority 3: Project provides benefits but SBWR Operations doesn't view it as a current critical need
>
> Priority 4: Project not considered critical at this time for continued reliable operation

Table 4-8 summarizes the proposed reliability improvement projects, the benefits provided by each project, the estimated cost of the project, and the project prioritization.

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Table 4-8: Summary of Near-Term Reliability Project Prioritization

Project Number	Project Name	Description	Benefits Provided	Estimated Cost Range	Prioritization
System-Wide Projects					
S1	Streamline Customer Service Protocols and Procedures	Update communications protocols and procedures and assign roles and responsibilities for SBWR and its retailers to reduce RWF staff time spent responding to customer issues	• Updated communication protocols, clarification of roles and responsibilities between SBWR and retailers. • Clarifies role of SBWR as wholesaler with customer support provided primarily by the retailers which reduces SBWR staff time needed to respond to customers • Maintains/improves LOS by providing clear communications with customers	\$100 - \$200 thousand	4
S2	Implement Next Phase of Asset Management Program	Actively managing the existing and future assets of the SBWR system, the remaining useful life of system assets can be extended while also providing justification for planning and funding of asset maintenance and replacement.	• Maintains the value of the SBWR assets through proactive preventative maintenance and equipment rehab/replacement. • Provides established basis for prioritizing system maintenance and renewal for funding	\$100 - \$200 thousand	4
S3	Seismic Reliability Assessment	Address a current gap in knowledge related to the seismic vulnerabilities of the SBWR system. Delineates LOS goals for post-seismic event and selection of a design seismic event	• Provides basis for developing additional reliability projects to address critical vulnerabilities that have a large consequence of failure related to LOS. • Provides SBWR with opportunity to do contingency planning for system recovery post-earthquake	\$200 - \$300 thousand	3

Project Number	Project Name	Description	Benefits Provided	Estimated Cost Range	Prioritization
S4	Obtain Program Support Equipment	Obtain vehicles, radios, tools, etc. needed to respond to pump station assignments and eliminate need for staff to use their own vehicles for these assignments.	• Enhances ability to respond to pump station normal operation and emergency conditions by providing operators with needed support equipment	$100 - $200 thousand	3
S5	Update SBWR Systems Operations Manual	Update O&M Manual to provide standardization in system operating procedures and eliminate inconsistent system operations.	• Establishes reliable, efficient, and standardized operating procedures • Incorporates new operational studies and hydraulic modeling to optimize operations and reduce costs • Provides transfer of knowledge as senior operators retire and are replaced with new staff • Standard operations will reduce existing flow fluctuations which will improve salinity blending and improve LOS.	$100 - $200 thousand	1
S6	Additional SBWR Distribution System Monitoring Stations	Evaluate locations and types of monitoring devices that could be added to the SBWR system to allow for better day-to-day control of the system as well as provide early detection of system trouble	• Provides real-time system monitoring data to help optimize system operations and provide information to manage the 103-milelong pipeline system • Provides advanced trouble detection in system and opportunity for operator intervention prior to an unplanned shutdown • Would provide information to	$1 - $4 million	3

Project Number	Project Name	Description	Benefits Provided	Estimated Cost Range	Prioritization
			validate retailer demands, identify system trouble, and better account for system lost water/revenue.		
S7	Investigate Additional Backup Supplies	Investigate potential sources and the feasibility of implementing a significant back up water supply that would allow SBWR to operate during a process upset or outage at the RWF	• Enhances customer LOS by providing significant back up water supply that would allow SBWR to operate during a process upset or outage at the RWF • Reduces the need for customer back up supplies and cost of maintaining and operating those supplies	\$100 - \$200 thousand	4
RWF Production Projects					
P1	Address Condition Issues from Condition Assessments Reports	Address existing deficiencies outlined in the RWF Condition Assessment reports including code compliance, seismic upgrades, electrical upgrades, equipment replacements.	• Addresses a number of significant deficiencies within the RWF boundaries. • Addresses multiple points of potential condition related failures in the production process	N/A(1)	N/A(1)
P2	Parallel Backwash Pipeline	Add a parallel backwash pipeline to support inspection, maintenance and rehabilitation without the need to shut down the filter process.	• Eliminates potential single point of failure • Addresses condition vulnerability caused by significant corrosion • Provides opportunity to take existing pipe out of service for inspection and maintenance.	N/A(1)	N/A(1)
P3	Filter Capacity Upgrade	Convert four additional filtration cells for recycled water	• Doubles the recycled water filtration capacity up to ~80 mgd	N/A(2)	Already being implemented

Project Number	Project Name	Description	Benefits Provided	Estimated Cost Range	Prioritization (2)
		production to increase filter production capacity.	(at current filtration rates) • Eliminates the filtration process as a capacity constraint for recycled water production		
P4	Parallel Pipeline to TPS	Retrofit CCC#3 for recycled water treatment and designing and construct a parallel pipeline from the filter building/CCCs to TPS to increase disinfection capacity.	• Addresses potential single point of failure by providing redundant pipe from RWF to TPS • Provides opportunity to take main pipe out of service during winter for maintenance and cleaning accumulated silt. • Increases disinfection capacity by adding additional Ct.	\$10 – \$12 million	3
P5	Recycled Water Storage at TPS	Construct recycled water storage tank at TPS to decouple production facilities from TPS distribution and to improve salinity control of the blended SVAWPC permeate/recycled water.	• Addresses operational challenges associated with the linkage between TPS pumping and recycled water production and allows the recycled water production to operate at more even rate • Provides opportunity to shut down production facilities to facilitate inspection and maintenance, without shutdown of TPS. • Improves salinity control of the blended product water by providing better blending facilities and decreasing the diurnal peaking factors on the production side.	\$15 – 18 million	3

Project Number	Project Name	Description	Benefits Provided	Estimated Cost Range	Prioritization
			• May support shifting of TPS pumping loads to lower cost periods under a beneficial energy rate schedule.		
P6	TPS Capacity Upgrade	Provide additional TPS pumps/capacity to ensure that there is unit redundancy (i.e. standby pumps) in the event of a pump failure.	• Increases TPS capacity to ensure that there is unit redundancy (i.e. standby pumps) in the event of a pump failure • Increases TPS capacity to meet long-term peak demands	\$1 - \$3 million	1 (Revised from Priority 3)[3]
P7	TPS Electrical Redundancy	Install backup electrical supply at TPS that will allow the site to maintain normal operations in the event of damage or interruption of electrical service on the existing single feed.	• Addresses potential single point of failure and provides reliable backup electrical supply to TPS.	\$400 - \$600 thousand	3
P8	Filtration and Chlorination Studies	Increase production capacity by completing the studies/pilot work needed to increase the allowable filtration rate and decrease the required disinfection Ct. Add remote ammonia dosing point for downstream chloramination.	• Increases rated production capacity to meet peak near-term plus committed demands. • Allows all filters, and potentially all CCC's to be operated for recycled water production, simplifying operations and increasing redundancy. • Potentially reduces NDMA formation by using free chlorine for disinfection followed by chloramination.	\$800,000 - \$1 million	1
P9	SCADA and Controls Upgrade	Upgrade the current control system to meet current and projected future operational	• Address current deficiencies within the SBWR control system including limited functionality,	\$7 – \$9 million	2

Project Number	Project Name	Description	Benefits Provided	Estimated Cost Range	Prioritization
		needs of the SBWR production and distribution systems	and difficulty in servicing and obtaining spare parts for obsolete equipment • Updates control strategies and algorithms to improve operational efficiency. • Provides equipment and programming for integration of RWF DCS with the remote site PLCs • Reduces burden on operators currently operating system manually by implementing control algorithms that allow the system to self-regulate during normal operations. • Provides enhanced trouble detection ability that can allow operator intervention ahead of an unplanned outage. • Would be integrated with updated operations manual, including a more streamlined manual that has reduced manual operation description		
Distribution Projects					
D1a	Condition Assessment Projects (2014-2015 Projects)	Implement recommendations from the 2010 SBWR Condition Assessment report to address existing deficiencies. This project is for the first phase of projects,	• Defines near-term maintenance and renewal program for ongoing SBWR system viability • Improves ability to maintain LOS by addressing existing, known	$18 – $21 million	2

Project Number	Project Name	Description	Benefits Provided	Estimated Cost Range	Prioritization
		identified as the 2014-2015 projects in the Condition Assessment	condition deficiencies. • Maintains asset value and performance of existing system and provides a safe working environment		
D1b	Condition Assessment Projects (2016 – 2010 Projects)	Implement recommendations from the 2010 SBWR Condition Assessment report to address existing deficiencies. This project is for the first phase of projects, identified as the 2016-2020 projects in the Condition Assessment	• Defines near-term maintenance and renewal program for ongoing SBWR system viability • Improves ability to maintain LOS by addressing existing, known condition deficiencies.	$20 – $23 million	4
D2	Valve Exercising Program	Develop and implement comprehensive valve exercising program targeting most critical valves on the backbone pipeline system	• Reduces duration of planned or emergency outages by keeping existing distribution system isolation valves in acceptable working order. • This is a baseline maintenance activity that should be done as part of normal operations.	<$100 thousand	2
D3	Valve Installation	Install replacement and additional line isolation valves such that the system outages for maintenance and repair work can be reduced to a reasonable time	• Reduces duration of planned or emergency outages by reducing the length of pipe that would need to be dewatered for pipe maintenance or repair. • Replacement of failed (frozen) valves maintains current SBWR system LOS	$1 – $4 million	3
D4	Address Transients between Pump	Investigate surge control improvements to address	• Eliminates a potentially damaging ongoing operating	$200 – $300 thousand	3

Project Number	Project Name	Description	Benefits Provided	Estimated Cost Range	Prioritization
	Station 5 and Pump Station 8	transients and vulnerabilities caused by pressure spikes,	condition. • Reduces vulnerability of distribution system equipment and piping failures caused by pressure surges		
D5	Upgrade Pump Station 5 Bypass	Construct new 42-inch diameter bypass pipe bridging between the upstream and downstream 42-inch backbone pipeline to and from Pump Station 5 to provide redundancy for taking P.S. 5 out of service for maintenance.	• Allows backbone pipeline to remain in service if PS 5 is out of service for maintenance or repairs (double isolation requirement) • Allows recycled water to flow back from storage reservoirs to Zone 1	$300 - $500 thousand	1
D6	Automate Zone Bypass Valve at Pump Station 8/11	Add control solenoid to allow remote operation of the bypass valve to deliver recycled water into Zones 1 and 2 from Zone 3 storage	• Allows zone bypass reducing valve at Pump Station 8/11 to be activated remotely, eliminating need for operators to manually open two isolation valves to initiate zone valve operations. • Reduces disruptions in lower zone supply by allowing remote operation of the zone valve to deliver recycled water into Zones 1 and 2 from Zone 3 storage.	<$50 thousand	2
D7	Calibrate Existing Meters	Implement a systematic customer and SBWR meter inspection and calibration program to reduce mismatch between customer meter use and the TPS metered volumes. These calibrations will serve as a	• Provides valuable check on metering accuracy and water balance within the SBWR distribution system. • Ensures equitable billing for customer water use	$100 - $200 thousand	4

Project Number	Project Name	Description	Benefits Provided	Estimated Cost Range	Prioritization
		guide for future Master Meter installations.			
D8	Additional Pipeline Looping	Add distribution pipe looping to improve the conveyance reliability through the system. Eight separate pipeline projects are included under this project description.	• Improves potential LOS vulnerabilities by adding looping (redundant) pipelines to improve current branch distribution system configuration. • Addresses inequities in level of service among retailers since customers served by the City of Milpitas and San José Water Company retailers and customers in the south end of the system have limited pipeline redundancy.	$60 thousand - $106 million depending on which pipelines are included	4
D9a	Add Zone 1 Storage	• Add approximately 6 million gallons of Zone 1 storage, equal to approximately 25% of maximum day demands.	• Improves current mismatch between storage and location of demands. Zone 1 has the highest demands but has no storage reservoir. • Improves reliability of existing distribution system, which is difficult to operate, manually intensive, and potentially prone to outages due to lack of storage and automated controls. With increased demands expected by 2015, hydraulic modeling suggests that the current system configuration may become unstable during high demand	$40 - $50 million (Costs shown are for adding new Zone 1 storage tank.)	1

Project Number	Project Name	Description	Benefits Provided	Estimated Cost Range	Prioritization
			periods and prone to unplanned customer and/or system shutdowns (e.g. emptying storage tanks, dropping system pressures) • Provides gravity flow of recycled water to Zone 1 customers in the event of power outage. • Improves ability to meet LOS goals, particularly for Zone 1 customers • Reduces the peaking factors at TPS thereby reducing the swings in production rates and making it easier to maintain a uniform blend of permeate/tertiary effluent		
D9b	Elevated Zone 2 Storage	Add 7.75 MG of new Zone 1 storage and 1.5 MG of new Zone 2 storage. Note that Project D9a would be needed as a predecessor to this project.	• Reconfigures the SBWR pumping and storage facilities to align with the pressure zones • Improves operational efficiency. • Allows PS 5 or PS8 to be taken out of service thereby reducing overall power costs • Reduces the burden on the existing pump stations as “on demand” facilities and provides opportunities to shift pumping loads to lower power cost periods	$36- $39 million	3

Project Number	Project Name	Description	Benefits Provided	Estimated Cost Range	Prioritization
D10	Health and Safety Facilities at Pump Stations	Build appropriate health and safety facilities at pump stations (for example, a toilet and sink at Station 5)	• Provides basic level of health and safety facilities for operations and maintenance staff at remote pump stations	<$100 thousand	3
D11 [4]	HVAC Upgrades at PS 5 and PS 8/11	Upgrade HVAC in electrical rooms to prevent VFD shutdowns due to high heat	• Increased HVAC cooling will extend service life of VFDs by 50% • Increased cooling will prevent shutdowns of VFDs and reduce potential for emergency shutdowns and repairs	$60 thousand	2

Notes:

[1] Projects P1 and P2 address condition assessment/reliability projects needed for the normal RWF wastewater treatment functions, not specifically for recycled water production. These two projects have been identified and included in the RWF Master Plan and the costs to implement them are included in the RWF budget.

[2] Project P3 is already being implemented by the RWF staff so costs of implementation are not included here.

[3] Project P6 revised to a priority 1 project as additional TPS capacity is needed for the near-term flows based on the implementation schedule for the Zone 1 project.

[4] This project was added based on later discussions with SBWR staff and was not part of the original projects discussed at the Reliability Workshop.

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4.5 Proposed 5-year SBWR CIP

After the initial prioritization that occurred during the Recommendations Workshop, the Priority 1 and 2 were further evaluated through discussions with SBWR staff and ESD management. These discussions resulted in an evaluation of consequences posed by potential levels of risks as the infrastructure ages and the recycled water demands increase, and how the Priority 1 and 2 projects could alleviate those potential risks. This discussion is summarized in Table 4-9. It should be noted that this discussion assumed maintaining a LOS similar to that of the existing system. It is recommended that the SBWR partners develop a more formal LOS plan as a guide to development and implementation of major SBWR system improvements.

Table 4-9: Level of Service Consequences

Level of Service Risk	History Commentary	Potential Consequences	Capital Projects and Options
Adequate Flow and Pressure			
TPS Large Pump Capacity does not meet projected peak hour flows. (Two 14.7 mgd, Two 11.4 mgd = 52.2 mgd)	When equipment and infrastructure was newer (<10 years old) it was more reliable. When the recycled water demands were lower, several of the TPS pumps could act as spares since they weren't all needed to meet the peak flows.	No Large Spare Pump at TPS Peak Hour. Potential outages: • Electrical service interruption (no backup power) • Pump motor failure (age issue risk) • Pump VFD failure (age issue risk) • Valves failure (age issue risk) • Inability to meet peak flows	• D1a - Renew and renovate pump station; and • P6 - Add Pump; or • D9/D5 - Add Zone 1 Storage to reduce TPS peaking requirement
RW Filter Capacity 38 mgd at 5 gpm/sf loading rate does not meet projected peak hour flows.	At lower demand, there was a spare filter.	Filter capacity needed for peak hour TPS pumping. Potential outages: • Filter Valve Failure (numerous valves) • Backwash pipeline leak • Other mechanical failures (underdrain system, wash arms, etc.) • Inability to meet peak flows	• P8a - Filter rerating project increases capacity minimizing outage. • D1a - Filter Rehab project will address age issues • D9/D5 - Zone 1 Storage helps to alleviate Peak filtration capacity need • SVAWPC capacity has reduced the risk of low flow and pressure.
Chlorination Capacity 44.3 mgd at 90 minute CT does not meet projected peak hour flows.	Facility age was not a concern previously. Shutdowns were easier with low demand and lower industrial use.	Chlorination capacity needed for peak hour TPS pumping. Potential outages: • Contact channel maintenance • Inability to meet peak flows	• SVAWPC capacity has minimized the risk of low flow and pressure. • P8b - Free chlorine project increases capacity. • D9/D5 - Zone 1 Storage provides time for chlorination shutdown

Level of Service Risk	History Commentary	Potential Consequences	Capital Projects and Options
Reliance on manual operation combined with high demands increases system vulnerability related to any kind of Operations misstep on Reservoir Fill or Pump 5/8/11 Operation -	At lower demand, minimal operator effort was needed to produce and distribute recycled water. Antiquated Control System requires increased operator attention to manually operate/balance the system.	As demands have increased and continued to increase the operational flexibility to produce and distribute recycled water has eroded. Potential outages: • Inability to fill reservoirs during lower demand periods could jeopardize ability to meet peak flow demands	• P9 – SCADA and Controls Upgrade limits operator low function utilization • S5 - Operations Manual Update
Equipment and Infrastructure failure due to aging infrastructure.	When equipment and infrastructure was newer (<10 years old) it was more reliable.	As equipment and mechanical systems age, shutdowns are needed for maintenance, restore, and rehabilitate. Potential outages: • Older equipment can lead to unplanned outages that will impact delivery and service to customers.	• D1, D2, D11, and other projects identified from Asset Management Program. • D6 - Automate Zone Bypass Valve at Pump Station 8/11 (Operational flexibility - Low cost operations enhancement to allow Zone 3 reservoirs to feed Zone 2)
Pressure Transients			
Higher flow rate from TPS results in more pressure transients	At lower demands, there were fewer pressure transients.	Pressure transients increase wear and tear on system. i.e. pipeline fatigue Potential outages: • Infrastructure failures resulting in leaks and unplanned outages	• D9/D5 - Add Elevated Zone 1 Storage help reduce pressure transient

Based on the prioritization during the Recommendations Workshop and subsequent evaluation of level of service risks, a 5 year CIP has been developed to include the Priority 1 and Priority 2 projects needed to address critical and urgent SBWR deficiencies identified in the SBWR Reliability Assessment. These priority projects fall within the following categories.

1. Production Capacity: The near-term peak hour demand is projected to be 53 mgd which exceeds the existing capacity of the recycled water production facilities. The proposed 5 year CIP includes implementation of Project P6 and P8.

    a. Project P6 TPS Capacity Upgrade: Add an additional 14.7 mgd (~1,000 hp) pump to match existing large pump capacity. This increases total firm capacity of TPS to approximately 56.2 mgd assuming one 14.7 mgd standby pump and one 4 mgd pump out of service. Design for the project should include evaluation of existing pump station capacity as age related wear may be an issue. Pump station hydraulic performance should also be confirmed for in the increase flow rate and head, and to confirm clearwell hydraulic characteristics.

    Project P8 Filtration and Chlorination Studies have been divided into the following projects:

    a. Project P8a: Conduct filtration studies and implement associated improvements to increase allowable hydraulic loading rate to filters (filter flux rate). Assuming regulatory approval is given to increase the filter flux rate to 7.5 gpm/sf, the recycled water filtration capacity using 4 filter cells would increase to 57 mgd, which is adequate to meet the near-term peak hour demands.

    b. Project P8b: Conduct chlorination studies and implement associated improvements to convert to free chlorine disinfection and obtain regulatory approval for decreased chlorine contact time. Assuming regulatory approval is given for a chlorine contact time of 20 minutes, the disinfection capacity for recycled water would increase to approximately 200 mgd.

    The Production Capacity projects will be needed to reliably meet the near-term peak hour demands of the system. The table below shows the existing capacity of the TPS, filtration and chlorination system without the modifications described above versus the estimated near-term recycled water flow rates. The existing production capacity is marginally adequate for the estimated peak day (with the exception of the peak day flow rate with SCVWD), but is inadequate to meet estimated peak hour flows. Until the production capacity projects can be completed, the City may need to implement demand management strategies to decrease the peak hour flow rates. Demand management strategies could include working with existing customers to more closely manage the timing of recycled water use or requiring new irrigation customers to irrigate between 2 pm and 7 pm to avoid the peak demand hours. Industrial customers have minimal impact on peak so new industrial customers could still be approved. In addition ,new small Zone 3 customers could move forward since existing Zone 3 storage trims the peak hour flow rates in that zone.

Table 4-10: Estimated Near-Term TPS Flow Rates vs Production Capacity

	Flow Rate w/o SCVWD	Flow Rate w/SCVWD	Existing TPS Capacity, mgd	Existing Filtration Capacity, mgd	Existing Disinfection Capacity, mgd
Annual RW Flow, AFY	15,000	20,000			
Daily Average, mgd	20.4	25.4	41.5	38.1	44.3
Peak Month, mgd	30.6	35.6	41.5	38.1	44.3
Peak Day, mgd	34.5	39.5	41.5	38.1 (inadequate for peak day w/SCVWD)	44.3
Peak Hour, mgd	48.3	53.3	52.2 (inadequate for peak hour)	38.1 (inadequate for peak hour)	44.3 (inadequate for peak hour)

2. Distribution System Capacity/Reliability: The existing distribution system is difficult to operate, manually intensive, and potentially prone to outages due to lack of storage and automated controls. With increased demands expected by 2015, hydraulic modeling suggests that increased storage is needed in Zone 1, the zone with the highest demand, to provide an operable system during high demand periods (e.g. minimize the chance of empty storage tanks, dropping system pressures). The proposed 5 year CIP includes two projects for improving reliability of service to Zone 1:
    a. Project D5 Pump Station 5 Bypass: Construct a new 42-inch diameter bypass pipe and isolation valves at 12th Street and Keys Street bridging between the upstream and downstream 42-inch backbone pipeline to and from Pump Station 5. This will enable taking Pump Station 5 out of service for maintenance while still keeping the backbone pipeline to remain in service.
    b. Project D9 Zone 1 Storage: Add operational storage to the Zone 1 distribution zone. Approximately 6 million gallons of storage is needed to meet a goal of providing storage equivalent to approximately 25% of maximum day demands in Zone 1.
3. Restore/Rehabilitate Existing Condition-Related Deficiencies: Addressing the existing system condition deficiencies is necessary to maintain the SBWR infrastructure assets in reliable working condition. Note that for the sake of the CIP, Project D1a has been divided into two separate projects:

a. Project D1a-1 Replace Pump Station 5 VFD's. These VFD's are obsolete and have exceeded their expected service life. Replacement of the VFD's is needed to reduce the potential for emergency shutdowns due to VFD failure. [8]

b. Project D1a-2 Other Condition Assessment Projects (2010-2015 Projects). Establish a budget to begin addressing the other near-term rehabilitation projects identified in the July 2010 SBWR System condition Assessment report. This project(s) needs to begin with a reassessment of SBWR equipment and infrastructure to prioritize capital needs. Collaboration is needed between City engineers, operations and maintenance staff and other parties to develop a work plan and strategy for ongoing rehabilitation.

c. Project D2 Valve Exercising Program. Develop and implement a comprehensive valve exercising program that would target the most critical valves on the backbone pipeline system, including line isolation valves and air valves (including associated small isolation valves). The program would implement routine valve exercising of all system valves every one to two years.

d. Project D11 Electrical Room HVAC Upgrades. Upgrade the HVAC in the electrical rooms of PS 5 and PS 8/11 to reduce VFD shutdowns due to high heat.

4. <u>Update Control Strategies/Equipment:</u> These projects include updated control strategies and equipment to enable more stable and efficient operation of the distribution system.

a. Project P9 SCADA and Controls Upgrade. The following portions of P9 are recommended for the 5 year CIP:

- Project P9a Automate Filter Backwash Process. Implement an automated backwash process initiated and controlled by a programmable logic controller. Currently, the backwash process is manually controlled requiring 40 minutes of operator time per backwash event.
- Project P9b Automate distribution system controls. Replace the current manual control system with an automatic control system to automate operation of the distribution pump stations and timing for reservoir filling. Automated system would lead to system optimization and improved energy efficiency.

b. Project D6 Automate Zone Bypass Valve at PS 8/11. Implement remote activation of zone bypass t PS 8/11 to allow water from Zone 3 back to Zone 2.

[8] The D1-a projects initially included replacement of a 54" flow meter, thought to be part of the discrepancy between measured TPS flows and water retailer records. Communication from the RWF in September 2014 stated that upon further review that staff from operations, instrumentation and SBWR engineering agreed that the 54"meter does not need replacement at this time so this project was removed from the near-term recommendations.

5. Provide Additional Operator Support: Many of the procedures on how to operate the SBWR facilities have been developed by trial and error over the last twenty years of operation and passed on from one operator to another. The distribution system currently relies primarily on manual control by the SBWR operators and the procedures on how to operate the system efficiently can vary among the operators. The following project is included in the 5 year CIP to address this vulnerability:

    a. Project S5 Update SBWR O&M Manual. Updating the SBWR O&M Manual establishes reliable, efficient, and standardized operating procedures and protects the institutional knowledge of system operations by documenting the transfer of knowledge to new staff as senior operators retire.

Table 4-11 summarizes the SBWR reliability projects recommended for the 5 year CIP.

Table 4-11: Recommended SBWR 5 year CIP

Project Number	Project Name	Estimated Cost Range
Increase Production Capacity		
P6	TPS Capacity Upgrade	$1 - $3 million
P8a	Filter Flux Rate	$75,000
P8b	Free Chlorine Disinfection Studies/Implementation	$500,000 - $1,000,000
Improve Distribution System (Peak Hour Capacity)		
D5	Upgrade Pump Station 5 Bypass	$300,000 - $500,000
D9	Zone 1 Storage	$40 million
Restore/Rehabilitate Existing Condition-Related Deficiencies		
D1a-1	PS 5 VFDs	$60,000
D1a-2	Other Condition Assessment Projects (2014-2015 Projects)	$2 million
D2	Valve Exercising Program	<$100,000/year
D11	PS 5 and PS8/11 Electrical Room HVAC replacement	$150,000 – $250,000
Update Control Strategies/Equipment to Improve Operational Efficiency		
P9a	Filter Backwash Automation	$100,000 – $500,000
P9b	Distribution System Automation	$650,000 – $2,150,000
D6	Automate Zone Bypass Valve at Pump Station 8/11	<$50,000
Provide Operator Operations Support		
S5	Update SBWR Systems Operations Manual	$100,000 - $200,000
Total Cost of CIP		**$45 - $49 million**

More information on each of the 5 year CIP projects can be found in Appendix 4B.

4.5.1 Project D9 Zone 1 Storage Siting Study

To provide more planning level information on Project D9 Zone 1 Storage, a Siting Study was completed to evaluate four potential storage site locations and identify a recommended Zone 1 storage site. The Siting Study identified pipeline routing to each candidate site, defined storage volume and pumping requirements (if applicable), described hydraulic modeling results, and compared the sites relative to system operability, reliability, energy use, O&M requirements, and environmental constraints. The Zone 1 Storage Siting TM Study is included in Appendix 4C. The Environmental Constraints Analysis for the reservoir sites is included in Appendix 4D.

Figure 4-3 shows the four sites evaluated which were selected based on (a) property ownership by either the City of San José or a recycled water retailer (i.e. City of Santa Clara, San José Water Company) and (b) the owner identifying the property as available.

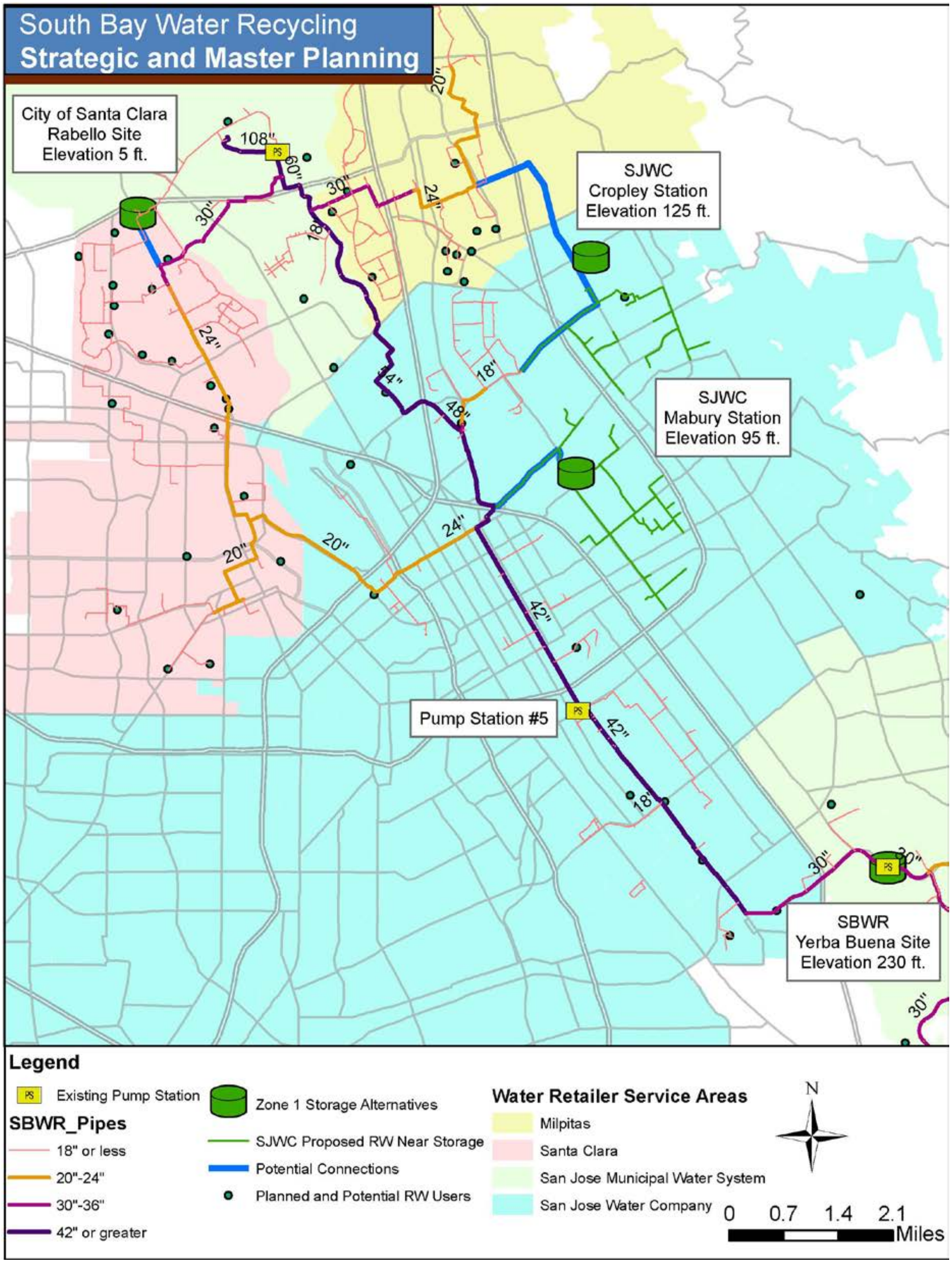
The four sites evaluated were:

- Cropley Station (land owned by San José Water Company)
- Mabury Station (land owned by San José Water Company)
- Rabello Pump Station (land owned by City of Santa Clara)
- Yerba Buena Storage and Pump Station 8/11 (land owned by City of San José)

The Cropley Station, Mabury Station, and Rabello Pump Station sites are non-elevated storage sites meaning they would require adjoining pump stations to deliver stored water back to the system. The Yerba Buena site is an elevated storage in which the reservoir elevation matches the Zone 1 hydraulic grade line elevation. Elevated storage tanks do not require an adjoining pump station for the Zone served.

Other potential privately owned sites were considered as options but initial discussions with property owners indicated no willingness to participate with the project so the privately owned sites were not included in the Siting Study.

Figure 4-3: Potential Zone 1 Storage Sites



Storage Analysis

Table 4-12 summarizes the existing and projected demands by zone and the target storage volume needed in each zone. A recommended target storage volume of 50 percent maximum day demands was established to provide increased reliability and operational flexibility. The target storage needed is considered a long-term goal and was not economically feasible in the near-term. Therefore, an incremental approach is recommended to provide 6 MG in the near-term (2 to 5 years).

The primary function of Zone 1 storage is to provide diurnal peak demand shaving and increase the peak capacity of the system to serve customers commitments. Figure 4-4 shows the existing and projected Zone 1 diurnal patterns. Ideally, Zone 1 storage would allow the TPS to pump at a relatively constant flow rate over 24 hours. When recycled water demand falls below the daily demand the tank would fill and when demand rises above the daily demand the tank would provide the additional supply to the system.

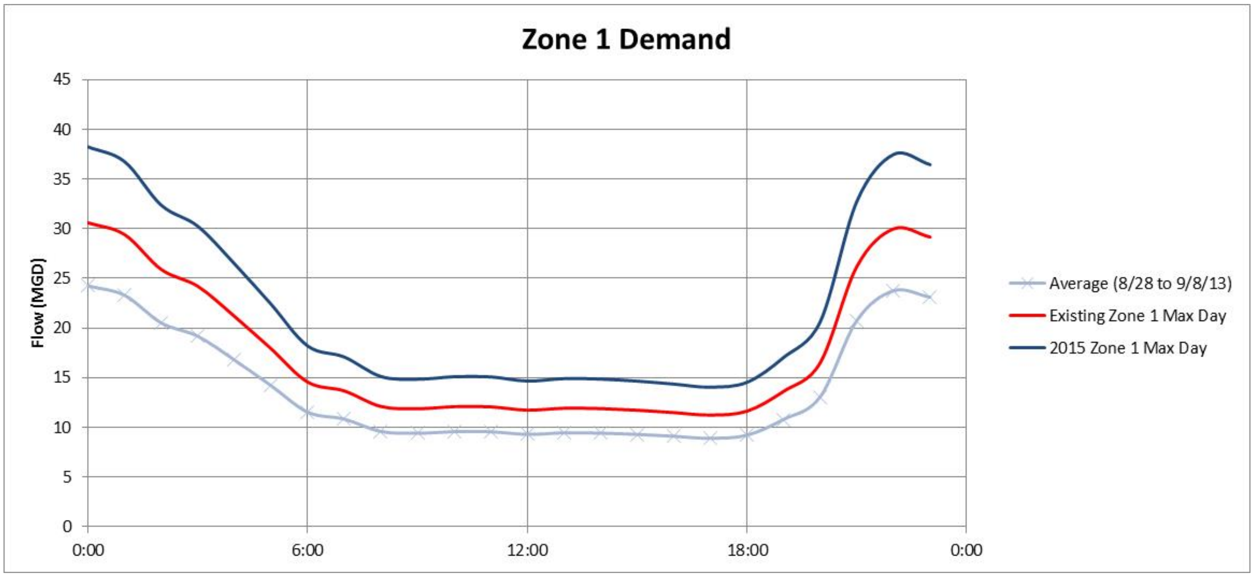
Table 4-12: Demand By Zone, Existing Storage, and Target Storage

	Existing Max Day (mgd)	Near-term Max Day (mgd)	Near-term w/ SCVWD Max Day (mgd)	Existing Storage (MG)	Target Storage (MG)	Target minus Existing Storage (MG)
Zone 1	17.6	22.0	22.0	0	6.0[b]	6.0
Zone 2	1.9	2.5	2.5	4	1.75[a]	-2.25
Zone 3	5.1	5.1	10.1	5.5	5.0[a]	-0.5
Villages	0.7	0.7	0.7	0	0.35	0.35

Footnotes:

a. Target storage for Zones 2 and 3 is based on 50% of “Near-term + SCVWD Max Day” demand.
b. For Zone 1, the 50% max day demand storage criterion equates to 11 MG of storage which would entail a significant capital expenditure. Given the limitations on capital funding, the SBWR system hydraulic model was used to evaluate system performance with storage volume less than the 11 MG identified. Modeling indicated that 6 MG of Zone 1 storage was adequate to stabilize the system. The Zone 1 recommended volume of 11 MG remains a long term objective to provide operational flexibility and system reliability.

Figure 4-4: Zone 1 Existing and Projected Max Day Demands



Notes:

1. This figure shows the demand for Zone 1 customers and does not include pass through flow for other Zones.

Alternative Comparison

The Cropley Station and Mabury Station are significant sites with the potential to accommodate 6+ MG of storage in above grade circular tanks. The Rabello Pump Station site has a smaller area with a potential for 2 to 3 MG in an above grade circular tank arrangement. The Yerba Buena site contains an existing 4 MG storage tank, Pump Station 8/11, and has the potential to add an additional 6+ MG of storage.

With a near term storage target of 6 MG, various alternatives were developed assuming either a single site to accommodate 6 MG or two tank locations with total volume of 6 MG. Table 4-13 shows a comparison of the alternatives relative to economic and non-economic criteria.

Table 4-13: Alternative Comparison

	Criteria	Cropley (3MG)/ Rabello (3MG)	Mabury (3MG)/ Rabello (3MG)	Cropley (3MG)/ Mabury (3MG)	Yerba Buena (4 MG) w/ New PS11[2, 3]	Mabury Station (6MG)	Cropley Station (6MG)
	Economic						
1	Total Capital Cost	$38,000,000	$32,000,000	$41,000,000	$40,000,000	$27,000,000	$43,000,000
2	Annual O&M Costs	$679,000	$644,000	$631,000	-$277,000	$419,000	$491,000
3	Present Value O&M Cost	$13,000,000	$13,000,000	$12,000,000	-$5,000,000	$8,000,000	$10,000,000
4	Net Present Value (Capital and O&M)	**$51,000,000**	**$45,000,000**	**$53,000,000**	**$35,000,000**	**$35,000,000**	**$53,000,000**
5	San José Property Ownership (No Land Lease required)				X		
6	O&M Savings				PS5 Retired		
7	New PS 11 Asset				X		
8	PS5 Asset Renewal Savings				X		
9	Energy Grant funding				X		
	System Performance/Hydraulics						
10	Reduced Energy Consumption				X		
11	Minimize Pressure Transients				X		
12	Located Further South		X (Mabury)	X (Mabury)	X	X	
13	Close to Transmission Line		X (Mabury)	X (Mabury)	X	X	
14	Located Near Significant Demand	X (Rabello)	X (Rabello)				
15	Active Flow Control From Storage Tanks	X	X	X		X	X
16	Total Storage	6	6	6	6	6	6
	Other Benefits (Low Labor, Reliability, etc.)						
17	Lowest Maintenance				X		
18	Simplest SCADA Operation				X		
19	Reduced Energy Consumption and Maintenance at TPS				X		
20	High Reliability Benefit for Retailer	SC (Rabello), SJWC (Cropley) and MP (Cropley)[2]	SC (Rabello), SJWC (Mabury)	MP (Cropley)[1], SJWC (Mabury, Cropley)	SJWC (YB) and Muni (Zone 3)	SJWC	MP[1], SJWC
21	High Multiple Zone Benefit				X (Zone 1, 2, and 3)		
22	No Zone 2 Service/Policy Impact	X	X	X		X	X
23	Zone 1 Distributed Storage Benefit	X	X	X			
	Design Benefits						
24	Additional Pipe Length Required	Cropley: SJ 10,500 LF[4] of 18", 2,000 LF of 24", MP: 11,000 LF of 20" Rabello: 4,200 LF of 24"	Mabury: 10,000 LF of 30" Rabello: 4,200 LF of 24"	Cropley: SJ: 10,500 LF[4] of 18", 2,000 LF of 24", MP: 11,000 LF of 20" Mabury: 10,000 LF of 24"	11,800 LF of 42-inch 9,600 LF of 20"	10,000 LF of 36"	MP: 11,000 LF of 20" SJ: 18,600 LF[4] of 36"
25	Required Hp for Zone 1 Pump Station	600/750	600/750	600/600	2000 (Replace - PS11)	1,000	1,000
26	Additional Zone 1 Pump Station Annual Energy Consumption	1,438,000 kWh	1,489,000 kWh	1,237,000 kWh	0 kWh	1,288,000 kWh	1,208,000 kWh
27	Site Elevation	Cropley 125 ft Rabello 5 ft	Mabury 95 ft Rabello 5 ft	Cropley 125 ft Mabury 95 ft	230 ft	95 ft	125 ft

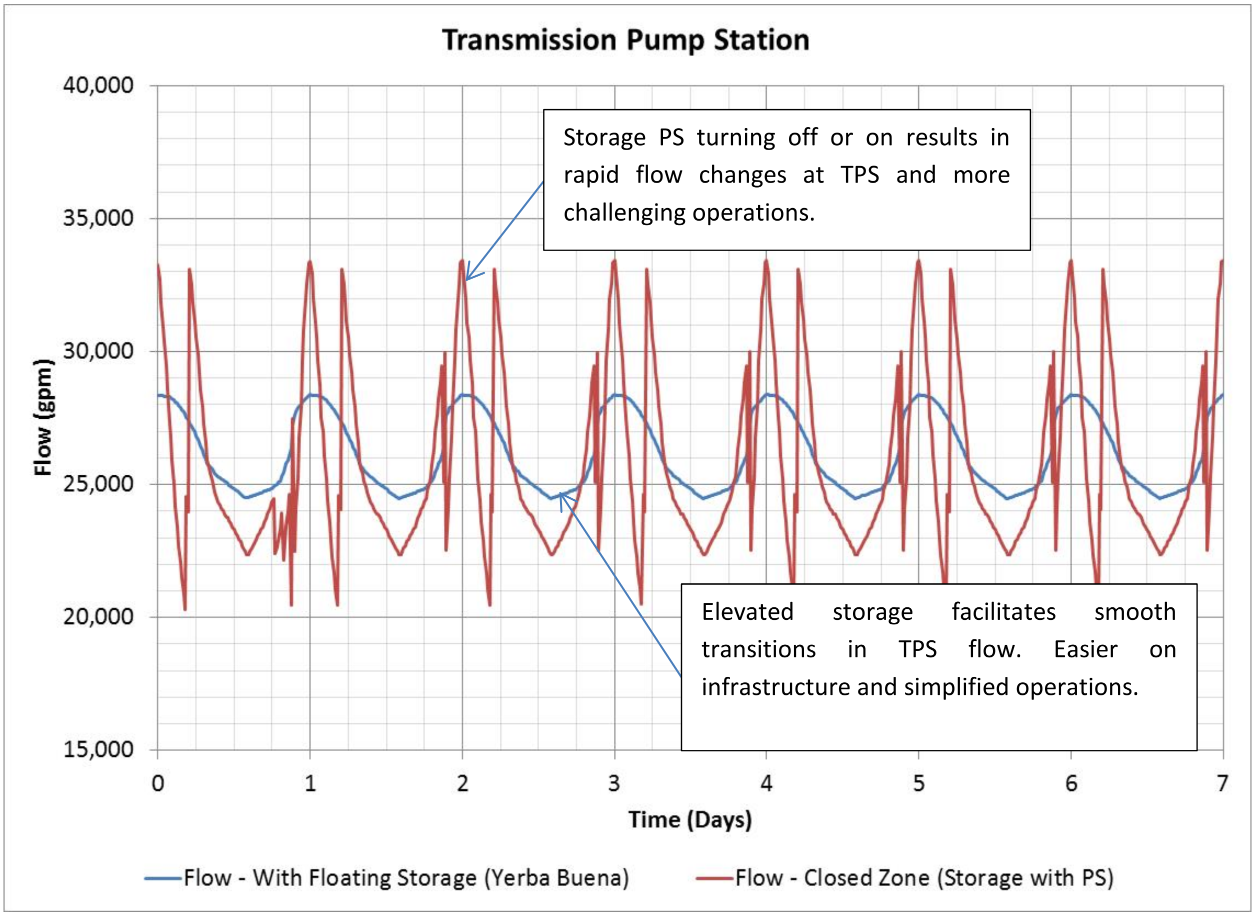
Notes:

1. Assumes connector pipeline to Milpitas (MP) from Cropley Station Storage.
2. Includes PS 5 O&M savings of $200,000 annually ($150,000 power and $100,000 in labor and consumables). Assuming $50,000 annual savings for PS5 Asset Renewal Savings.

3. Retrofit of existing PS 11 would save an estimated $7.0M.
4. The 6 MG Cropley Alternative requires a 36" pipeline to be constructed back to the 42-inch transmission main. The 3 MG Cropley ties into existing 18-inch on Hostetter Road.
5. No reservoir constructed at Yerba Buena, using available 2.25 MG surplus storage at existing reservoir.
6. 2000 Hp to support construction of future YB reservoir.

The SBWR InfoWater (hydraulic) model was used to evaluate the alternatives and size infrastructure. Figure 4-5 shows a comparison of TPS modeled flows for a system with elevated storage compared to a system without elevated storage. Elevated storage facilitates smooth TPS flow transitions and offers numerous hydraulic, system performance, and operability benefits.

Figure 4-5: Model Results for Transmission Pump Stations



Recommended Alternative

Based on the alternative comparison, the Yerba Buena alternative is the best value based on cost and benefits. Benefits of the project include:

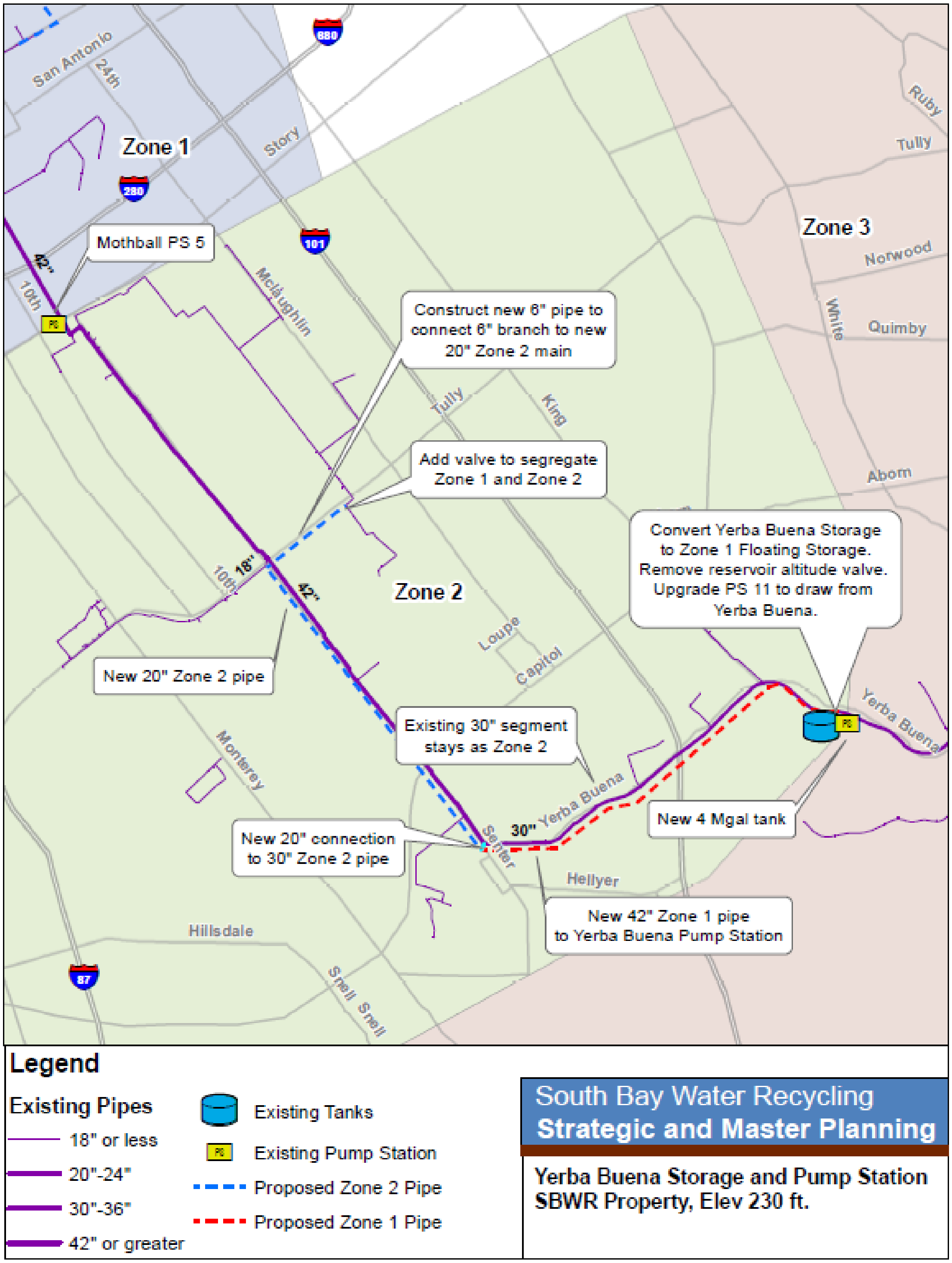
- Simplest operation (Alternative with lowest number of pump stations)
- Best Zone 1 hydraulics (elevated storage)
- Reduction of O&M and reduction asset replacement cost at PS 5. Potential PS5 property sales value
- Consolidation of new storage into existing Yerba Buena site. Does not add additional site(s) that will need to be operated and maintained
- SBWR owned property (No land lease which may be required with other sites)

- Based on hydraulic modeling, storage located further south from TPS alleviates the peak hour flows that would need to be conveyed in the 42-inch Senter Road transmission line which helps to stabilize pressure
- Reduced energy consumption which provides an avenue for funding from PG&E programs

Figure 4-6 and Figure 4-7 show the pipeline alignments and Yerba Buena storage tank to be added. The Yerba Buena alternative is comprised of the following major elements:

- Zone 1 pipe: 11,800 of 42 inch pipeline from Senter Road/Sylvandale Ave. to the Yerba Buena reservoir site. Needed to deliver water directly to Yerba Buena Reservoir while minimizing discharge pressure at TPS (minimize headloss).
- Zone 2 pipe: 9,600 ft of 18 inch pipeline in Senter Road from Sylvandale Ave. to Tully Road, 2,700 ft of 10 inch pipeline in Tully Road to connect to 6"main
- Pump Station 5 Bypass Pipeline Improvement
- Continue using PS 8 to serve Zone 2 demands (PS8 is connected to the existing 30-inch Zone 2 pipeline and would feed the Zone 2 pipe back toward Tully Road). Alternatively, retire PS8 and serve Zone 2 from Zone 3 via pressure reducing valve.
- New Pump Station 11 that draws directly from Yerba Buena and pumps directly to Zone 3
- 4 MG storage tank provides a total of 8 MG at the Yerba Buena site with 1.75 MG assumed to be allocated for Zone 2 demands and 6.25 MG allocated to Zone 1

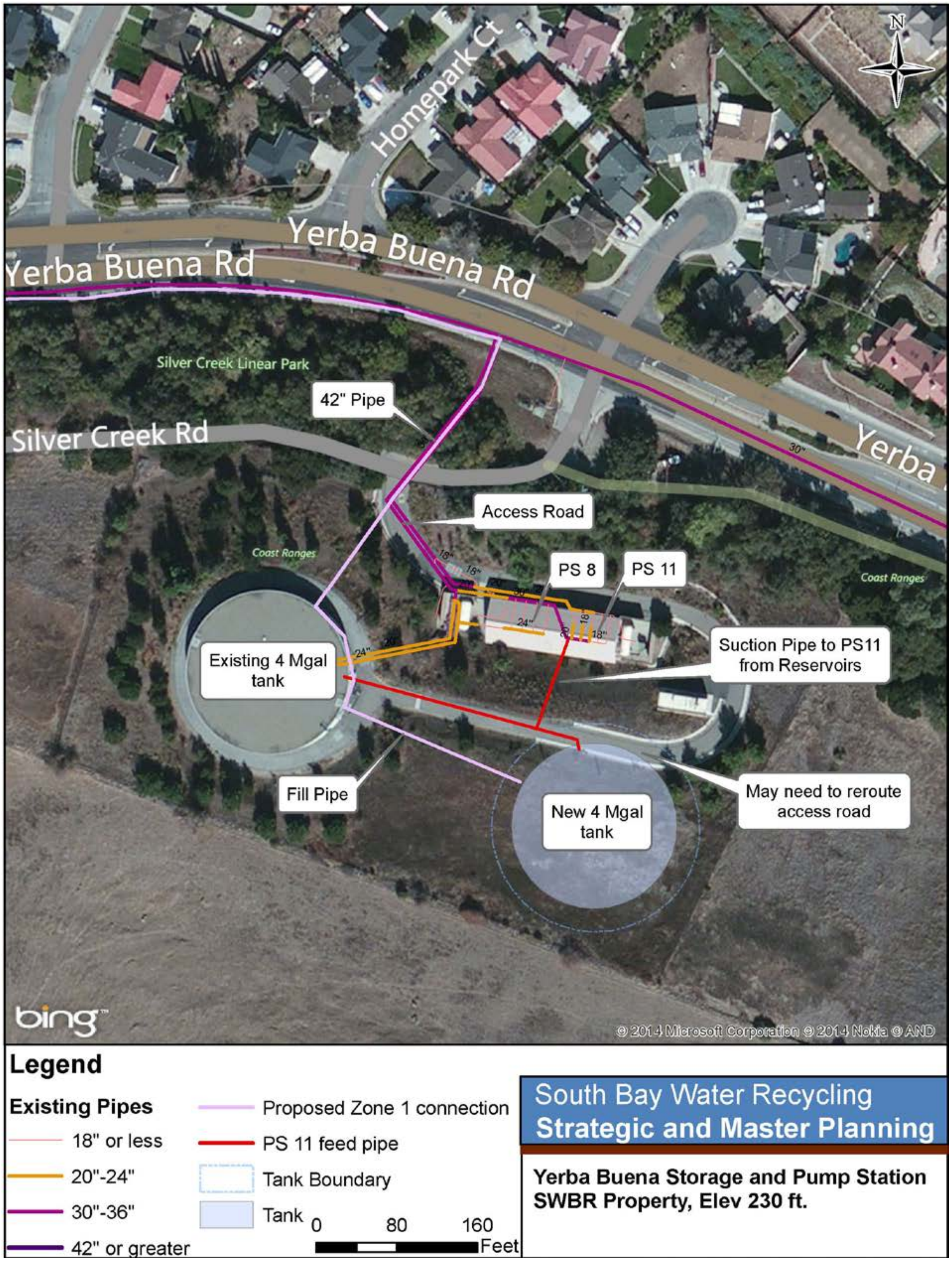
Figure 4-6: Pipeline Additions and Zone 2 Modification[a]



Notes:

a. These pipeline improvements represent one alternative for maintaining existing Zone 2 pressure to existing customers. Other alternatives like small onsite pump stations owned by customers should be evaluated.

Figure 4-7: Overview of Yerba Buena Site



The Yerba Buena Reservoir/ Pump Station 5 Retirement project would be phased to spread out capital expenditures and meet cash flow and financing requirements. A potential phased approach includes:

Phase 1: 42-inch Zone 1 Pipeline, 18-inch Zone 2 Pipeline, PS 5 Bypass Connection
Phase 2: Additional 4 MG Storage
Phase 3: New PS 11 (in conjunction with SCVWD 5 mgd demand in Zone 3)

Table 4-14 summarizes the estimated capital cost for each phase. Phase 1 provides immediate hydraulic and operational benefits as the existing 4 MG Yerba Buena Reservoir provides elevated storage for Zone 1. During peak demand periods, approximately 2.25 MG of the existing Yerba Buena tank is available for Zone 1. Phase 1 potential cost saving ideas including providing irrigation pump stations for Zone 2 customers that should be evaluated further during the pre-design Phase.

The Phase 2 4 MG storage tank can be implemented as funding becomes available. The timing for Phase 2 is a function of demand increases and to what extent a moderate level of service reliability is desired. Storage volume provides more time for both planned and unplanned shutdowns without service interruption to customers. Assuming a shutdown of TPS, 6 MG of storage for Zone 1 would provide a winter shutdown capability of 20 to 24 hours.

The Phase 3 New PS 11 would be needed in conjunction with an additional SCVWD 5 mgd in Zone 3. The existing PS 8 and PS11 arrangement with Zone 3 reservoirs has adequate capacity for existing demands.

Table 4-14 Recommended Phased Implementation Capital Cost Estimate

Element	Phase 1: 42-inch, 18-inch, PS 5 Bypass	Phase 2: 4 MG Storage	Phase 3: New PS 11
Construction Cost	**$14,600,000**	**$5,400,000**	**$7,800,000**
Implementation Cost (30%)	$4,400,000	$1,600,000	$2,300,000
Project Contingency (10%)	$1,900,000	$700,000	$1,000,000
Total Capital Budget	**$20,900,000**	**$7,700,000**	**$11,100,000**

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5. Long Term NPR Alternatives

This section describes required improvements to the SBWR production and distribution system to meet the long-term NPR demands described in Section 3. The NPR pathway is one of the long-term pathways being evaluated in terms of reaching the Strategic Plan targets described in Section 1. For the sake of analyzing the “Maximize NPR Pathway” developed in the initial Visioning Process for the Strategic Plan, this section determines the required infrastructure and costs needed to implement all of the long-term NPR demands identified in Section 3. It is likely that long-term expansion of the NPR system to serve new customers will be undertaken by individual water retailers either acting alone or in partnership with the City as the representative of SBWR so in actual practice it is therefore likely that only a portion of the long-term NPR demands and infrastructure identified in this Section will be constructed.

Section 3 provided an analysis of long-term NPR demands based on planning information from the six water retailers serving the SJ/SC RWF service area, i.e. the City of Milpitas, the City of Santa Clara, San José Muni, SJWC, California Water Service and Great Oaks Water Company. Of these six retailers, four – the City of Milpitas, the City of Santa Clara, San José Muni and SJWC – have plans to expand recycled water use. Table 5-1 summarizes the retailers’ additional long-term NPR demands as developed in Section 3.

Table 5-1: Potential Additional Long-Term Recycled Water Demands

Retailer	Total Potential Markets (AFY)
City of Milpitas	1,100
City of Santa Clara	900
San José Muni	1,150
SJWC	6,820
Total	**10,000** (rounded)

In addition, the Silver Creek Pipeline Agreement (2002) between the City of San José and the SCVWD reserves 5 mgd of SBWR capacity for SCVWD use. SCVWD’s 5 mgd of reserved capacity is currently envisioned to be used for potable reuse. However, SCVWD’s 5 mgd commitment is included in the analysis of long-term NPR system requirements since the water would be conveyed through the SBWR distribution system and the evaluation of required infrastructure needs to take into account the flow rate contributed by SCVWD’s 5 mgd.

The improvements in this section are sized to meet the estimated long-term recycled water flows including the 5 mgd SCVWD commitment as shown below.

Table 5-2: Long-Term Recycled Water Flow Rates from TPS

	Baseline w/ SCVWD (1)	Long-Term Additional NPR	Total Long-term NPR w/ SCVWD
Annual RW Flow, AFY	20,000	10,000	30,000
Daily Average, mgd	25.4	8.9	34.3
Peak Month, mgd	35.6	13.4	49.0
Peak Day, mgd	39.5	15.1	54.6
Peak Hour, mgd (2)	53.3	21.1	74.4

(3) *SCVWD has a 5 mgd commitment for their Phase 1 IPR project. It is assumed that the 5 mgd will be delivered at a constant flow rate so the additional 5 mgd was added to the baseline and long-term flow rates without applying peaking factors to the 5 mgd.*

(4) *The peak hour demands are based on the TPS flow pattern exhibited in 2013. However, the peak hour demands will be dampened in the long-term with the construction of the additional storage recommended as part of the near-term CIP, and with potential changes in the operation of the SBWR distribution system such as increased management of the timing of individual customer demands. This report assumes that the treatment and trunk line distribution system will be sized to meet the peak day flows and that peak hour flows will be met by storage in the system.*

The following information is included in this section:

- Description of required infrastructure to serve the long-term peak day NPR demands
- Estimated cost to serve the long-term NPR demands

5.1 Recycled Water Treatment Facilities

5.1.1 Tertiary Facilities

The tertiary recycled water treatment processes at the SJ/SC RWF include granular media filtration and disinfection with sodium hypochlorite. The current treatment capacity of each process, at Title 22 loading rates, was calculated in Section 4 with the following results:

- Granular Media Filters: 38.1 mgd theoretical maximum daily production at 5.0 gpm/sf loading rate with four filter cells in service and assuming one backwash per day
- Disinfection: 44.3 mgd maximum capacity at 90 minute modal contact time for channel and pipe combined

The following two projects to increase the SJ/SC RWF treatment capacity are included in a recommended near-term, 5-year SBWR CIP to enhance reliability, provide greater operational flexibility, and increase treatment capacity.

- Filter Flux Rate Project: This project would complete the studies and modifications necessary to obtain approval for operating the tertiary filters at a higher loading rate. If only 4 filter cells were operating at a higher flux of 7.5 gpm, the capacity of the filters would be 57 mgd. It is more likely that all 8 filters would operate in a similar mode at the higher flux rate resulting in a capacity of 114 mgd. In either case, this project would remove the tertiary filtration capacity as a constraint in meeting the long-term NPR demands.

- Free Chlorine Disinfection Project: This project would perform the studies and modifications necessary to obtain approval for operating the disinfection system in a free chlorine mode and reduce the required modal contact time from 90 minutes to approximately 20 minutes. This would result in a recycled water disinfection capacity of approximately 200 mgd.

Assuming these projects are completed as part of the near-term 5 year CIP, there will be adequate tertiary treatment capacity to meet the long-term NPR demands. Therefore, no additional tertiary recycled water facilities are included in the long-term NPR alternatives.

Table 5-3: Comparison of RWF Treatment Capacity to Long-Term Demands

Process	Current Title 22 Capacity	Capacity after Filter Flux and Free Chlorine Disinfection Projects	Capacity needed to meet Long-Term Peak Day Demands	Adequate Capacity for Long-Term?
Tertiary Filtration, mgd	38.1	57[1]	54.6	Yes
Disinfection, mgd	44.3	200	54.6	Yes

Note: Assuming use of 4 filter cells for recycled water production and remaining filter cells dedicated to discharge.

5.2 Distribution System Expansion

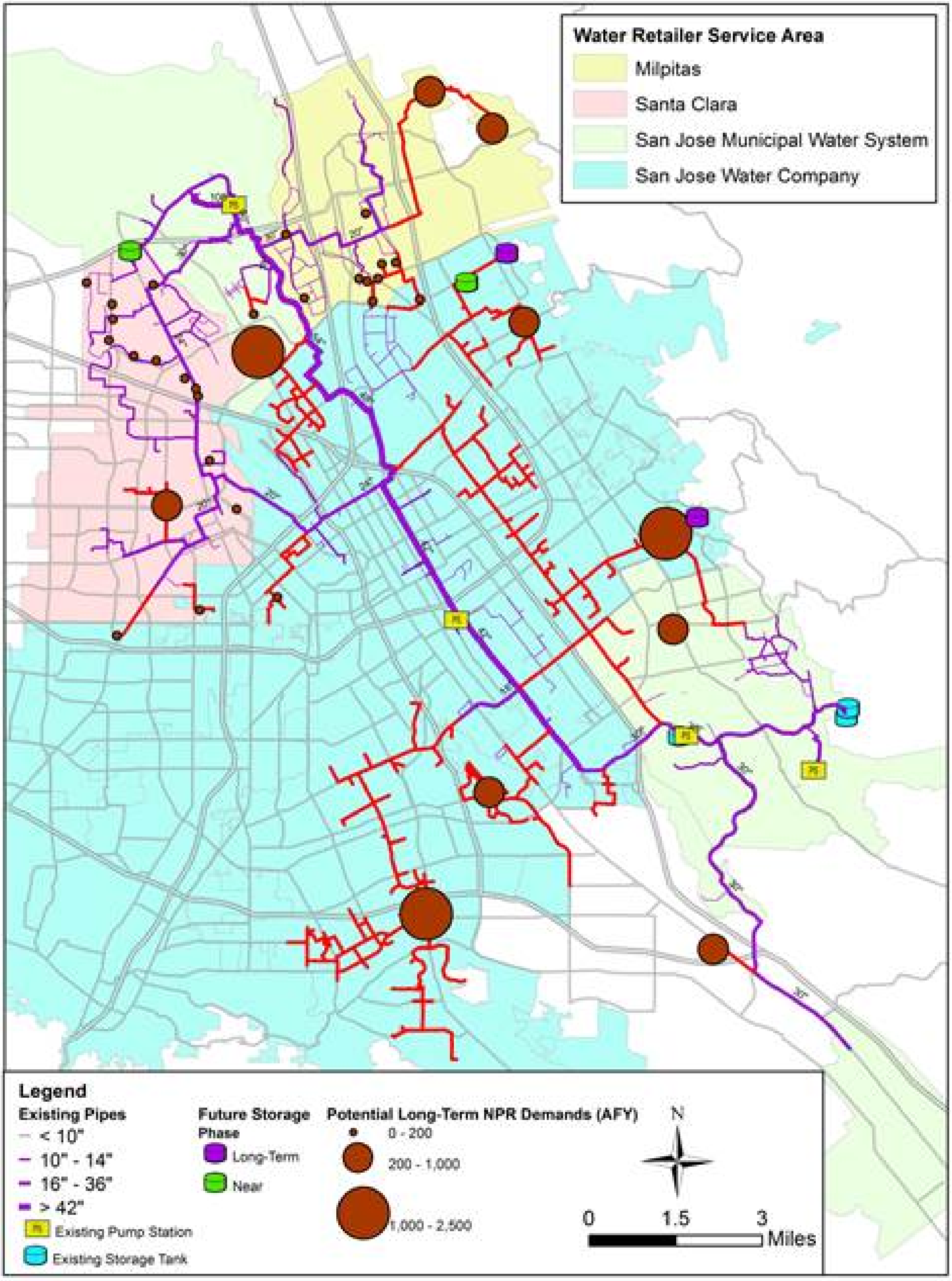
This section describes the distribution system infrastructure needed to serve the long-term NPR demands identified through the NPR Market Assessment. Figure 5-1 identifies the general location of the long-term demands and potential recycled water pipeline extensions to serve those demands.

5.2.1 San José Water Company:

The 2011 Update to the SJWC RWMP represents SJWC's latest planning related to growth of the recycled water system. Within the RWMP Update, SJWC identified extensions from the SBWR system which SJWC believes are reasonable to construct given cost and estimated customer demand. As previously discussed in Section 3, recycled water projections for SJWC are based on the SJWC RWMP which estimated a total additional demand of 8,020 AFY along SBWR extensions. The SBWR near-term commitments of 1,200 AFY are already included in the near-term recycled water use. The remaining 6,820 AFY of potential demands are considered long-term potential future demands.

In Figure 5-1, the long-term SJWC NPR demands are shown as aggregate demands near the centroid of each alignment.

Figure 5-1: Long-Term Non-Potable Reuse Demands



SJWC's RWMP Update provides details on the infrastructure needed to meet the future demands including pipe lengths as well as the number of customer site retrofits required to accommodate recycled water use. Table 5-4 summarizes the proposed infrastructure.

Table 5-4: Infrastructure to Serve SJWC's Long-Tem Demand

SJWC Alignment	Pipe Sizes (Length)	Number of Retrofits
A	4-IN (3,700 ft) 6-IN (2,600 ft) 10-IN (16,800 ft)	29
D	6-IN (13,400 ft) 8-IN (29,300 ft) 24-IN (19,200 ft)	62
E	6-IN (34,500 ft) 8-IN (7,700 ft) 12-IN (10,100 ft) 30-IN (8,600 ft)	39
K	6-IN (10,200 ft) 8-IN (7,700 ft)	9
L	6-IN (18,000 ft) 8-IN (12,800 ft) 10-IN (12,100 ft) 12-IN (10,500 ft)	13
N	10-IN (8,100 ft)	3
Q	4-IN (37,550 ft) 6-IN (37,550 ft) 10-IN (27,900 ft) 12-IN (16,100 ft) 18-IN (15,600 ft) 24-IN (16,600 ft)	66
R	4-IN (2,300 ft) 6-IN (9,300 ft) 8-IN (2,000 ft)	13

5.2.2 Milpitas

The City of Milpitas's plans for increased NPR use focus on the Milpitas Transit Area, which is being developed around the proposed Milpitas BART station extension and VTA Light Rail system. The Transit Area Recycled Water Analysis estimated that 16,200 feet of 6-inch pipe would be necessary to serve these uses.

In addition to the uses identified by the City of Milpitas, SBWR's Cooling Tower Initiative identified approximately 150 AFY of industrial demand from existing Milpitas water user that could be converted to recycled water. These customers were identified due to their proximity to existing SBWR pipelines and would be served from the existing infrastructure.

In Figure 5-1, the Transit Area demand is shown as an aggregate within the Transit Area Specific Plan area and the customers identified through the SBWR Cooling Tower Initiative are shown in their respective locations. Because individual customers requiring retrofits have not been identified, for the cost estimate, the retrofit costs were estimated based on a cost per acre-foot.

Milpitas water supply planning conducted in the fall of 2014 identified recycled water service to the east of I680 including service to the two golf course in the eastern foothills. The potential alignments identified by Milpitas are shown in Appendix 3A.

5.2.3 Santa Clara

Long-term increases in NPR use within the City of Santa Clara were based on the Santa Clara 2010 UWMP and are attributed to new development and redevelopment along existing recycled water pipelines and increased use by current recycled water customers. As such these demands, which are estimated at 500 AFY, will require short extensions of the recycled water system and the cost of customer retrofits.

Likewise, the 355 AFY of industrial demand identified through SBWR's Cooling Tower Initiative are assumed to be served from existing infrastructure and short service extensions. In Figure 5-1, the increased demand projected by the Santa Clara 2010 UWMP is shown as a single demand within the City of Santa Clara and customers identified through the SBWR Cooling Tower Initiative are shown in their respective locations.

5.2.4 San José Muni

Long-term recycled water demands in the San José Muni service area are based on the water supply assessment performed for the Envision San José 2040 General Plan Update. The 1,150 AFY of long-term demand is allocated among San José Muni's North San José, Evergreen and Edenvale service areas by, respectively 60%, 30%, and 10%. Because the San José Muni projects are not associated with defined projects, infrastructure size and length assumption were made to estimate expansion costs.

5.2.5 System Wide Improvements

In addition to the pipeline extension costs, system wide improvements would be required within the SBWR distribution system to provide capacity to accommodate the increased flows associated with the long-term NPR demands. The SBWR InfoWater hydraulic model was used to estimate the transmission improvements necessary to deliver the long-term peak day demand of 54.6 mgd. Based on the existing model, the long-term demands and transmission main were added to the model. Pump station upgrades and storage tanks were added to simulate the long-term operation. Based on the significant level of long-term demands, key assumptions for the model simulation included:

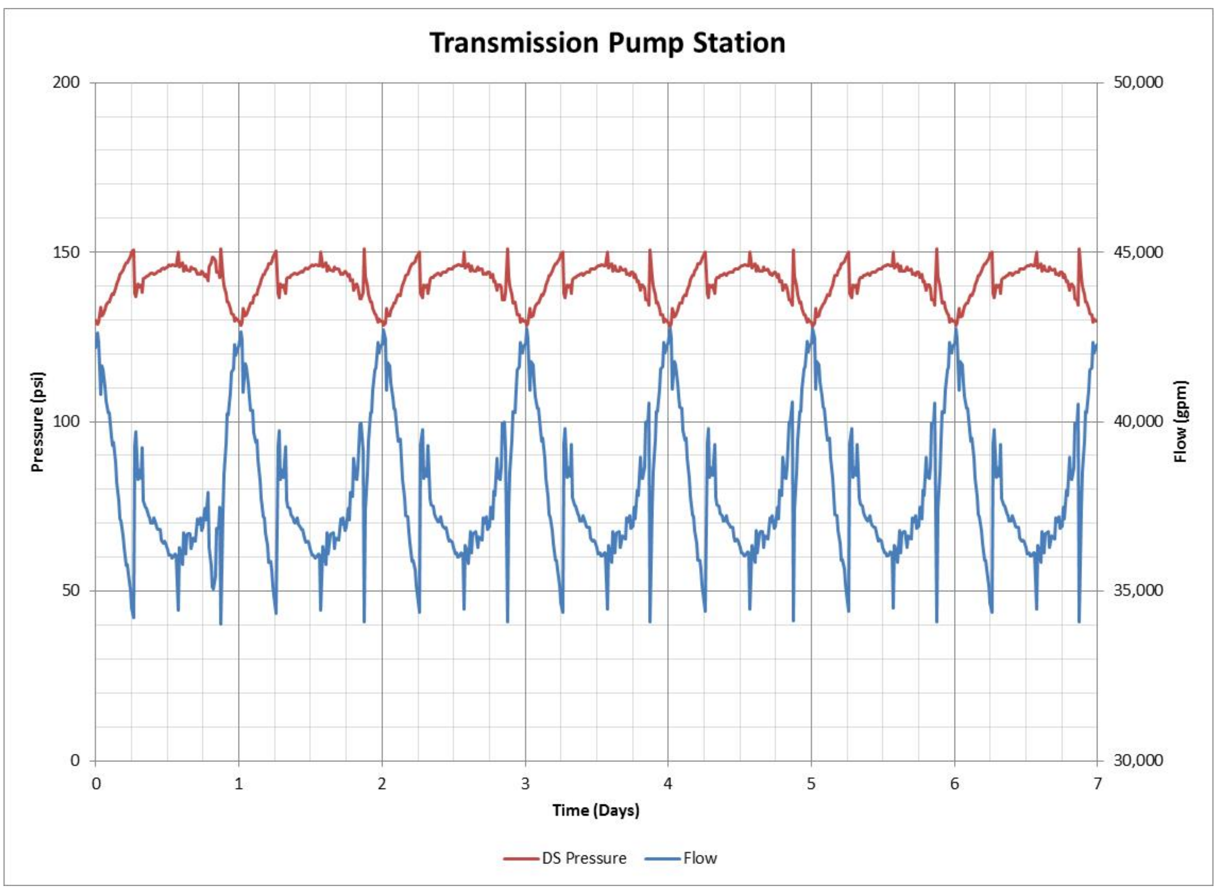
- Near-term storage of 6 MG (non-elevated) with a pump station is added to Zone 1

- Elevated storage tanks in Zone 1 and 2 are required for operational stability of the long-term scenario
- Upsizing and extension of SJWC planned pipeline on King Road to create a looped system south of Hedding Street

Figure 5-2 shows the projected long-term model simulation of the TPS under peak day conditions including the systems improvements necessary to deliver the additional demand. These improvements, which are summarized in Table 5-5 consist of additional storage, pump station upgrades/pumping capacity and a parallel backbone pipeline for the 12th Street and Senter Road Pipelines.

Recycled water systems typically have storage sufficient to provide from 50 to 100 percent of maximum day demand. For the long-term NPR alternative, adding distribution system storage to maintain 50 percent of maximum day demands is recommended to provide a reliable, albeit interruptible, level of service. The long-term demands will increase the maximum day demands within Zone 1 and Zone 2 by 7.6 mgd and 10.4 mgd respectively. Providing half a day of storage, these increased demands translate to the need for an additional 4 million gallons of storage in Zone 1 and 5 million gallons of storage in Zone 2.

Figure 5-2: Long-term Model Simulation



Notes:

1. The primary purpose of the model simulation was to identify improvements to support delivery of higher demands. Recognizing the numerous future outcomes that could unfold, in-depth alternative analysis on system optimization were not performed as part of the master plan.
2. Storage tanks locations assumed for this simulation included Zone 1 storage at Yerba Buena, Cropley Station and Rabello. Alternative configurations of storage would alter the results shown above.
3. Assumes new demand follows a similar diurnal pattern to the existing system except where specific demand pattern information was available (i.e. uniform 24 hour 5 mgd demand used for SCVWD Ford Pond project).

Table 5-5: System-Wide Improvements

Improvement	Infrastructure Required
Storage	4 MG Elevated storage tank in Zone 1 (Bottom elevation 230 ft) 5 MG Elevated storage tank in Zone 2 (Bottom elevation 330 ft)
Pump Stations	Pump Station 5 capacity and hydraulic upgrade Pump Station 11 capacity and hydraulic upgrade Pump Station 8 decommissioning Additional transmission pump station (TPS) capacity (add two pumps in existing available pump bays)
Parallel Backbone Pipe	39,900 feet of 30-inch parallel pipeline on King Road (south of Hedding Ave)

Notes:

1. *PS8 decommissioning and PS 11 upgrades to draw directly from Yerba Buena reservoir is recommended to simplify operation of the system. This improvement is envisioned to be undertaken as PS 8 and 11 reach the end of their expected service life.*
2. *For the hydraulic model, Zone 1 elevated storage was assumed at Cropley Avenue and Old Piedmont Avenue. For modeling purpose, Zone 2 elevated storage was assumed to be located up Marten Avenue in the vicinity of Clayton Road.*

The projected long-term flows require renovation and upgrade of the existing pump stations as the design flow rates increase and the pump station total dynamic head (TDH) increases due to additional headloss associated with higher pipeline velocity. Table 5-6 summarizes the pump station design points for the envisioned long-term scenario.

Table 5-6: Long-Term Pump Station Estimate Design Point

Zone	Pump Station	TDH (ft)	Design Flow (gpm)
1	TPS	275	38,000
2	PS5	140	17,000
3	PS11	445	8,300
1	Rabello PS	240	4,000
1	Cropley Station PS	150	4,000

The TPS would need to be renovated to provide the additional flow and head needed. It is envisioned that the existing vertical pumps could be retrofitted with an additional bowl and two additional pumps would be added to meet the capacity requirement. With the assumed additional of elevated storage to the system the two new pumps are assumed to be constant speed pump for cost estimate purposes. TPS has seven additional pump bays to allow for installation of new pumps for increased capacity, and this analysis assumes the two additional pumps could be added to meet long-term needs by simply procuring the pumps and installing them in one of the spare bays. It is assumed that TPS facilities do not require major structural, electrical, or other upgrades to support the pump capacity expansion.

Pump station 5 flow and TDH required would increase significantly under the long-term demand. Therefore, it is assumed all the pumps would be replaced. For cost estimating purposes, it is assumed that pump station 5 facilities do not require major structural, electrical, or other upgrades to support the pump capacity expansion.

Based on the current age of the existing pump station 8 and 11, it is assumed that the pump station 8 would be decommissioned and pump station 11 would be modified to take suction directly from Yerba Buena Reservoir rather than relying on suction pressure from pump station 8 (Zone 2). It is assumed that all pump station 11 pumps would be replaced in this scenario. This modification would simplify operation of pump station 11.

It should be noted that the hydraulic analysis and long-term infrastructure scenario above represents one long-term option. If significant additional long-term NPR is implemented, additional infrastructure alternative evaluation and hydraulic modeling should be performed. The identified infrastructure improvements are a function of the specific detail of the long-term scenario including location of demands, assumption of future elevated storage location, and parallel pipelines. Modifications to these variables would alter the design criteria at the existing pump stations. Alternative analysis (i.e. use of Yerba Buena for Zone 1 Storage) would alter the hydraulics of the system and require a different set of improvements.

5.3 Estimated Costs

5.3.1 Capital Costs

The estimated capital costs for the infrastructure identified in Section 5.2 are shown below in Table 5-7 . The costs shown are total capital costs and include contingencies and project implementation costs. Two versions of the costs are shown; one excluding on-site customer retrofit costs and one that does include the on-site costs. Details of the cost estimate are included in Appendix 5A. Funding for long-term NPR improvements is envisioned to be provided by water supply beneficiaries as wastewater benefits are minimal to none.

Table 5-7: Estimated Capital Costs to Implement Long-Term NPR Demands

Component	Estimated Capital Cost (Excluding Retrofit Cost)	Estimated Capital Cost (Including Retrofit Cost)
Pipelines	$129,600,000	$129,600,000
Pump Stations	$13,600,000	$13,600,000
Reservoirs	$27,000,000	$27,000,000
Retrofits	$ -	$12,800,000
Base Construction Cost	$170,200,000	$183,000,000
Implementation Costs @30%	$51,000,000	$55,000,000
Project Contingency @ 10%	$22,000,000	$24,000,000
Total Capital Cost	**$243,200,000**	**$262,000,000**

5.3.2 Annual Operating Costs

The City provided information on the existing annual operating costs of the SBWR system as input to the rate analysis. The annual operating costs include both personnel and non-personnel costs associated with recycled water production across various departments within the City and RWF. Based on the information provided by the City for the 2013 costs and production ($6,000,000 O&M costs and 13,340 AF), the annual O&M cost for recycled water production and distribution was $450/AF. The estimate for O&M for the long-term alternative assumes the same unit operating cost of $450/AF f resulting in a total additional annual operating cost of $4.5 million for the additional 10,000 AF of long-term NPR demand.

An additional annual cost not included above is development of a rehabilitation and replacement (R&R) fund for maintenance and eventual replacement of the system. To estimate an annual R&R fund, it is assumed that the system will have an overall average life of 50 years so 1/50th of the base construction costs, or $3.4 (excluding retrofit costs) to $3.7 million (including retrofit costs), would be placed annually in the R&R fund for the long-term NPR infrastructure.

5.3.3 Cost of Long-Term NPR Water

The estimated unit cost of water for the additional 10,000 AFY of long-term NPR demand, excluding on-site customer retrofits is $1,690/AF as shown below in Table 5-8. The cost estimate does not include advanced treatment facilities necessary to maintain a 500 mg/l TDS level for the additional 10,000 AFY of demand.

Table 5-8: Estimated Cost of Long-Term NPR Water

Item	Estimated Cost (Excluding Retrofit Cost)	Estimated Cost (Including Retrofit Cost)
Total Estimated Capital Costs	\$243,000,000	\$262,000,000
Annualized Capital Costs[1]	\$12,400,000	\$13,400,000
Annual O&M Costs	\$4,500,000	\$4,500,000
Total Annualized Cost	\$16,900,000	\$17,900,000
Annual Long-Term Demands, AFY	10,000	10,000
Cost of Long-Term NPR Water, \$/AF	**\$1,690**	**\$1,790**
Cost of Long-Term NPR including R&R Fund, \$/AF [2]	*\$2,030*	*\$2,160*

Notes:

1. *Capital costs are annualized over 30 years assuming financing rate of 5.5%, inflation rate of 2.5% for a net interest rate of 3%.*
2. *Annual O&M costs do not include an allowance for an R&R fund. Including an annual R&R fund of \$3.4 to 3.7 million (i.e. 1/50th of the base construction cost) would increase the unit cost of water to \$2,030/AF excluding retrofit cost and \$2,160/AF including retrofit cost.*

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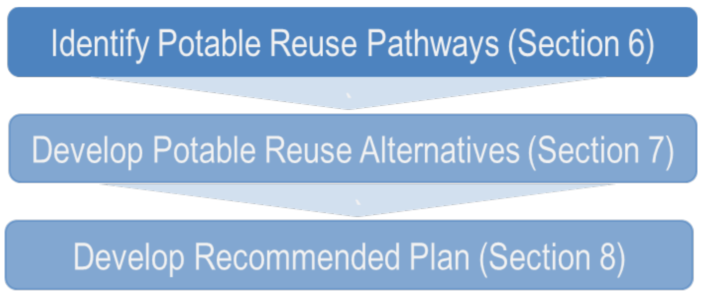
6. Potable Reuse Pathways

This section incorporates the apparent best potable reuse strategies identified in SCVWD's Potable Reuse Feasibility Study (2012) (Appendix 6A) into potable reuse pathways expanded to achieve the targets established for the SBWR Strategic Plan. Section 7 develops near-term and long-term potable reuse alternatives based on the pathways identified in this section. Section 8 evaluates the potable reuse alternatives and presents a recommended plan.



For the purpose of determining the maximum potable reuse target, a baseline NPR demand of 15,000 acre-feet per year (AFY) is assumed. The maximum 2025 and 2035 potable reuse targets are summarized in Table 6-1.

Table 6-1 Potable Reuse Targets

Year	Recycled Water Target (AFY)	Baseline Non-Potable Reuse Demand (AFY)	IPR/DPR Target (AFY)
2025	40,000	15,000	25,000
2035	50,000	15,000	35,000

SCVWD staff has extensively studied various potable reuse options available to develop either a GWR project or a DPR project to expand recycled water use in SCVWD's service area. These potential options include both centralized (near the SVAWPC) and satellite treatment (remote location fed by the SBWR system), GWR through percolation ponds and injection wells, and consideration of DPR through adding purified recycled water into the Central Pipeline, which is part of the raw water conveyance system. Appendix 6A provides information on the previous studies that have been completed for potable reuse, which include the following:

- Advanced Recycled Water Treatment Feasibility Study (May 2004)
- Silicon Valley Advanced Water Purification Center (SVAWPC) Documents
- Recycled Water Master Plan (March 2009)
- Draft Potable Reuse Study (Internal Draft, October 2012)
- Draft Potable Reuse Project Concepts (2012)

The following is a summary of conclusions based on the review of previous potable reuse studies listed above. These conclusions provide the basis for the potable reuse pathways described in this section.

- The Los Gatos percolation ponds have the largest potential recharge capacity if local flows are diverted to other uses. Up to 20,000 AFY of purified recycled water can be effectively used to support a full off-stream program in the Los Gatos system. Combined with the injection wells recharge concept, the Los Gatos GWR project can support up to a 30 mgd IPR project.
- The Coyote and Penitencia GWR project concepts are the most feasible satellite advanced water purification facility (AWPF) concepts in terms of identified site locations, available AWPF feed water from the SBWR system, and proximity to off-stream percolation ponds with capacity to receive purified recycled water.
- While the addition of injection wells for both the Coyote and Penitencia project concepts may increase the capacity and reliability of GWR, the production capacity of the AWPF would be limited by the flow capacities available for IPR from the SBWR system, which is currently 5 mgd at Coyote (Silver Creek Pipeline) and 2.2 mgd at Penitencia (SBWR system extension through the San José Water Company (SJWC) Master Plan pipeline extensions).
- The Guadalupe percolation ponds have little to no opportunity for GWR. Under existing operations there is little to no available capacity for IPR recharge during most years. Only in critically dry years, which occur about 15 percent of the time, would there be significant (50 percent) unused capacity.

Based on the recommended potable reuse strategies developed in the previous studies (summarized in Appendix 6A), three potable reuse pathways are identified for further evaluation:

- Pathway 1: GWR with Centralized Treatment
- Pathway 2: GWR with Satellite Treatment
- Pathway 3: DPR with Centralized Treatment

Pathway 1 would consist of groundwater replenishment (GWR) with centralized treatment at a new AWPF located adjacent to the SVAWPC. Purified recycled water from the AWPF would be recharged to the groundwater through the Los Gatos Recharge System. Figure 6-1 provides an overview of the SBWR system with a centralized treatment facility. Source water for the centralized AWPF would be delivered from the Regional Wastewater Facility (RWF).

Pathway 2 would consist of GWR with satellite treatment at new AWPFs located in Coyote, Penitencia, and Los Gatos. Purified recycled water from each AWPF would be recharged to the groundwater through the respective recharge systems. Figure 6-2 provides an overview of the SBWR system with satellite treatment. Source water for the centralized AWPF would be delivered via the SBWR distribution system.

Similar to Pathway 1, Pathway 3 would consist of a centralized AWPF adjacent to the SVAWPC. Purified recycled water from the AWPF would be used for direct potable reuse (DPR) through a connection to the Central Pipeline where it would be blended with State Project water for treatment at a surface water treatment plant (WTP). Figure 6-1 provides an overview of the SBWR system with a centralized treatment facility.

Pathways that include RO treatment would require an approach for RO concentrate disposal. Concentrate discharge options as well as treatment and minimization strategies are evaluated and discussed later in Appendix 6B. It is noted that for the satellite pathway, the City has indicated that the City would not support large discharge quantities of concentrate to its collection system or directly into the RWF. However, the City is open to discussions for smaller quantities associated with pilot demonstration projects as long as it does not impact collection and wastewater treatment operations nor significantly increase TDS concentration in the final influent.

Figure 6-1: SBWR System with Potable Reuse Pathways 1 and 3

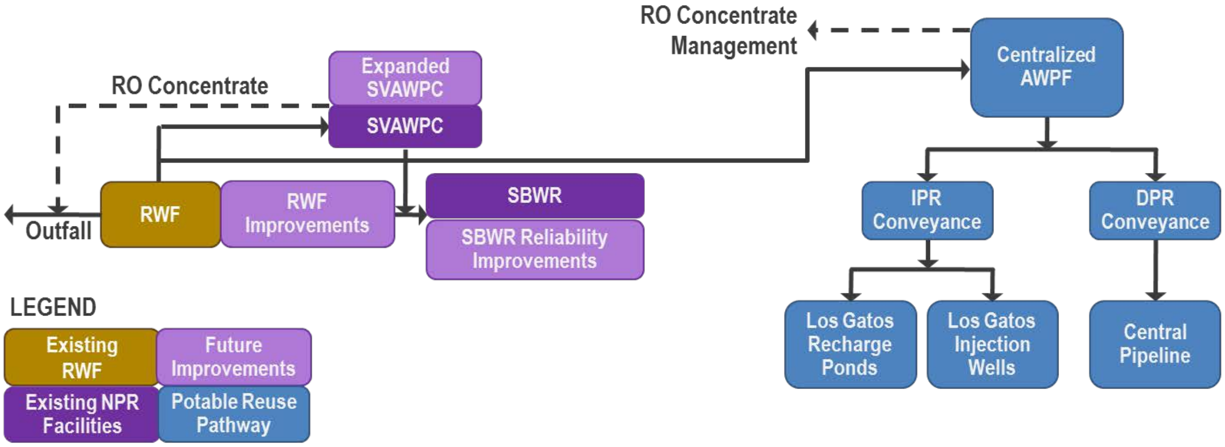


Figure 6-2: SBWR System with Potable Reuse Pathway 2

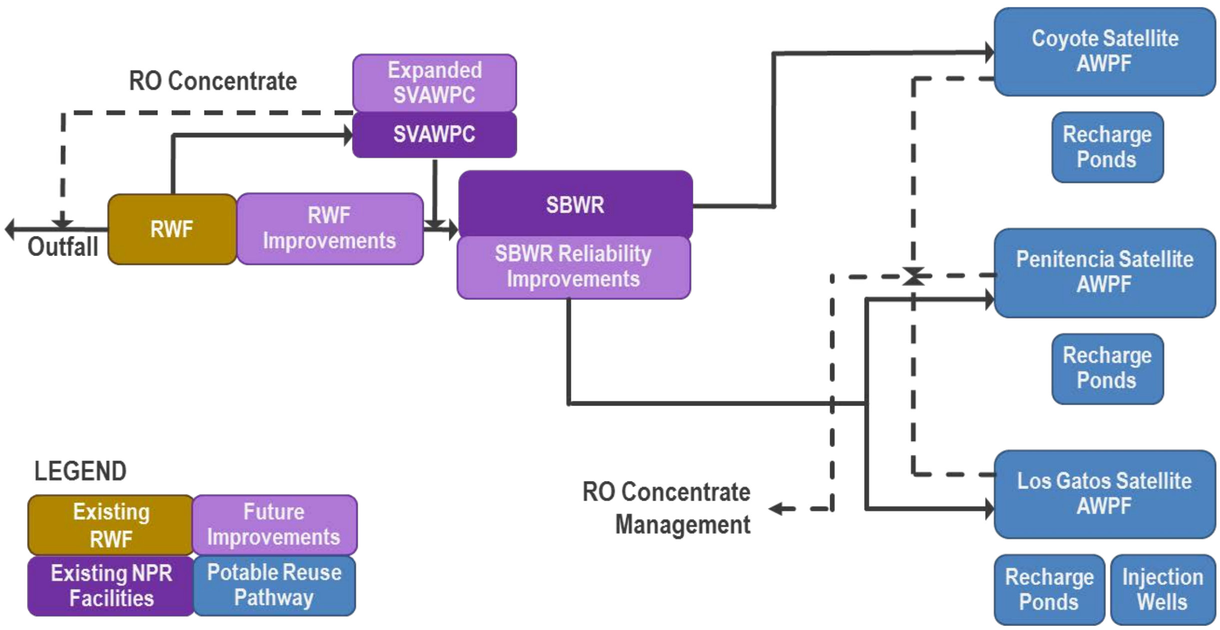


Table 6-2 provides a summary of each pathway in combination with different advanced treatment options. The following sections describe the current potable reuse regulations as well as advanced treatment options that can be utilized to produce purified recycled water for GWR and DPR, which will then set the stage for defining and evaluating the three potable reuse pathways.

Table 6-2: Potable Reuse Pathways

	Centralized Pathways				Satellite Pathways		
IPR or DPR	**IPR**	**IPR**	**IPR**	**DPR**	**IPR**	**IPR**	**IPR**
Pathway	1	1	1	3	2	2	2
Treatment Options							
Membrane filtration (MF), reverse osmosis (RO) and disinfection	✔				✔		
Full advanced treatment (membrane filtration, reverse osmosis, and disinfection/advanced oxidation process (AOP))		✔		✔		✔	
Alternative treatment (ozone with biological activated carbon, membrane filtration, and disinfection)			✔				✔
Recharge Methods							
Percolation (GWR)	✔	✔	✔		✔	✔	✔
Direct Injection (GWR)		✔				✔	
Raw Water Pipeline (DPR)				✔			

SBWR and the District also investigated using recycled water for reservoir or streamflow augmentation, as discussed in Appendix 6B, Reservoir and Streamflow Augmentation Opportunities. Surface water augmentation would blend purified water that has undergone advanced treatment with untreated water in a reservoir, and the blended water would then be treated and disinfected at a drinking water treatment plant and distributed into the drinking water system. Streamflow augmentation is not specifically categorized as IPR, although it has potential to augment surface water and groundwater that serve as municipal water supplies. Streamflow augmentation involves discharge of purified recycled water into streams or creeks for purposes of environmental enhancement and/or, in cases where the surface water is unlined, for groundwater recharge. Both reservoir and streamflow augmentation projects face a challenging regulatory/permitting environment. Regulations for reservoir augmentation are currently under development by the California Department of Public Health (CDPH)[9] and projects are approved on a case-by-case basis, requiring extensive coordination with regulatory agencies. The permitting challenges for these projects are potentially greater than required for other potable reuse options under consideration. Reservoir and streamflow augmentation are not recommended as IPR options for the SBWR Strategic Plan. See Appendix 6B for more information.

6.1 Potable Reuse Regulatory Update

This section provides information on the use of recycled water for GWR and DPR. Appendix 6B addresses surface water augmentation using recycled water. The purpose of this discussion is to summarize the applicable regulations that apply to GWR projects and will be used to assess how regulatory requirements could affect potable reuse options for SCVWD, and in particular, the permitting complexity of proposed potable reuse alternatives to be evaluated as part other Strategic Plan tasks.

The use of recycled water (potable and non-potable) is regulated under the Clean Water Act when applicable (when a project involves a discharge to a Water of the U.S. – see Section 9 on surface water augmentation), the Safe Drinking Water Act, and several State laws, regulations, and policies, with different responsibilities assigned to the State Water Resources Control Board (SWRCB), the nine Regional Water Quality Control Boards (RWQCBs), and the SWRCB Division of Drinking Water (DDW), formerly the CDPH.

The California Water Code (CWC) and Health and Safety Code (H&SC) contain California's statutes that regulate the use of water and the protection of water quality, public health, water recycling, and water rights. The key statutes that are relevant to water recycling are presented in Table 6-3. A complete compendium is available on the DDW website.[10]

[9] Effective July 1, 2014, the California Department of Public Health Drinking Water Program (including recycled water responsibilities) was transferred to the SWRCB and named the Division of Drinking Water.
[10] See http://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/Lawbook.shtml.

Table 6-3: Summary of Key California Statutes for Potable Reuse

Code	Purpose
Water Rights	
CWC section 1210-1212	Requires that prior to making any change in the point of discharge, place of use, or purpose of treated wastewater, approval must be obtained from the SWRCB.
Recycled Water Definitions	
CWC sections 13050, 13512, 13576, 13577, 13350, and 13552-13554	Recycled water is defined in the CWC as water, which as a result of treatment of waste, is suitable for a direct beneficial use or a controlled use that would not otherwise occur and therefore considered a valuable resource.
CWC sections 13561	Defines DPR, GWR and surface water augmentation.
Water Quality	
CWC section 13170	Authorizes the SWRCB to adopt State policies for water quality control.
CWC sections 13240-42	Authorizes RWQCB to adopt Water Quality Control Plans (Basin Plans) that assign beneficial uses for surface waters and groundwaters, and contain numeric and narrative water quality objectives that must provide reasonable protection of the beneficial uses of the groundwater. One of the factors that must be considered when establishing water quality objectives is the need to develop and use recycled water. Basin Plans must include a program of implementation for achieving the water quality objectives. For the SBWR study area, the San Francisco RWQCB's Basin Plan applies.
H&SC sections 116270 et seq.	This is the California Safe Drinking Water Act that authorizes primary and secondary maximum contaminant levels (MCLs) as included in the California Code of Regulations, Title 17 – Public Health, Chapter 5, Subchapter 1, Group 4 – Drinking Water Supplies, sections 7583 through 7630.
H&SC section 116455	Requires public water systems to take certain actions if drinking water exceeds Notification Levels (NLs). NLs are health-based advisory levels established by the DDW for chemicals in drinking water that lack MCLs. When chemicals are found at concentrations greater than their NLs, certain requirements and recommendations apply.
Recycled Water Permits	
CWC sections 13260, 13263, 13269, 13523.1	Dischargers proposing to discharge waste that could affect the quality of waters of the state must file a report of waste discharge to the RWQCB. After receiving this report, the RWQCB can issue specific or general Waste Discharge Requirements (WDRs) and/or Water Recycling Requirements

Code	Purpose
	(WRRs) that reasonably protect all beneficial uses and that implement any relevant water quality control plans and policies. The RWQCB can also issue a Master Reclamation Permit, which is a WDR that covers multiple non-potable reuse applications and requires periodic site inspections and adoption of rules and regulations for recycled water use. A RWQCB may require a discharger to provide monitoring program reports or conduct studies.
CWC section 13263.7	For compliance with permit limits, the release or discharge of recycled water suitable for direct potable reuse or surface water augmentation may be determined at the point where the recycled water enters the conveyance facility but prior to co-mingling with any raw water and consent for the discharge is obtained from the owner of the conveyance facility.
CWC section 13552.5	Authorizes the SWRCB to adopt General WDRs for Landscape Irrigation Uses of Municipal Recycled Water to streamline tertiary disinfected recycled water use. The General Permit was adopted in 2009; in 2014 the SWRCB adopted a new General Permit that supersedes this permit and covers all non-potable reuse applications.
H&SC section 116551	The DDW cannot issue a permit to a public water system or amend an existing permit for the use of a reservoir as a source of supply that is directly augmented with recycled water unless DDW (1) performs an engineering evaluation that evaluates the proposed treatment technology and finds that the technology will ensure that the recycled water meets MCLs and poses no significant threat to public health; and (2) holds at least three public hearings in the area where the recycled water is proposed to be used or supplied for human consumption.
H&SC section 116271	Effective July 1, 2014 transfers the CDPH Drinking Water Program to the SWRCB, including water reclamation and direct and indirect potable reuse; creates the Deputy Director of the new SWRCB DDW.
CWC section 13528.5	Effective July 1, 2014, the SWRCB may carry out the duties and authority granted to a RWQCB pursuant to Chapter 7 of the CWC (Water Reclamation sections 13500 – 13557, which include issuing potable reuse permits).
Recycled Water Regulations	
CWC sections 13500-13529.4; H&SC 116800 et seq.	Requires DDW to establish uniform statewide recycling criteria. DDW has developed these criteria for non-potable reuse and GWR and they are codified in Title 22 of the California Code of Regulations; regulations for cross connections are codified in Title 17.
CWC section 13540	Prohibits the use of any waste well that extends into a water-bearing stratum that is, or could be, used as a water supply for domestic purposes; injection

Code	Purpose
	wells or vadose zone wells used for recharge are part of this category (injection wells or vadose zone wells are considered waste wells under the CWC). An exception can be provided if (1) the RWQCB finds that water quality considerations do not preclude controlled recharge by direct injection, and (2) DDW finds, following a public hearing, that the proposed recharge will not degrade groundwater quality as a source of domestic water supply. This section of the CWC also allows DDW to make and enforce regulations pertaining replenishment of recycled water using injection wells.
CWC sections 13522.5 and 13523	Requires any person who proposes to recycle or to use recycled water to file an Engineering Report with the RWQCB on the proposed use. After receiving the report, and consulting with and receiving recommendations from DDW, and any necessary evidentiary hearing, the RWQCB must issue a permit (WDRs and/or WRRs) for the use.
CWC sections 13562-13563	Requires DDW to adopt uniform water recycling criteria for GWR by June 30, 2014 as emergency regulations, and for surface water augmentation by December 31, 2016; and requires DDW to investigate the feasibility of developing criteria for DPR and to provide a final report on that investigation to the Legislature by December 31, 2016. By February 14, 2014, DDW must convene an expert panel to advise DDW on water recycling criteria for surface water augmentation and the feasibility of DPR.

The remainder of this discussion is organized into the following topics:

- June 2014 GWR Regulations
- SWRCB Anti-degradation Policies
- SWRCB Recycled Water Policy
- RWQCB Groundwater Uses and Water Quality Objectives
- SWRCB Monitoring for Constituents of Emerging Concern (CECs) in Inland and Marine Discharges
- Update on DPR in California
- Update on DPR Outside of California
- Regulatory Implications for Future Use of Recycled Water for Stream Flow Augmentation and Off-stream Percolation

6.1.1 June 2014 GWR Regulations

Prior to June 18, 2014, the Water Recycling Criteria (Title 22 of the California Code of Regulations) included narrative requirements for planned GWR projects. The regulations required that the quality of recycled water must at all times fully protect public health and that DDW recommendations would be made on an individual case-by-case basis and would 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.

Since 1976, CDPH (now DDW) issued numerous draft versions of more detailed GWR regulations that served as guidance for the requirements applied to the six permitted GWR projects all of which are located in Southern California (see Table 6-4), as well as for planning GWR. In June 2014, these regulations were finalized, and will be the basis for any future facilities.

Table 6-4: Permitted Groundwater Replenishment Projects in California

Project	Type of Groundwater Replenishment Application	Years of Operation	Recycled Water Treatment	Dilution Water	Recycled Water Volume AFY	Planned Recycled Water Expansion AFY
Montebello Forebay Project, Los Angeles County	Surface spreading	51	Disinfected tertiary	Storm water, potable water, groundwater underflow	55,000[a]	21,000[a]
West Coast Basin Seawater Intrusion Barrier, Los Angeles County	Injection	19	AWT	Potable water; will use 100 percent recycled water for future expansion	17,000[a]	7,200[a,b]
Dominquez Gap Seawater Intrusion Barrier, Los Angeles County	Injection	10	AWT	Potable water; will use 100 percent recycled water for future expansion	5,400[a]	7,500[a,c]
Chino Basin Project, San Bernardino County	Surface spreading	8	Disinfected tertiary	Storm water, potable water, groundwater underflow	22,000[d]	---
Alamitos Gap Seawater Intrusion Barrier Project, Los Angeles County	Injection	8	AWT	Potable water; will use 100 percent recycled water for future expansion	3,400[a]	8,900[a,b]
Groundwater Replenishment System (GWRS), Orange County	Injection (seawater barrier) and spreading	5[e]	AWT	Use 100 percent AWT recycled water	78,000[f]	25,000[f]

Notes:

a. Source: information used for the Central and West Basin Salt Nutrient Management Plan. The permit was amended in April 2014 to allow up to 45 percent recycled water to be used for recharge.

b. Expected to be online in Fall 2014.

c. Expected to be online in 2017/18.

d. Source: from RWQCB Order No. R8-2005-0033.

e. Prior to GWRS, operated Water Factory 21 that blended AWT recycled water and groundwater for prevention of seawater intrusion.

f. Source: http://www.gwrsystem.com/images/stories/GWRS%20Expansion_State%20and%20Local.pdf; construction to be completed in 2015.

Final GWR regulations were adopted and went into effect June 18, 2014. The GWR Regulations are organized by type of project: (1) surface application (surface spreading) and (2) subsurface application (injection or vadose zone wells).

A summary of the key provisions in the GWR Regulations is presented in Table 6-5.

Table 6-5: GWR Regulations

	Surface Application	Subsurface Application
Source Control	Must administer a comprehensive source control program to prevent undesirable chemicals from entering raw wastewater. The source control program must include: (1) an assessment of the fate of DDW and RWQCB-specified contaminants through the wastewater and recycled water treatment systems; (2) provisions for contaminant source investigations and contaminant monitoring that focus on DDW and RWQCB-specified contaminants; (3) an outreach program to industrial, commercial, and residential communities; and (4) an up-to-date inventory of contaminants. *Note:* If the agency that administers the source control program is different than the agency producing or distributing the recycled water, DDW will require an agreement between the agencies to ensure the source control requirements are met.	
Boundaries Restricting Construction of Drinking Water Wells	Project proponents must establish (1) a "zone of controlled potable well construction," which represents the greatest of the horizontal and vertical distances reflecting the retention times required for pathogen control or for response retention time; and (2) a "secondary boundary" representing a zone of potential controlled potable well construction that may be beyond the zone of controlled potable well construction thereby requiring additional study. *Note:* Since it is not fully understood how the secondary boundary will be established, it will have to be negotiated with DDW; this requirement may lead to more restrictions on well development and required studies and more impacts in areas with numerous production wells and/or the desire to develop new wells to capture recharge water.	
Emergency Response Plan	A project sponsor must develop and be willing to implement a DDW-approved plan for an alternative source of potable water supply or treatment at a drinking water well if a GWR project causes the well to no longer be safe for drinking purposes.	
Adequate Managerial and Technical Capability	A project sponsor must demonstrate that it possess adequate managerial and technical capability to comply with the regulations. *Note:* DDW has indicated that project sponsors can use applicable sections of the drinking water Technical Managerial and Financial Assessment to demonstrate compliance with this requirement.	
Pathogen Control	- Must meet Title 22 disinfected tertiary effluent requirements. - The treatment system must achieve a 12-log enteric virus reduction, a 10-log Giardia cyst reduction, and a 10-log Cryptosporidium oocyst reduction using at least 3 treatment barriers. - For each pathogen, a separate treatment process can only be credited up to a 6-log reduction and at least 3 processes must each achieve no less than 1.0-log reduction. - Retention time: a credit for virus of 1-log/month (up to 6-logs) can be counted; the retention time must be validated by an added or intrinsic tracer approved by DDW.	- The treatment system must achieve a 12-log enteric virus reduction, a 10-log Giardia cyst reduction, and a 10-log Cryptosporidium oocyst reduction using at least 3 treatment barriers. - For each pathogen, a separate treatment process can only be credited up to a 6-log reduction and at least 3 processes must each achieve no less than 1.0-log reduction. - Retention time: a credit for virus of 1-log/month; must be validated by an added or intrinsic tracer approved by DDW.

Table 6-5: GWR Regulations

	Surface Application	Subsurface Application
	Giardia/Cryptosporidium Credit: If a project meets meet Title 22 disinfected tertiary effluent requirements or provides advanced treatment for the entire flow, and 6 months retention underground, a project will be credited with 10-log *Giardia* cyst reduction and 10-log *Cryptosporidium* oocyst reduction. *Note:* Meeting Title 22 450 CT disinfected tertiary requirements does not guarantee a 5-log virus reduction credit; will require project sponsors to have further discussion or demonstration with DDW.	
Nitrogen (N) Control	Total N must be less than 10 mg/L as N in recycled water or recharge water before or after application.	
Regulated Chemicals Control	**Recycled Water:** must meet all primary maximum contaminant levels (MCLs), with the exception of nitrogen compounds; for disinfection byproducts, for surface application projects, compliance can be determined in the recycled water or the recharge water before or after surface application and for subsurface application projects in the recycled water or recharge water; for secondary MCLs, compliance can be determined in recycled water or recharge water. **Diluent Water:** must meet primary and secondary MCLs based on upper limit if not historically used for recharge (except for secondary MCLs for color, turbidity, and odor).	
Notification Levels (NLs)	**Recycled Water:** the regulations include actions to be taken if an NL is exceeded in the recycled water or recharge water after application (excluding the effects of dilution), including additional monitoring. **Diluent Water:** Must ensure that diluent water does not exceed an NL and have a plan in place on actions to be taken if exceed an NL for credit prior to the operation of a project, diluent water must meet NLs.	
Total Organic Carbon (TOC)	**Surface application:** TOC_{max} = 0.5 mg/L ÷ RWC in undiluted recycled water prior to application or within the zone of percolation, diluted percolated recycled water with the value adjusted to negate diluent water, or the undiluted recycled water prior to application amended using a soil aquifer treatment (SAT) factor. *Note:* For surface application projects, treatment must consider the level of TOC to be achieved or a TOC alternative approved by DDW.	Recycled water TOC_{max} = 0.5 mg/L. *Note:* All recycled water must undergo advanced treatment – see advanced treatment criteria.
RWC	The RWC is defined by volume and TOC: - The recycled water applied at the GWR Project ÷ (recycled	The RWC is defined by volume and TOC: - The recycled water applied at the GWR Project ÷ (recycled water +

Table 6-5: GWR Regulations

	Surface Application	Subsurface Application
	water + credited dilution water). - The Initial Minimum RWC = 0.5 mg/L ÷ the maximum TOC concentration in the recycled water (before or after recharge) based on a 20-week running average.	credited dilution water). - The Initial Minimum RWC can be = 0.5 mg/L ÷ the maximum TOC concentration in the recycled water (0.5 mg/L).
Initial RWC	- Up to 20 percent unless an alternative initial RWC is approved by DDW based on: (1) the review of the engineering report <u>and</u> (2) information obtained as a result of the public hearing <u>and</u> (3) the project sponsor demonstrates that the treatment processes preceding SAT can reliably achieve a TOC 20-week running average no greater than 0.5 mg/L. - The RWC averaging period is 120 months. - TOC is sampled in undiluted recycled water after treatment or undiluted recycled water in the "zone of percolation." *Note:* A surface spreading project must start at a 20 percent RWC unless DDW has approved a higher RWC (100 percent is a possibility) and advanced treatment is provided to meet a TOC concentration of 0.5 mg/L (e.g., would require application of RO and AOP).	- To be determined by DDW (does not preclude starting at 100 percent). - The RWC averaging period is 120 months. *Note:* A subsurface application project has the possibility of starting at a 100 percent RWC if approved by DDW.
Increased RWC	Sequential incremental increases ≥ 50 percent and ≥ 75 percent allowed if: - The TOC 20-week average for prior 52 weeks = 0.5 mg/L ÷ RWC proposed max. - The increase is approved by DDW and authorized in the project permit. *Note:* Typically the RWC_{max} will be established during the project startup period (the first 6-12 months of operation). But, this provision allows phasing of projects if desired.	Increases allowed if: - The TOC 20-week average for prior 52 weeks < 0.5 mg/L. - The increase is approved by DDW and authorized in the project permit.
Advanced Treatment Criteria	**RO:** - Each membrane element must achieve a minimum sodium chloride (NaCl) rejection ≥ 99.0 percent and an average (nominal) NaCl rejection ≥ 99.2 percent using ASTM Method D4194-03 (2008), using the following substitute test conditions: (1) tests are operated at a	

Table 6-5: GWR Regulations

	Surface Application	Subsurface Application
	recovery ≥ 15 percent; (2) NaCl rejection is based on 3 or more successive measurements; (3) influent pH between 6.5 and 8.0; and (4) influent NaCl concentration ≤ 2,000 mg/L. - During the 20 weeks of full-scale operation, the membrane produces a permeate having no more than 5 percent of the sample results having TOC > 0.25 mg/L based on weekly monitoring. **AOP** – there are two options: - Option 1 - Conduct an occurrence study that identifies 9 indicators representing 9 functional groups, with 0.5-log removals for 7 of the indicators and 0.3-log removals for 2 of the indicators; establish at least one surrogate or operational parameter that reflects the removal of at least 5 of the 9 indicators (one of the surrogates must be monitored continuously); confirm the results using a study via challenge or spiking tests. - Option 2 - Conduct testing that includes challenge or spiking tests to demonstrate that the AOP process removes 0.5-log of 1,4-dioxane; establish surrogate or operational parameters that reflect whether the 0.5-log reduction of 1,4-dioxane is attained, and one of the surrogates can be monitored continuously.	
Application of Advanced Treatment	Advanced treatment is only needed for that portion of recycled water needed to meet the TOC/RWC requirements desired by the project sponsor.	Applied to the full recycled water volume.
SAT Performance	- Monitor recycled water or recharge water before and after recharge for 3 indicator constituents of emerging concern (CECs) with reductions < 90 percent triggering investigation. If a project sponsor demonstrates there are not 3 indicator compounds available and suitable for indicating a 90 percent reduction, a project sponsor may utilize an indicator compound that achieves a reduction less than 90 percent pending DDW approval of the compound and reduction criteria. - Project sponsors must conduct a DDW approved CEC occurrence study prior to operation and then every 5 years.	None.
Response Retention Time (RRT)	- RRT is the time recycled water must be retained underground to identify any treatment failure and implement actions so that inadequately treated recycled water does not enter a potable water system, including the plan to provide an alternative water supply or treatment. - The minimum RRT is 2 months, but must be justified by the project sponsor. - The RRT must be validated using an added tracer or a DDW approved intrinsic tracer.[a]	

Table 6-5: GWR Regulations

	Surface Application	Subsurface Application
Project Planning		

Method used to estimate the retention time to the nearest downgradient drinking water well	Virus Log Reduction Credit per Month
Tracer study using added tracer (first 10 percent of the peak tracer unit value reaches the downgradient endpoint)	1.0 log
Tracer study utilizing an intrinsic tracer (first 10 percent of the peak tracer unit value reaches the downgradient endpoint)	0.67 logs
Numerical modeling consisting of calibrated finite element or finite difference models using validated and verified computer codes used for simulating groundwater flow	0.50 logs
Analytical modeling using existing academically-accepted equations such as Darcy's Law to estimate groundwater flow conditions based on simplifying aquifer assumptions	0.25 logs
Method used to estimate RRT	Response Time Credit per Month
Tracer study using added tracer (first 10 percent of the peak tracer unit value reaches the downgradient endpoint)	1 month
Tracer study utilizing an intrinsic tracer first 10 percent of the peak tracer unit value reaches the downgradient endpoint)	0.67 months
Numerical modeling consisting of calibrated finite element or finite difference models using validated and verified computer codes used for simulating groundwater flow.	0.5 months
Analytical modeling using existing academically-accepted equations such as Darcy's Law to estimate groundwater flow conditions based on simplifying aquifer assumptions.	0.25 months

Alternatives

Allowed for all provisions in the regulations if:

- The project sponsor has demonstrated that the alternative provides the same level of public health protection.
- The alternative has been approved by DDW.
- If required by DDW or RWQCB, the project sponsor will conduct a public hearing.

Table 6-5: GWR Regulations

	Surface Application	Subsurface Application
	- An expert panel must review the alternative unless otherwise specified by DDW.	
Engineering Report	The project sponsor must submit an Engineering Report to DDW and RWQCB that indicates how a GWR project will comply with all regulations and includes a contingency plan to insure that no untreated or inadequately treated water will be used. The report must be approved by DDW.	

Notes: [a]The retention time represents the difference from when the water with the tracer is to when either 2 percent of the initially introduced tracer concentration has reached the downgradient monitoring point, or 10 percent of the peak tracer unit value is observed at the downgradient monitoring point. With DDW approval, an intrinsic tracer may be used in lieu of an added tracer with no more credit provided than 0.67-log per month.

6.1.2 SWRCB Requirements

There are two state policies of particular importance with respect to GWR projects for protection of water quality and human health: two anti-degradation policies, and the Recycled Water Policy, which is reviewed below. In addition, the SWRCB Division of Water Rights implements the CWC 1211 petitions for change.

California's anti-degradation policies are found in Resolution 68-16, Policy with Respect to Maintaining Higher Quality Waters in California, and Resolution 88-63, Sources of Drinking Water Policy.[11] These resolutions are binding on all State agencies. They apply to both surface waters and groundwaters (and thus GWR projects), protect both existing and potential beneficial uses of surface water and groundwater, and are incorporated into RWQCB Basin Plans.

Resolution 68-16 (Anti-degradation Policy)

The Anti-degradation Policy requires that existing high water quality be maintained to the maximum extent possible, but allows lowering of water quality if the change is "consistent with maximum benefit to the people of the state, will not unreasonably effect present and anticipated use of such water (including drinking), and will not result in water quality less than prescribed in policies." The Anti-degradation Policy also stipulates that any discharge to existing high quality waters will be required to "meet waste discharge requirements which will result in the best practicable treatment or control of the discharge to ensure that (a) pollution or nuisance will not occur and (b) the highest water quality consistent with maximum benefit to the people of the State will be maintained."

Resolution 88-63 (Sources of Drinking Water Policy)

The Sources of Drinking Water Policy designates the municipal and domestic supply (MUN) beneficial use for all surface waters and groundwater except for those: (1) with total dissolved solids (TDS) exceeding 3,000 mg/L, (2) with contamination that cannot reasonably be treated for domestic use, (3) where there is insufficient water supply, (4) in systems designed for wastewater collection or conveying or holding agricultural drainage, or (5) regulated as a geothermal energy producing source. Resolution 88-63 addresses only designation of water as drinking water source; it does not establish objectives for constituents that threaten source waters designated as MUN.

SWRCB Recycled Water Policy

The Recycled Water Policy was adopted by the SWRCB in February 2009. It was subsequently amended in 2013 with regard to monitoring constituents of emerging concern (CECs) for GWR projects. The Recycled Water Policy was a critical step in creating uniformity in how RWQCBs were individually interpreting and implementing Resolution 68-16 for water recycling projects, including GWR projects.

Salt Nutrient Management Plans (SNMPs)

The Recycled Water Policy included provisions for managing salts and nutrients on a regional or watershed basis through development of SNMPs rather than imposing requirements on individual recycled water projects (which had been the practice prior to adoption of the Recycled Water Policy).

[11] See http://www.swrcb.ca.gov/plans_policies/.

Unfavorable groundwater salt and nutrient conditions can be caused by natural soils, discharges of waste, irrigation using surface water, groundwater, or recycled water, and water supply augmentation using surface or recycled water. Regulation of recycled water alone will not address these conditions.

SNMPs are to be developed for every groundwater basin/sub-basin by May 2014 (May 2016 with a RWQCB-approved extension). The SNMP must identify salt and nutrient sources; identify basin/sub-basin assimilative capacity and loading estimates; and evaluate the fate and transport of salts and nutrients. The SNMP must include implementation measures to manage salt and nutrient loadings on a sustainable basis and an anti-degradation analysis demonstrating that all recycling projects identified in the plan will collectively satisfy the requirements of Resolution No. 68-16. The SNMP must also include an appropriate cost effective network of monitoring locations to determine if salts, nutrients and other constituents of concern (as identified in the SNMPs) are consistent with applicable water quality objectives.

RWQCB GWR Requirements

The Recycled Water Policy does not limit the authority of a RWQCB to include more stringent requirements for GWR projects to protect designated beneficial uses of groundwater, *provided* that any proposed limitations for the protection of public health may only be imposed following regular consultation with DDW.[12] The Recycled Water Policy also does not limit the authority of a RWQCB to impose additional requirements for a proposed GWR project that has a substantial adverse effect on the fate and transport of a contaminant plume (for example those caused by industrial contamination or gas stations), or changes the geochemistry of an aquifer thereby causing the dissolution of naturally occurring constituents, such as arsenic, from the geologic formation into groundwater. These provisions require additional assessment of the impacts of a GWR project on areas of contamination in a basin and/or if the quality of the water used for recharge causes constituents, such as naturally occurring arsenic, to become mobile and impact groundwater.

Anti-degradation and Assimilative Capacity for GWR Projects

Assimilative capacity is the ability for groundwater to receive contaminants without detrimental effects to human health or other beneficial uses. It is typically derived by comparing background ambient chemical concentrations in groundwater to the concentrations of the applicable RWQCB Water Quality Control Plan (Basin Plan) groundwater quality objectives. The difference between the ambient concentration and groundwater quality objective is the available assimilative capacity.

The Recycled Water Policy established two assimilative capacity thresholds in the absence of an adopted SNMP for conducting anti-degradation analyses. A GWR project that utilizes less than 10 percent of the available assimilative capacity in a groundwater basin/sub-basin (or multiple projects utilizing less than 20 percent of the available assimilative capacity in a groundwater basin/sub-basin) is only required to conduct an anti-degradation analysis verifying the use of the assimilative capacity. In the event a project or multiple projects utilize more than the fraction of the assimilative capacity (e.g., 10 percent for a

[12] An internal SWRCB task force is discussing issues such as consultation between DDW and RWQCBs as the transition process for DDW proceeds during Fiscal Year 2014/15.

single project or 20 percent for multiple projects), the project proponent must conduct a RWQCB-deemed acceptable (and more elaborate) anti-degradation analysis. A RWQCB has the discretionary authority to allocate assimilative capacity to GWR projects. There is a presumed assumption that allocations greater than the Recycled Water Policy thresholds would not be granted without concomitant mitigation or an amendment to the Basin Plan groundwater quality objective to create more assimilative capacity for allocation. GWR projects that utilize advanced treated recycled water will use very little to essentially none of the available assimilative capacity for salts and nutrients.

CEC Monitoring

As part of the SWRCB Recycled Water Policy, a Science Advisory Panel was formed to identify a list of CECs for monitoring recycled water used for GWR and landscape irrigation. The Panel completed its report in June 2010 and recommended monitoring selected health-based and treatment performance indicator CECs and surrogates for GWR projects. No CEC monitoring was recommended for landscape irrigation. The groundwater recharge monitoring recommendations were directed at surface spreading using tertiary recycled water (specifically monitoring recycled water and groundwater) and injection projects using RO and advanced oxidation (specifically monitoring recycled water).

The Recycled Water Policy was amended by the SWRCB on January 22, 2013 and the Amendment was approved by OAL on April 25, 2013. The Recycled Water Policy Amendment provides the final list of specific CECs and monitoring frequencies (see Table 6-6), and procedures for evaluating the data and responding to the results. The next update of CEC monitoring by an expert panel will occur in 2015. As part of the GWR Regulations, DDW has CEC requirements and monitoring locations that must be addressed in a project's Engineering Report.

Table 6-6: SWRCB Recycled Water Policy CECs to be Monitored

Constituent[a]	Constituent Group	Relevance/Indicator Type	Reporting Limit (μg/L)[b]
Groundwater Recharge Reuse – Surface Application			
17β-estradiol	Steroid hormones	Health	0.001
Caffeine	Stimulant	Health & Performance	0.05
N-Nitrosodimethylamine (NDMA) (NDMA)	Disinfection byproduct	Health	0.002
Triclosan	Antimicrobial	Health	0.05
Gemfibrozil	Pharmaceutical	Performance	0.01
Iopromide	Pharmaceutical	Performance	0.05
N,N-Diethyl-meta-toluaminde (DDET)	Personal care product	Performance	0.05
Sucralose	Food additive	Performance	0.1
Groundwater Recharge and Reuse – Subsurface Application			
17β-estradiol	Steroid hormones	Health	0.001
Caffeine	Stimulant	Health & Performance	0.05
NDMA	Disinfection byproduct	Health & Performance	0.002
Triclosan	Antimicrobial	Health	0.05
DEET	Personal care product	Performance	0.05
Sucralose	Food additive	Performance	0.1

Notes:
a. Monitoring frequency is quarterly for the initial assessment phase; semi-annually for the baseline phase; and semi-annually to annually for the standard operation phase; CECs can be removed or monitoring can increase based on the results
b. μg/L – microgram per liter

SWRCB CEC Monitoring for Inland and Marine Discharges

The SWRCB is working on developing a CEC monitoring framework for surface water discharges with the assistance of the Southern California Coastal Water Research Project (SCCWRP). SCCWRP and the David and Lucile Packard Foundation sponsored an expert panel that has prepared a 2012 report (Monitoring Strategies for Chemicals of Emerging Concern (CECs) in California's Aquatic Ecosystems: Recommendations of a Science Advisory Panel) that provided the State with recommendations on appropriate monitoring and management strategies for inland surface waters and marine waters to limit the impact of CECs on oceans, estuaries and coastal wetlands, and freshwater ecosystems.13 To vet the recommendations from the expert panel, SCCWRP is developing a pilot study for regions within the State. The Plan will address:

- Monitoring requirements - which CECs to monitor in various matrices, scenarios, and candidate watersheds/water bodies, where and how often to monitor, etc.

[13] See **http://ftp.sccwrp.org/pub/download/DOCUMENTS/TechnicalReports/692_CECEcosystemsPanelReport_Final.pdf.**

- Special studies to evaluate cutting edge technology.
- Quality assurance/quality control guidelines.

When monitoring recommendations are adopted by the SWRCB, these requirements would be applicable for any GWR project that discharges to an inland surface water or disposes of RO concentrate through an ocean outfall. Updates on this effort are available on the SWRCB website at: http://www.swrcb.ca.gov/water_issues/programs/swamp/cec_aquatic/.

RWQCB Groundwater Beneficial Uses and Water Quality Objectives

The potential GWR projects would replenish the Santa Clara Valley Groundwater Basin (Santa Clara Sub-basin). Table 2-2 in the San Francisco Basin Plan lists four existing beneficial uses for the Santa Clara Sub-basin: Municipal and Domestic Supply (MUN), industrial process water supply (PROC), industrial service water supply (IND), and agricultural water supply (AGR). To protect the MUN beneficial use, the Basin Plan establishes water quality objectives including those based on primary and secondary MCLs. To protect the AGR beneficial use, the Basin Plan includes groundwater objectives.

To assess treatment options, the following groundwater objectives for salts must be considered as shown in Table 6-7:

Table 6-7: Basin Plan Groundwater Salinity Objectives for the Santa Clara Sub-Basin

Constituent	MUN	AGR	
		Threshold	Limit
Electrical conductivity (EC), millimhos per centimeter	900[a]	---	0.2- 3.0
TDS, mg/L	500[a]	---	---
Chloride, mg/L	250[a,b]	142.0	355.0
Sulfate, mg/L	250[a,b]	---	---

Notes:

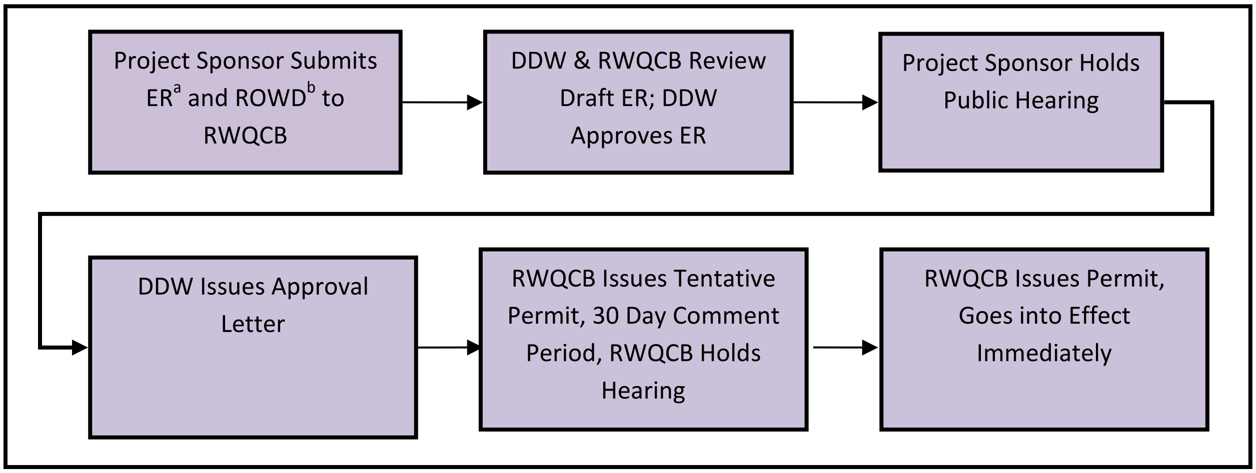
a. Recommended level in Title 22 Secondary Drinking Water Standards, May 2006.
b. These MCLs were not included in Basin Plan Table 3-5, but were included in the May 2006 version of the Title 22 Secondary Drinking Water Standards, and are therefore applicable.

Permitting GWR Projects

Effective July 1, 2014, the DDW as part of the SWRCB has the authority to issue WDRs and WRRs. As the transition proceeds during Fiscal Year 2014/15, more information will be available on how permitting responsibilities will be handled by DDW and RWQCBs.

The current (or potentially interim) process for project approval and permitting of GWR projects is depicted in Figure 6-3. The RWQCB would issue the permit based on requirements consistent with the GWR Regulations, Basin Plans, SNMPs, and State policies. The type of permit (WDR and/or WRR) issued would depend on how and where the recycled water is “discharged”.

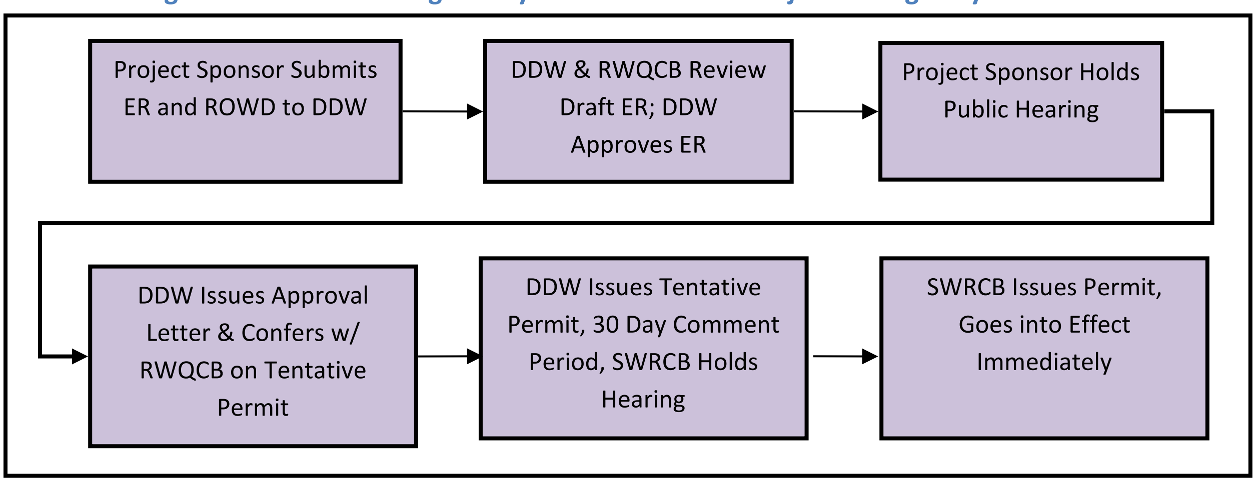
Figure 6-3: Current Regulatory Process for GWR Projects Using Recycled Water



Notes:
a. ER – Engineering Report.
b. ROWD – Report of Waste Discharge.

If DDW becomes the permitting authority for GWR projects, the possible approval and permitting process may follow the steps shown in Figure 6-4.

Figure 6-4: Potential Regulatory Process for GWR Projects Using Recycled Water



6.1.3 Update on Direct Potable Reuse in California

Senate Bills 322 and 918 require DDW, in consultation with the SWRCB, to investigate and report to the Legislature by the end of December 2016 on the feasibility of developing uniform criteria for DPR with the assistance of an expert panel and advisory group. The advisory group has been formed[14], and will assist with establishing the expert panel.[15] The expert panel will:

- Assess what, if any, additional areas of research are needed to be able to establish uniform water recycling criteria for DPR;
- Advise DDW on public health issues and scientific and technical matters regarding development of uniform water recycling criteria for IPR through surface water augmentation; and
- Advise DDW on public health issues and scientific and technical matters regarding the feasibility of developing uniform water recycling criteria for DPR.

The WateReuse Association, WateReuse California, WateReuse Research Foundation (WRRF), and California Urban Water Agencies are spearheading discussions and research related to DPR. WateReuse California has an active Potable Reuse Committee that is tracking relevant research, legislation, and planning efforts related to DPR (see **http://www.watereuse.org/sections/california/direct-potable**).

During 2012, a major focal point for WRRF, in conjunction with WateReuse California, was the launch of the DPR Initiative, which is a $6 million, four-year effort designed to commission specific research targeted at DPR feasibility and acceptance in California and to assist DDW with implementation of the December 2016 report to the California Legislature per Senate Bill 918.

Of the projects comprising the DPR Initiative, from a regulatory perspective, WRRF Project 11-02 is of note. This project includes an NWRI expert panel report that examines pathogen and chemical specific criteria for DPR.[16] Subsequent work includes pilot and bench scale testing to assess the equivalency of advanced treatment trains and determine what modifications, if any, are necessary to satisfy public health criteria for DPR. Other WRRF DPR research projects include the following:

- 11-01: Monitoring for Reliability and Process Control of Potable Reuse Applications
- 11-05: Demonstrating the Benefits of Engineered Direct Potable Reuse vs. Unintentional Indirect Potable Reuse Systems
- 11-10: Evaluation of Risk Reduction Principles for Direct Potable Reuse
- 12-06: Guidelines for Engineered Storage of Direct Potable Reuse
- 12-07: Methods for Integrity Testing of NF and RO Membranes
- 13-02: Model Public Communication Plan for Advancing DPR Acceptance

[14] See http://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/RW_DPR_advisorygroup.shtml.
[15] See http://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/RW_SWA_DPRexpertpanel.shtml.
[16] See http://nwri-usa.org/pdfs/DirectPotableWorkshopSummaryFINAL091010.pdf.

- 13-03: Critical Control Point Assessment to Quantify Robustness and Reliability of Multiple Treatment Barriers of DPR
- 13-12: Evaluation of Source Water Control Options and the Impact of Selected Strategies on DPR
- 13-13: Development of Operations and Maintenance Plan, Training, and Certification for DPR Systems
- 13-14: Assessment of Techniques to Evaluate and Demonstrate the Safety of Water from DPR Treatment Facilities (joint project with the Water Research Foundation)
- 13-15: Blending Requirements for Water from DPR Treatment Facilities (joint project with the Water Research Foundation)

6.1.4 Update on Direct Potable Reuse Outside of California

The longest operational DPR project is the Windhoek project in Namibia (Africa). There are two operational projects in the U.S.: the Colorado River Municipal Water District (CRMWD) Project at Big Spring, Texas (Big Spring Project) and the City of Wichita Falls, Texas project. In addition the Village of Cloudcroft, New Mexico has a project in the regulatory approval/construction stage. Information on each project is provided below.

Windhoek

This project has been in operation since 1968 serving a population of 250,000 people. The project currently produces 5.5 million gallon per day (mgd) of recycled water from the New Goreangab facility and then is blended with potable water consisting of treated surface water or groundwater (50 percent) before being released to the City of Windhoek water distribution system. The recycled water treatment system at the is comprised of the following unit treatment processes: powdered activated carbon, pre-ozonation, coagulation/flocculation, dissolved air flotation, sand filtration, ozonation/hydrogen peroxide, biologically activated carbon (BAC), granular activated carbon (GAC), ultrafiltration (UF), and chlorination.

Texas Projects

The Texas Commission on Environmental Quality (TCEQ) evaluates DPR projects on a case-by-case basis per Texas regulations that allow for the use of an alternative raw water source and innovative alternative treatment. TCEQ requires pilot study or verification testing for each project. Requirements are established for regulated contaminants as the agency does not believe it has jurisdiction to regulate unregulated contaminants. There are no storage requirements. Projects are given specific design, operational, reporting, calibration, and record keeping requirements.

Big Spring Project This project began delivering water to consumers in April 2013. The project consists of a 2.5 mgd advanced water treatment facility, with 1.78 mgd of purified recycled water blended with the raw water supply (up to 20 percent). The combined waters are treated at the CRMWD water treatment plant, and then delivered to customers. The advanced treatment system receives disinfected tertiary effluent and uses MF/RO/AOP.

City of Wichita Falls: The project began delivering water to customers in July 2014. Disinfected secondary effluent is treated using MF/RO and blended with raw lake water on a 50:50 basis for treatment at the conventional surface water treatment plant. The final product water goes into existing storage prior to distribution to customers.

Texas Water Development Board Resource Document

The Texas Water Development Board (TWDB) is co-funding a project (Evaluating the Potential of Direct Reuse in Texas) along with a number of Texas utility stakeholders to support the development of a resource document that will provide scientific and technical information related to the implementation of DPR projects in Texas. The TWDB has contracted with a consulting team that includes a number of leading potable reuse experts to help develop this resource document, including Nellor Environmental Associates. TCEQ is working closely with the TWDB in the development of this resource document. Additional information on the project is available at the TWDB website at: http://www.twdb.state.tx.us/innovativewater/reuse/projects/directpotable/index.asp.

Cloudcroft, New Mexico PURe Water Project

Originally this project was considered to be an IPR project by its sponsor because it includes a mixing/storage component. It is currently being treated by the New Mexico Environment Department as a DPR project. This project, under construction, consists of sewage treatment using a membrane bioreactor, RO, and AOP with the recycled water blended with spring water (>51 percent and stored), and then further treated using UF, UV, GAC, and chlorination before being served to customers. This facility is expected to be online in 2015.

6.1.5 Regulatory Implications for Off-stream Percolation with Nexus to a Water of the U.S.

A future potable reuse alternative may involve the use of existing off-stream percolation facilities for surface spreading of recycled water. These facilities are currently used to recharge State Water Project water, Central Valley Project water, and stormwater. Based on the current practice, a permit is not required for recharge; however, if in the future recycled water is included as a source of recharge, it would trigger application of the DDW Groundwater Recharge and a RWQCB permit. If the discharge is to an off-stream percolation basin, it would require an RWQCB permit (possibly only Water Recycling Requirements (WRR), but more likely both a WRR and Waste Discharge Requirements (WDR)). The exception would be if the there is a significant nexus between the percolation ponds and a water of the U.S. (e.g., day lighting in surface water after percolation) that would necessitate a National Pollutant Discharge Eliminations System (NPDES) permit. Per the Ninth Circuit Court Healdsburg ruling, in such circumstances, a discharge to a percolation pond would require an NPDES permit.[17] Also, the U. S. Environmental Protection Agency (USEPA) has proposed regulations regarding defining Waters of the

[17] See Northern California River Watch v. City of Healdsburg, 457 F.3d 1023 (9th Cir. 2006).

U.S. (WOTUS). The proposal broadly expands what would be covered under the federal definition, including off stream spreading basins. The comment period for the proposed ended in October 2014. It is a controversial rule and is expected to garner significant comments. It is not known at this time if USEPA will revise the rule prior to promulgation, not proceed with the rule, or wait until the next Administration to take action.

As discussed in the Surface Water Augmentation TM, consideration of a project that discharges to Waters of the U.S. designated as MUN should take into consideration that the permits could include stringent requirements, specifically the human health criteria in the California Toxics Rule (CTR) and how effluent limitations are established based on the Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California (SIP).

In 2000, the USEPA adopted the CTR that included aquatic life criteria for 23 priority pollutants and human health criteria for 57 priority pollutants. The freshwater criteria are expressed as (1) Criteria Maximum Concentrations (CMCs) that are equal to the highest concentration of a pollutant to which aquatic life can be exposed for a short period of time without a deleterious effect; and (2) as Criteria Continuous Concentrations (CCCs) that are equal to the highest concentration of a pollutant to which aquatic life can be exposed for an extended period of time (4 days) without a deleterious effect. The CCC criteria are more stringent than the CMC criteria.

The CTR human health criteria are based on exposure to a pollutant that occurs through the ingestion of water and contaminated fish and shellfish. In calculating the criteria, the underlying exposure assumptions are (1) the consumption of 2 liters per day of water at the criteria concentration and the consumption of 6.5 grams per day of fish and shellfish contaminated at a level equal to the criteria concentration but multiplied by a bio-concentration factor (water and organisms criteria); and (2) the consumption of 6.5 grams per day of fish and shellfish contaminated at a level equal to the criteria concentration but multiplied by a bio-concentration factor (organism only criteria). The CTR human health criteria protect the general population at an incremental cancer risk level of one in a million (10^{-6}) based on USEPA's Integrated Risk Information System as of October 1996. The water and organism criteria, which apply to MUN and REC-1, are more stringent than the organism only criteria, which apply to REC-2.

In adopting criteria in the CTR, the USEPA in some cases included the National Toxics Rule (NTR) criteria and in others updated some of the CWA section 304(a) recommended criteria based on new or revised reference doses and cancer potency factors and updated aquatic life toxicity data sets.

In the same year, the SWRCB adopted implementation procedures for the CTR through the SIP. The SIP was amended in 2005. The CTR criteria and SIP are applicable to discharges of wastewater to all inland surface waters and enclosed bays and estuaries of California, except where existing State objectives have been previously adopted and are more restrictive, where site-specific objectives have been adopted by the State and approved by USEPA, or where 1992 NTR federal criteria already are in place.

The SIP includes procedures to determine which priority pollutants need effluent limitations (e.g., reasonable potential analysis); methods to calculate water quality-based effluent limitations (this includes statistical equations that adjust CTR criteria for effluent variability and for averaging periods and exceedance frequencies of the criteria/objectives); and policies regarding mixing zones, metals translators, monitoring, pollution prevention, reporting levels for determining compliance, and whole effluent toxicity control. Using the SIP, permit limits are established for those CTR constituents that have the reasonable potential to cause or contribute to an excursion above any applicable criteria including consideration of a mixing zone (e.g., dilution factor).

For a receiving water with a municipal and domestic drinking water supply beneficial uses (MUN) as designated in the Basin Plan, there are a number of priority pollutants with extremely stringent CTR human health criteria (water and organisms). Examples of some these pollutants include three disinfection byproducts (and their CTR criteria):

- NDMA – 0.69 nanograms per liter (ng/L)
- Chlorodibromomethane (CDBM) – 0.401 µg/L
- Dichlorobromomethane (DCBM) – 0.56 µg/L

Data from potable reuse projects with advanced treatment systems (MF/RO/AOP), such as GWRS, West Coast Basin Barrier, and the San Diego Demonstration Project, show that at times concentrations of the three constituents are higher than the CTR criteria. This is not an issue for GWRS and the West Coast Basin Barrier because they do not discharge to a Water of the U.S (for the proposed San Diego reservoir augmentation project, a mixing zone is expected to be granted). Thus in the absence of a mixing zone, it may be difficult to consistently meet these criteria end-of-pipe, and application of additional advanced treatment processes beyond RO and AOP would be likely. Removal of CDBM and DCBM would likely require air stripping, GAC, or BAC, and removal of NDMA would require additional UV to achieve photolysis.

The USEPA has updated its national recommended water quality criteria for human health for 94 chemical pollutants to reflect the latest scientific information and USEPA policies, including updated fish consumption rates. Once finalized, the USEPA water quality criteria provide recommendations to states and tribes authorized to establish water quality standards under the CWA. For human health criteria that are predominantly based on fish consumption exposure, the new criteria are more stringent than the criteria in the CTR based on the use of revised fish consumption rates and relative source contribution factors (this does not impact the three disinfection byproducts). If the CTR were to be amended (or the SWRCB elected to adopt its own water quality based on the revised human health criteria), this would impact surface water discharge limits.

Any discharges to an inland Water of the U.S. would be impacted by future State Policies (for example the forthcoming Nutrient Policy, Toxicity Policy, and new water quality objectives for methymercury) that could require additional treatment.

NPDES permits also have more significant associated civil and criminal liability for permit violations in comparison to land disposal WDRs or WRRs, including third party lawsuits.

6.2 Advanced Water Purification Treatment Options

Advanced treatment provides additional protections to the local groundwater basin and enables potable reuse pathways to achieve the SBWR Strategic Plan recycled water targets. There are three AWPF treatment options that could be applied to the potable reuse pathways described earlier.

The three treatment options that are considered for potable reuse include the following:

- Option 1: MF and RO with disinfection
- Option 2: Full Advanced Treatment: MF, RO with AOP and disinfection
- Option 3: Alternative treatment: Ozone, BAC, and disinfection

These three treatment options are described in more detail in this section.

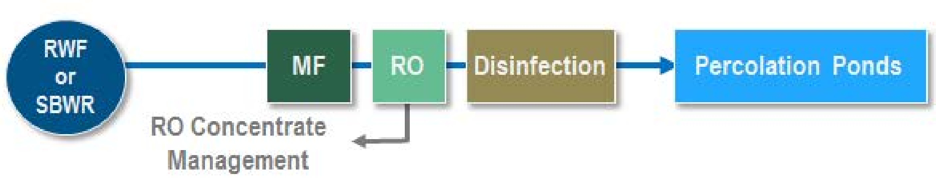
6.2.1 Option 1: MF and RO with Disinfection (MF, RO, and UV)

This treatment option consists of MF/RO followed by disinfection. Ultraviolet light irradiation (UV) disinfection is assumed for this evaluation to be consistent with the disinfection system designed for the SVAWPC.

Overview

See Figure 6-5 for the process flow diagram of this treatment option. Feed water would be sourced from either the RWF (centralized treatment) or SBWR distribution system (satellite treatment). The process train would consist of membrane filtration (MF), RO, and UV disinfection. Purified recycled water would be recharged via surface spreading at the percolation ponds. While this process train is not considered full advanced treatment and therefore ineligible for direction injection into the groundwater aquifer, the use of percolation ponds adds another natural treatment step for the purified recycled water by leveraging the soil aquifer treatment (SAT) capability of ponds for the reduction of TOC and CEC concentrations in the purified recycled water.

Figure 6-5: Process Flow Diagram – RO with UV Disinfection



Process Description

The following are brief descriptions of treatment technologies within this treatment option. Three treatment technologies are described: MF, RO, and UV disinfection. These technologies are widely used in drinking water and recycled water applications.

Membrane Filtration

Treatment trains employing RO technology in wastewater applications require pretreatment to ensure suitable feed water that minimizes fouling of the RO membranes by suspended solids and colloidal matter. Typically, RO pretreatment is achieved by a MF system. MF systems are capable of removing nearly 100 percent of the total suspended solids (TSS), bacteria, protozoa, and algae from the water, without impacting dissolved material in the water, and without reliance on chemical pretreatment. MF technologies include both microfiltration and ultrafiltration. These technologies are approved by DDW for use in recycled water applications and have been granted credit in drinking water applications for removal of 99.99 percent of non-viral pathogens (removal credits for viruses vary by manufacturer and have not been granted in any California IPR projects to date).

MF systems are available in submerged or pressurized systems and use different module configurations depending on the system. In submerged systems, membranes are suspended in a basin and the feed water is at atmospheric pressure. In this scenario, a pump is used to provide vacuum pressure on the filtrate side of the membrane. Pressurized systems typically use pumps to apply a trans-membrane pressure to the feed, while the filtrate (treated) water is at roughly atmospheric pressure. In both instances, the pressure difference generated across the membranes drives the filtration process and the removal of pathogens.

The difference between microfiltration and ultrafiltration is in the nominal pore size. Microfiltration membranes have a nominal pore size between 0.1 and 0.2 micrograms (µm), whereas ultrafiltration membranes have a nominal pore size between 0.01 and 0.08 µm. In most cases the two technologies are used interchangeably, operating at similar pressures, removal rates, and fouling rates. The membrane geometry is a hollow fiber membrane, where several hollow membrane fibers are wrapped in a tubular formation, with filtration occurring through the walls of the fibers. The feed water is generally introduced from the outside of the membrane fibers; however, some manufacturers utilize an inside-out configuration.

To avoid membrane fouling, hollow fiber membranes are typically backwashed every 20 minutes to a half hour using water, often combined with air scour. Backwash pumps are typically required along with an on-site storage reservoir. MF systems utilize a clean-in-place (CIP) system to provide periodic (typically once a month) regenerative cleaning of the MF membranes with chemical addition, often consisting of both acid and sodium hypochlorite cleaning. Blowers are typically required when air scour is used during a backwash.

Membrane pre-filters or strainers are typically provided by the manufacturer as part of the MF package upstream of the membrane filtration to protect the membranes from damage due to larger particulates. Different MF systems have different feed water quality requirements for protecting their membranes from damage. It is recommended that all system suppliers provide pre-screening of the MF feed water to remove suspended solids particles greater than 0.1 to 2 mm (100 to 2,000 micron, depending on the system manufacturer).

Figure 6-6 shows a pressurized MF installation at the existing SVAWPC in San José, California.

Figure 6-6: Pall MF System at the Existing SVAWPC

Reverse Osmosis

RO is a physical separation process that uses a membrane to separate the solvent portion of a solution from the solute portion by applying pressure. RO has an extensive history of being effectively utilized in wastewater treatment, recycled water, and seawater desalination for removal of a wide array of dissolved constituents that are not removed through a filtration process. RO has shown that it is effective at removing the refractory dissolved organic constituents of particular concern in potable reuse applications.

The RO process involves the application of hydrostatic pressure to a liquid to allow the liquid to overcome the osmotic pressure and pass through a semi-permeable membrane. The RO membranes are composed of thin film composite (TFC) materials consisting of polysulfone support layer with polyamide membrane skin. The benefits of TFC include high porosity, high uniformity, and use over a wide pH range. The drawbacks of the TFC membranes include low free chlorine tolerance and moderate compaction over time. RO membranes are configured in spiral wound elements. Multiple elements, typically six or seven, are used in series, within a horizontal pressure vessel.

RO systems used for reuse applications typically operate at 70 to 85 percent feed water recovery, depending on the feed water quality and the number of stages utilized. For preliminary planning it is assumed that the RO system will have 85 percent recovery. The RO system for the AWPF will have two or three stages.

The RO membranes will remove the majority of the dissolved organic and inorganic components, producing permeate with low TDS and TOC. The membranes will also remove any microorganisms that were not removed in previous processes. Most contaminants of emerging concern, such as pharmaceuticals and personal care products, will also be removed by the RO membranes, however, some key constituents, such as NDMA and 1,4-dioxane are not entirely removed and will require additional treatment through AOP (see Section 6.2.2). Figure 6-7 shows the RO system at existing SVAWPC.

Figure 6-7: RO System at the Existing SVAWPC

When RO removes contaminants, it creates a concentrate stream with elevated levels of these contaminants. This concentrate stream can be challenging to dispose of in inland locations, and will contribute to elevated salinity in the wastewater collection system if disposed of through local sewers. Based on water quality data available for the RWF, RO concentrate water quality is estimated in Table 6-8 for all constituents that were detectable in the source water. An RO recovery of 85 percent was assumed to be consistent with the recovery rate of the SVAWPC, which will also be the most-likely recovery for a centralized AWPF. Recovery rates for satellite AWPFs could be higher (i.e., 90 to 92.5 percent) to minimize the amount of RO concentrate that would need to be added to the sewer and returned to the RWF. An additional third-stage high recovery RO system operated in a scaling mode or some other concentrate minimization treatment process would be required increase the overall RO system recovery from 85 percent to above 90 percent.

Table 6-8: RO Concentrate Quality Projections (85% recovery)

Constituent	Units	Average Feed Concentration[1]	RO Rejection Rate[2]	Concentration in RO Concentrate
Ammonia	(mg/L)	0.733	98%	4.80
Antimony	(µg/L)	0.403	99%	2.66
Arsenic	(µg/L)	1.037	80%	5.74
Beryllium	(µg/L)	0.007	98%	0.05
Chlorodibromomethane	(µg/L)	2.899	99%	19.2
Chloroform	(µg/L)	8.571	99%	56.7
Copper	(µg/L)	3.091	99%	20.4
Cyanide	(µg/L)	2.264	96%	14.6
Lead	(µg/L)	0.290	99%	1.92
Mercury	(µg/L)	0.002	98%	0.01
Methylene Chloride	(µg/L)	0.294	99%	1.94
Nickel	(µg/L)	6.312	98%	41.4
Selenium	(µg/L)	0.473	98%	3.10
Silver	(µg/L)	0.026	98%	0.17
Thallium	(µg/L)	0.030	98%	0.20
Toluene	(µg/L)	0.424	99%	2.80
Total Chromium	(µg/L)	0.533	99%	3.52
Zinc	(µg/L)	2.850	96%	18.4

Notes:
1 - Feed concentrations based on average feed concentration data from the RWF secondary effluent between June 2009 and September 2012.
2 - RO rejection rates are based on various vendor software data as well as experience with similar advanced treatment systems. The largest values in the rejection rate ranges for RO were used in the model to be conservative.

Ultraviolet Light Disinfection

UV disinfection systems function by transferring electromagnetic energy from lamps to the microorganisms, penetrating the cell walls, and destroying the cell's ability to reproduce. The main components of a UV disinfection system are mercury arc lamps, a reactor, and ballasts. The source of UV radiation is either from a low-pressure or medium-pressure mercury arc lamp with low or high intensities. The optimum wavelength to effectively inactivate microorganisms is in the range of 250 to 270 nanometers (nm). The effectiveness of a UV disinfection system depends on the characteristics of the feed water, the intensity of UV radiation, the amount of time the microorganisms are exposed to the radiation, and the reactor configuration. To meet Title 22 disinfection requirements, UV disinfection systems must achieve a 5-log virus reduction, which is typically based on disinfection of poliovirus or MS2, used as a surrogate. By this standard, a dose of 40 millijoules per square centimeter (mJ/cm^2) is needed to comply with Title 22 disinfection requirements. In contrast, drinking water standards for UV disinfection are based on the more difficult to remove adenovirus, which requires a dose of 186 mJ/cm^2 for 4-log reduction.

UV systems are available in either open channel or pressurized system configurations. In open channel systems, the UV lamps are installed in modules within channels where feed water flows either parallel or perpendicularly to the lamps. A weir is typically located at the end of the channel to keep the lamp modules submerged. In pressurized systems, UV lamps are installed in quartz sleeves inside a stainless steel vessel or chamber. The lamps are oriented either parallel or perpendicular to the direction of flow, depending on the manufacturer. Electrical connections for the lamps are located outside the lamp chamber. Each chamber includes flanged connections for feed piping and discharge piping. Isolation valves are required upstream and downstream of each chamber to allow draining individual chambers for maintenance or replacement. In both configurations, ballasts installed in the proximity of the channel or chambers provide the starting voltage for the lamps and maintain a continuous current.

Figure 6-8 shows a pressurized UV reactor by Wedeco where the lamps are oriented parallel to the flow in stainless steel vessels. Pressurized systems are typical for disinfection of RO permeate and can be upgraded to provide advanced oxidation if additional CEC treatment is required for full advanced treatment (MF/RO and UV lamps with hydrogen peroxide (UV/peroxide) as defined by DDW).

Figure 6-8: Pressurized UV System by Wedeco at the Existing SVAWPC

Pathogen Removal Credits

One of the key regulatory requirements is the pathogen control log reduction credits for *Giardia*, *Cryptospordium*, and viruses using muliple treatment barriers. To date, DDW has only approved pathogen reduction credits for the expanded Vander Lans Advanced Water Treatment Facility that supplies recycled water for the Alamitos Barrier and a small IPR project in Cambria, North of San Luis Obispo. Based on those reduction credits from wastewater treatment, advanced treatment, and underground residence time, and based on reduction credits granted for identical processes in drinking water treatment, Table 6-9 presents estimated pathogen reduction credits for Option 1 in combination with underground retention time.

Table 6-9: Pathogen Log Removal Credits – RO with UV Disinfection

Pathogen	DDW Require-ments	Primary/ Secondary[1]	Title 22 Treatment (Tertiary Filtration/ Disinfection)	MF [2]	RO [2]	UV [2]	Retention Time (2-6 mo.)[3]	Granted for T22 + 6 mo. Travel [3]	Total
Virus	12	2	0-5 [4]	0	2	2	2-6	--	12 – 17 [4]
Giardia	10	2	-	4	2	6	-	10	>10
Crypto-sporidium	10	1	-	4	2	6	-	10	>10

Notes:

1 – Credits granted for the Los Angeles County Sanitation Districts Water Reclamation Plants that provide source water to the Vander Lans Advanced Treatment Facility based on information in the literature. The SBWR system would have to conduct a similar evaluation to be assigned these credits

2- MF credits based on pathogen credits granted by DDW in drinking water applications and to Cambria Community Services District for 2014 IPR project. RO credits based on pathogen credits granted by DDW in drinking water applications (Sand City Desalination Facility). UV credits based on UV Disinfection Guidance Manual and a UV dose of 100 mJ/cm^2. Higher credits (up to 6-log) may be granted for this UV dose, if using recycled water criteria rather than drinking water standards.

3 - If Title 22 disinfected tertiary requirements are met and a minimum 6 month travel time is provided, 10-log credits will be granted for Giardia and Cryptosporidium. Lower travel times, as low as 2-months, can be permitted if sufficient pathogen removal is achieved through other means.

4 – Virus removal for tertiary treatment will have to be proven and negotiated with DDW. This is only applicable for a satellite treatment because Title 22 tertiary effluent is used as source water. No tertiary disinfection credits should be assumed for a centralized treatment facility.

Existing Installations

MF/RO with UV disinfection has been implemented at the SVAWPC so this process is familiar to SCVWD and the City. Treated water from the SVAWPC is not used for IPR however, as it is blended with tertiary effluent to provide TDS reduction in the SBWR system. The CDPH (now DDW) has historically allowed groundwater recharge via surface spreading for disinfected tertiary effluent. For example, the Montebello Forebay in Los Angeles County receives disinfected tertiary effluent from the Water Reclamation Plant for groundwater recharge. The West Basin Municipal Water District facility and the Vander Lans facility operated without AOP (MF/RO/disinfection) for groundwater injection before UV-AOP was implemented recently (addition of AOP at Vander Lans is currently underway). Similarly, IPR facilities in Western Australia and Singapore utilize MF/RO/UV without AOP for indirect potable reuse, and this process is used for DPR in Wichita Falls, Texas.

Option Assessment

The advantages and disadvantages of MF/RO with UV disinfection are summarized in Table 6-10.

Table 6-10: Option 1 Advantages and Disadvantages

Advantages	Disadvantages
• Lower cost than full advanced treatment since AOP is not required for surface spreading applications. Annual O&M costs would also be lower because less power and chemicals would be required as compared to AOP. • Higher TOC removal compared to alternative treatment options (e.g., ozone-BAC). RO is a proven treatment technology to remove TOC in the purified water, resulting in a higher RWC for recharge applications. • Can be upgraded to full advanced treatment by adding additional UV/peroxide for advanced oxidation.	• Recharge is limited to surface spreading. Surface spreading operations may be restricted at percolation ponds during wet season. • Subsurface application projects must treat all of the water using RO/AOP (i.e., direct injection). • RO concentrate management is required. • Partially dependent on soil aquifer treatment (SAT) to provide removal of some low molecular weight constituents of emerging concern (CECs) that are poorly removed by RO. DDW may require SAT performance monitoring, which would determine ultimate RWC. Startup RWC may be as low as 20%, so project yield could be less than with full advanced treatment. • Since this option does not have AOP, it does not have a redundant barrier to SAT for trace organics removal.

6.2.2 Option 2: Full Advanced Treatment (MF, RO, AOP and Disinfection)

This treatment option consists of MF/RO followed by an AOP and disinfection. This process train is also referred to as full advanced treatment in the DDW groundwater recharge regulations.

Overview

Figure 6-9 shows the process flow diagram of this treatment option for IPR applications. Feed water would be sourced from either the RWF (centralized treatment) or SBWR distribution system (satellite treatment). The process train would consist of MF, RO, and AOP/disinfection, which for this evaluation is assumed to UV/peroxide. While there are other alternative systems, e.g., ozone with hydrogen peroxide or UV with sodium hypochlorite, UV/peroxide is the only AOP to date that has been approved by DDW and in operation for groundwater recharge. It is recommended that a pilot study be conducted prior to the design and construction of a full advanced treatment system in order to determine the most suitable AOP alternative to meet water quality goals as well as DDW approval.

Purified recycled water would be recharged via surface spreading at recharge ponds. This treatment train is the only treatment option that can be used for direct injection into a groundwater basin. While regulations for DPR do not yet exist, it is assumed that full advanced treatment is the only treatment train that could be used for DPR in California.

Figure 6-9: Process Flow Diagram – Full Advanced Treatment (for GWR)

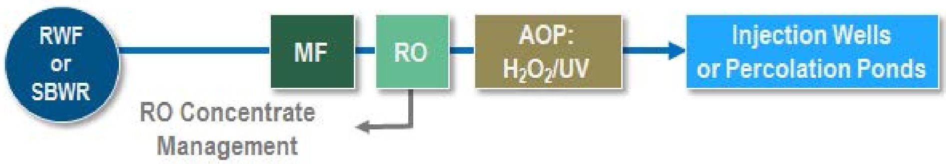
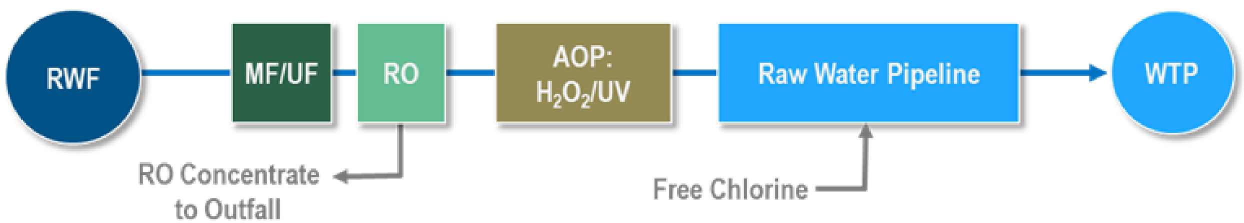


Figure 6-10 shows the process flow diagram of this treatment option for DPR applications. In absence of the direct potable reuse criteria and need for completed research regarding the suitability of alternative treatment technologies for direct potable reuse, it is assumed that full advanced treatment plus an additional disinfection step would be needed for direct potable reuse in California. Feed water would be sourced from the RWF into a centralized AWPF. The process train at the centralized AWPF would consist of MF, RO, and AOP with UV/peroxide, with free chlorine added in the distribution system for additional disinfection. Purified recycled water would be recharged via direct connection to the raw water supply system, where it would be blended with other raw water sources prior to treatment at a drinking water treatment facility.

Figure 6-10: Process Flow Diagram – Full Advanced Treatment (for DPR)



Process Description

See previous paragraphs for descriptions of the MF, RO, and UV disinfection processes. Advanced oxidation is discussed in this section.

Advanced Oxidation Process

The GWR Regulations include specific criteria for AOP performance. It was included as a required treatment process to address constituents not well removed by RO, due to their low molecular weight and low ionic charge. While some of these constituents, such as NDMA, are light sensitive and can be removed by UV without AOP, others, such as 1,4-dioxane, may require AOP to sufficiently remove. The three operational GWR projects that have received authorization for 100 percent RWC (GWRS, Alamitos Barrier, and West Coast Basin Barrier) use a treatment process consisting of secondary effluent source water that undergoes MF/RO/AOP using UV/peroxide.

UV/peroxide destroys microconstituents through two simultaneous mechanisms:

- The first mechanism is through UV photolysis (exposure to UV light) where UV photons are able to break the bonds of certain chemicals if the bond's energy is less than the photon energy.

- The second mechanism is through UV light reacting with peroxide to generate hydroxyl radicals. The peroxide is added to the RO permeate upstream of the UV process at a dose ranging from 3.0 to 5.0 mg/L.

The GWR Regulations offer two options for demonstrating AOP performance (see, Advanced Treatment Criteria for AOP). It is recommended that Option 2 be utilized, whereby the UV/peroxide system would be designed to provide at least a level of treatment to achieve a 0.5-log (69 percent) 1,4-dioxane reduction. It is generally accepted that an equivalent UV dose for NDMA and 1,4-dioxane removal is higher than the UV dose needed for disinfection, e.g., the required UV dose for 1-log reduction of NDMA could be in the range of 500 to 1,000 mJ/cm^2, Hence, the sizing of the UV system will be governed by the UV dose required for advanced oxidation.

Pathogen Removal Credits

Table 6-11 presents estimated pathogen reduction credits for Option 2 in combination with underground retention, based either on direct injection or surface spreading. Table 6-12 presents estimated pathogen reduciton credits assuming DPR was utilized.

Table 6-11: Pathogen Log Removal Credits – MF/RO/AOP (for GWR)

Pathogen	DDW Require-ments	Primary/ Secondary[1]	Title 22 Treatment (Tertiary Filtration/ Disinfection)	MF[2]	RO[2]	AOP[2]	Retention Time (2-6 months)	Total
Virus	12	2	0-5 [3]	0	2	6	2-6	12 – 21 [3]
Giardia	10	2	--	4	2	6	0	14
Crypto-sporidium	10	1	--	4	2	6	0	13

Notes:

1 – Credits granted for the Los Angeles County Sanitation Districts Water Reclamation Plants that provide source water to the Vander Lans Advanced Treatment Facility based on information in the literature. The SBWR system would have to conduct a similar evaluation to be assigned these credits

2 - MF credits based on pathogen credits granted by DDW in drinking water applications and to Cambria Community Services District for 2014 IPR project. RO credits based on pathogen credits granted by DDW in drinking water applications (Sand City Desalination Facility). UV/AOP credits based on credits granted for Vander Lans and Cambria..

3 – Virus removal for tertiary treatment will have to be proven and negotiated with DDW. This is only applicable for a satellite treatment because Title 22 tertiary effluent is used as source water.

Table 6-12: Pathogen Log Removal Credits – MF/RO/AOP (for DPR)

Pathogen	Anticipated Requirements[1]	Primary/ Secondary	MF[2]	RO[2]	UV/AOP[2]	Convey-ance with Free Chlorine [3]	Water Treat-ment Plant [4]	Total
Virus	12	2	0	2	6	6	0	16
Giardia	10	2	4	2	6	3	3	20
Crypto-sporidium	10	1	4	2	6	0	2	15

Notes:

1 – Pathogen reduction requirements are assumed to be the same as for groundwater replenishment, however, draft DPR regulations have not yet been published.

2 – See Note 2 in Table 6-10.

3 - Chlorine will be added to the connector pipeline downstream of the AWPF discharge.

4 – Although water treatment plants must provide 4-log virus reduction, this is typically done with free chlorine, and the maximum credit is already assumed for free chlorine disinfection using the conveyance pipeline.

Existing Installations

Table 6-13 provides a list of representative indirect and direct potable reuse projects around the world using advanced treatment technologies. While many of these facilities utilize AOP for full advanced treatment, new facilities continue to be permitted outside of California without AOP. The full advanced treatment process is often referred to as the "California Model" for IPR, as it is the only process allowed under the current California regulations for direct injection into potable supply aquifers.

Table 6-13: Existing Projects Using Advanced Treatment for IPR

Owner	Facility Description	AOP	IPR	DPR
West Basin Municipal Water District Los Angeles County, CA	Edward C. Little WRF (1994) – 30 mgd. 5 types of water Media filtration, MF/RO/UV/peroxide) for IPR; biological nitrification; double pass RO T22, GW recharge, nitrified cooling, Boiler feed.	✔	✔	
Orange County Water District Fountain Valley, CA	Groundwater Replenishment System (2007) – expanding from 70 to 100 mgd (2015) MF/RO/UV/peroxide Seawater barrier (injection wells), GW recharge (spreading)	✔	✔	
Water Replenishment District Long Beach, CA	Leo J. Vander Lans WTF – expanding from 3 to 8 mgd (2014) MF/RO/UV (AOP currently being added) Seawater barrier, injection wells	✔	✔	
City of Scottsdale Scottsdale, AZ	Scottsdale Water Campus (2001+) – 12 mgd Media filtration (NPR), MF/RO/UV/peroxide for IPR Irrigation, groundwater recharge/vadose zone injection	✔	✔	
LA Bureau of Sanitation San Pedro, CA	Terminal Island WTP (2005) – 5 mgd MF/RO (UV was not required at time of construction) Seawater barrier, injection wells		✔	
Water Corporation of Western Australia Perth, Australia	Beenyup Advanced Water Treatment Facility (2016) – 10 mgd MF/RO/UV (no AOP) Midbasin injection for potable reuse		✔	
Singapore PUB	NEWater treatment facilities (2002+) – 20 mgd MF/RO/UV (no AOP) Reservoir augmentation for IPR, industrial use		✔	
Colorado River MWD, Big Spring, TX	Colorado River Municipal Water District (CRMWD) Regional WRP (Big Spring) (2013) – 2 mgd MF/RO/UV/peroxide Source water for potable water treatment plant (15%) blended with lake water	✔		✔
Wichita Falls, TX	City of Wichita Falls Emergency Water Supply Project (2014) – 5 mgd MF/RO (UV being added without AOP) Source water for potable water treatment plant (50%) blended with lake water			✔

Option Assessment

The advantages and disadvantages of full advanced treatment are summarized in Table 6-14.

Table 6-14: Option 2 Advantages and Disadvantages

Advantages	Disadvantages
• RO/AOP is included in the DDW regulations for both surface and subsurface spreading. This means that there will be flexibility in recharging the purified recycled water either at the percolation ponds or injection wells. • MF/RO/AOP is assumed to be approved for DPR, though no draft DPR regulations have been proposed in California at this time. • Higher TOC removal compared to alternative treatment options (e.g., ozone/BAC). RO is a proven treatment technology to removed TOC in the purified water, resulting in a higher RWC for recharge applications. There are no requirements for minimum dilution during the first year for full advanced treatment, and an initial RWC as high as 100 percent could be approved. • MF/RO/AOP has already been approved for other groundwater recharge projects in California • This option is not dependent on SAT for CEC removal because it is accomplished via AOP. • Since this option includes AOP, there is an additional redundant barrier to SAT for trace organics removal.	• Potentially the highest capital due to the multiple membrane process and UV/peroxide process. • Potentially the highest O&M costs among all treatment options due to power (RO and UV/peroxide) and chemical consumption required for MF/RO/AOP. • RO concentrate management is required.

6.2.3 Option 3: Alternative Treatment: Ozone-BAC and Disinfection

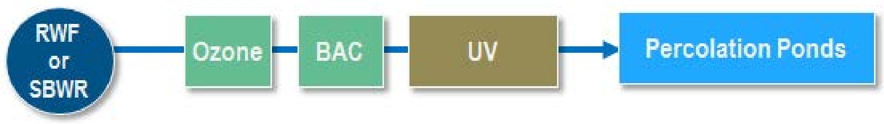
RO is used extensively in potable reuse applications in California as detailed above. This advanced water purification process provides exceptional water quality, but has disadvantages such as high costs (capital and O&M) and concentrate production. Of specific concern for the City and SCVWD is disposal of the concentrate from a future AWPF. See Section 0 for discussion of concentrate management options.

Ozone with biological activated carbon (BAC) or biologically active filtration (BAF) is fairly common for potable water treatment. This treatment option has recently begun to receive scrutiny as a potential advanced treatment strategy for potable water reuse applications as well; for example, this treatment option is being studied as part of WateReuse Research Foundation Project 11-02. Ozone enhanced BAC filtration (ozone-BAC) provides some total organic carbon (TOC) reduction and oxidation of CECs and does not generate a concentrate stream. A potential weakness of this alternative is that it does not reduce TDS and the TOC reduction is significantly less than with alternatives using RO.

Overview

The ozone-BAC treatment train includes the ozone system (ozone generator and contactor), BAC filters, and UV disinfection. The process flow diagram for this treatment option is shown in Figure 6-11: Process Flow Diagram – Ozone-BAC.

Figure 6-11: Process Flow Diagram – Ozone-BAC



Process Description

Ozone is used to break up larger organic material into smaller pieces or smaller molecules, referred to as assimilable organic carbon (AOC) that can be removed by the bacteria that grow on the activated carbon. Ozone-BAC could be used to replace the MF/RO processes where TDS reduction is not required. At several existing plants, ozone is also being investigated ahead of MF to reduce membrane fouling and after the RO for advanced oxidation.

When ozone is used with BAC filtration, the combined treatment process controls taste and odor, reduces color, and removes unwanted trace organic compounds and dissolved organic carbon (DOC) that can react with chemical disinfectants to form disinfection byproducts or cause membrane fouling. Ozone can also be used to disinfect the recycled water. For this study, ozone-BAC (Option 3) is only being considered as a process alternative to MF/RO.

Ozone-BAC typically involves ozone addition followed by GAC filtration. As noted above, the ozonation breaks down the high-molecular weight organic compounds to more biologically degradable organic matter, while the GAC filtration removes a matrix of organic compounds from water by sorption. When operated as a biological filter, the microorganisms colonize the GAC surface and metabolize the organic matter so that the GAC filter becomes a BAC filter.

Since neither the ozone nor the GAC reduce the TDS, partial treatment of the water with MF and RO may be needed to attain acceptable salt concentrations for the Santa Clara sub-basin. This partial treatment is similar to the treatment provided by the SVAWPC that was recently constructed by the City and SCVWD to reduce the TDS concentration of the SBWR recycled water. It is assumed that a TDS concentration of 500 mg/L, the target TDS concentration for the non-potable recycled water, would also be acceptable for groundwater replenishment, however, lower limits could be established based on local basin plan objectives. A side-stream MF/RO treatment facility would only be needed for a centralized facility that treats secondary effluent. If satellite facilities are selected, then sidestream

MF/RO treatment is not needed because the satellite plants would treat non-potable recycled water that has already been reduced to a TDS concentration of 500 mg/L at the SVAWPC to meet the SBWR TDS water quality requirements. It is therefore assumed that the SVAWPC would be expanded to accommodate any increased flows to the proposed new satellite plants.

Water Quality

This section discusses water quality of water produced by ozone-BAC for inactivation of pathogens, trace organic contaminants, and TOC:

Inactivation of Pathogens: Ozone is a more powerful oxidant and disinfectant than chlorine, chloramines, or hydrogen peroxide; however, because ozone-BAC only removes a portion of the TOC, the product water is susceptible to regrowth after the BAC process, and effluent total coliform levels can exceed the 2.2 MPN/100 ML threshold. For this reason, and to meet the requirements of the Title 22 and GWR regulations, UV disinfection is assumed downstream of the ozone-BAC process. As an alternative, a post-BAC ozone contactor could also be used to provide this additional disinfection.

Trace Organic Contaminants: The Reno-Stead Water Reclamation Facility (RSWRF) pilot study showed that the ozone-peroxide and BAC processes were extremely effective in reducing the concentrations of a suite of trace organic contaminants (TrOCs). Ozone-peroxide was able to reduce the estradiol equivalents below the method reporting limits (MRLs), and individual steroid hormones, except estrone, to below MRLs. In addition, the BAC was particularly effective for the oxidant-resistant compounds, such as the flame retardants tris-1-chloro-2-propylphosphate (TCPP) and tris-2-chloroethylphosphate (TCEP). (Gerrity, et al., 2011)

Similar to the RSWRF pilot study, the LAWRPP study showed that the ozone treatment oxidized bulk organics to produce lower-molecular-weight compounds, allowing the biological process in the BAC to degrade the low-molecular-weight compounds. Large molecular weight compounds, however, relied on the adsorptive capabilities of the GAC for removal, resulting in breakthrough when the adsorptive capacity had been exceeded. (Levine, Madireddi, Lazarova, Stenstrom, & Suffet, 2000).

Total Organic Carbon: The ozone-BAC process at the SCWRP achieved 36 percent COD removal (van Leeuwen, Pipe-Martin, & Lehmann, 2003). The RSWRF pilot study showed that while the ozone-peroxide process achieved significant transformation of the bulk organics, minimal organics were removed prior to the BAC. However, the BAC process achieved 33 percent TOC removal (Gerrity, et al., 2011). The RSWRF pilot study showed that the post-ozone biological filtration with sand or activated carbon is an effective mitigation strategy for reducing oxidation byproducts (Gerrity, et al., 2011). Downstream of BAC, there is potential for further TOC reduction through soil aquifer treatment, however, no full-scale studies have been done to determine the level of additional treatment that can be anticipated through soil aquifer treatment after ozone/BAC.

Nitrogen: Ozone-BAC does not remove nitrogen compounds. This to meet the GWR Regulations and Basin Plan requirements, it would be necessary to address nitrogen removal at the wastewater treatment plant or the wastewater treatment in combination with soil aquifer treatment. The total nitrogen levels at the RWF (4.2 mg/L average) are currently less than the 10 mg/L limit in the GWR regulations, indicating that nitrogen removal may not be a concern for GWR with ozone-BAC.

Pathogen Removal Credits

For surface spreading applications, the allowable RWC would be established during startup operations based on TOC or an alternative such as biodegradable organic carbon. For Ozone-BAC to be authorized for subsurface injection would require authorization under the Alternatives section of the GWR Regulations.. The ozone-BAC process removes some TOC (approximately 30 - 50 percent), but no nitrogen containing compounds, both regulated by the GWR regulations. Since the tertiary recycled water created by the RWF should already meet the GWR regulations for surface recharge, ozone-BAC should be able to gain approval for surface spreading. Since some TOC is removed by the BAC, TOC levels would be expected to be lower, and the amount of blend water required could be less than for tertiary recycled water alone.

Table 6-15 presents estimated pathogen reduction credits for Option 3 in combination with underground retention. Note that while a centralized AWPF would require a sidestream RO train to lower the TDS of the advanced treated recycled water, satellite AWPF would not require sidestream RO because the TDS of the SBWR source water is already compliant with anticipated groundwater requirements. No log removal credits are assigned to a sidestream RO train.

Table 6-15: Pathogen Log Removal Credits – Ozone-BAC

Pathogen	DDW Require-ments	Primary/ Secondary [1]	Title 22 Treatment (Tertiary Filtration/ Disinfection)	Ozone [2]	BAC [2]	UV [2]	Retention Time (6 mo.)	Granted for T22 + 6 mo. Travel [3]	Total
Virus	12	2	0 - 5 [4]	6	0	0	6	--	14 – 19 [2]
Giardia	10	2	-	4	0	6	0	10	>10
Crypto-sporidium	10	1	-	0	0	6	0	10	10

Notes:

1 – Credits granted for the Los Angeles County Sanitation Districts Water Reclamation Plants that provide source water to the Vander Lans Advanced Treatment Facility based on information in the literature. The SBWR system would have to conduct a similar evaluation to be assigned these credits

2 – Ozone credits based on Long Term 2 Enhanced Surface Water Treatment Rule and CT value of 2 mg/L-min. No pathogen credits are assumed for BAC. UV credits based on UV Disinfection guidance manual and minimum 33 mJ/cm^2 dose. Higher virus credits may be granted for UV if using recycled water criteria rather than drinking water standards.

3 - If Title 22 disinfected tertiary requirements are met and a minimum 6 month travel time is provided, 10-log credits will be granted for Giardia and Cryptosporidium. Lower travel times, as low as 2-months, can be permitted if sufficient pathogen removal is achieved through other means.

4 – Virus removal for tertiary treatment will have to be proven and negotiated with DDW. This is only applicable for a satellite treatment because Title 22 tertiary effluent is used as source water. No tertiary disinfection credits should be assumed for a centralized treatment facility.

Existing Installations

Ozone-BAC is widely used in potable water plants, with about 400 installations in the United States (U.S.) and about 3,000 installations worldwide (Oneby, Bromley, Borchardt, & Harrison, 2010). The majority of these systems include a post-ozone biological filtration step (Evans, Opitz, Daniel, & Schulz, 2010). While the use of ozone is widespread in potable water plants, it is much more limited in wastewater treatment plants (WWTPs), with about 10 operating facilities in U.S. The number of ozone facilities for WWTP effluent disinfection grew to 44 between 1975 and 1985, but the number has declined due to operational and maintenance problems of early ozone installations (Oneby, Bromley, Borchardt, & Harrison, 2010). Examples of wastewater and reclaimed water treatment applications using ozone-BAC are summarized in Appendix 6B.

The WateReuse Research Foundation grant project "Equivalency of Advanced Treatment Trains for Potable Reuse" (WateReuse-11-02), which was led by Trussell Technologies, Inc., investigated potential treatment trains to be used for direct potable reuse. In May 2013, pilot testing started with two potential ozone-BAC treatment trains for direct potable reuse, including:

- Ozone, BAC, MF, and UV AOP
- MF, Ozone, BAC, UV AOP

The WateReuse Research Foundation will be releasing the report for the 11-02 project in 2015, however, preliminary results from the pilot testing have suggested that both treatment trains can be effective in a potable reuse scheme. This information could be used to further evaluate the feasibility of ozone-BAC as an alternative treatment technology to be considered by the City and SCVWD for potable reuse.

Option Assessment

The advantages and disadvantages of the ozone-BAC treatment option are summarized in Table 6-16**.**

Table 6-16: Option 3 Advantages and Disadvantages

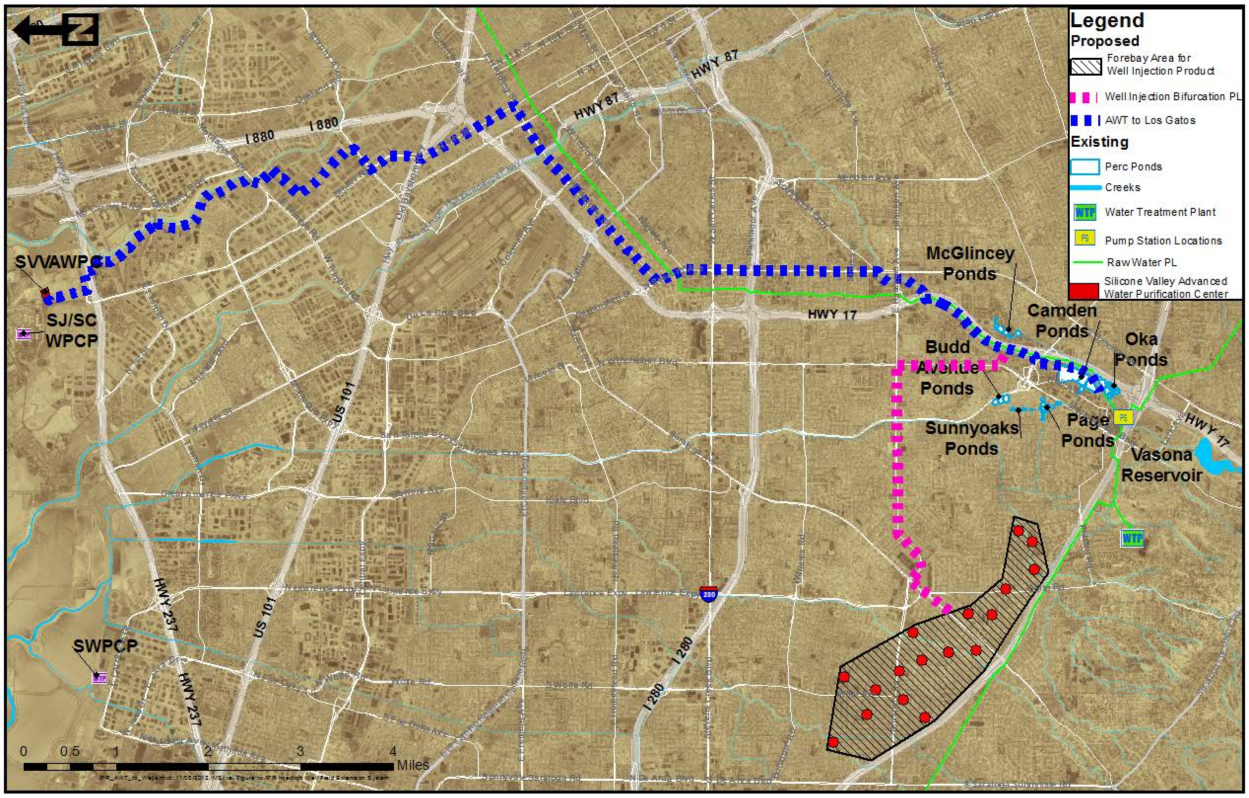
Advantages	Disadvantages
• Effective at removing TrOCs/CECs, some of which are not well removed by the RO process alone. • Minimization of a concentrate stream (when ozone-BAC is used in lieu of full RO); there would still be some concentrate produced from a side-stream RO to minimize TDS. Hence, there would still be concentrate management associated with the SVAWPC. • Reduced energy consumption and costs (when ozone-BAC is used in lieu of RO). • Potential for lower capital and/or operating costs, relative to alternatives utilizing MF	• Less effective at removing TrOCs/CECs when compared to MF/RO/AOP process train. • The RWC for surface spreading application may not be approved at 100 percent; for subsurface application it would have to be approved under the Alternatives section of the GWR Regulations. • Ozone-BAC does not reduce TDS. If ozone-BAC is considered for centralized treatment, then sidestream MF/RO treatment is required to meet a TDS concentration of 500 mg/L. For satellite facilities, sidestream MF/RO treatment is

Advantages	Disadvantages
and RO, although ancillary facility costs must be considered before a clear determination can be made.	not needed because the Title 22 water treated by the satellite facility would already have a TDS concentration of 500 mg/L. • Limited to no removal of nitrogen compounds. Since the future total nitrogen levels in the SBWR system would be reduced in future through blending with SVAWPC product water to be closer to the 10 mg/L (as N) regulatory limit even before SAT is considered, additional nitrogen removal should not be required. • Loss of biological layer from BAC may require chlorine addition and continuous residual downstream of filters to prevent bacterial regrowth in transmission piping. • Potential for creation of ozone byproducts, including bromate and NDMA. While these could be controlled through changes in the treatment process (pH adjustment), they could create complications for operators trying to balance removal of CECs with formation of other hazardous byproducts. • In some conditions, ozone has been shown to create NDMA in influent water that has not undergone nutrient removal at the wastewater plant. It is thought that the nitrifying/denitrifying processes remove precursors that create NDMA when oxidized by ozone. • Higher TOC in effluent as compared to MF/RO/UV and MF/RO/AOP. Ozone-BAC removes less than 30-50 percent of the TOC. This will impact the RWC achievable for GWR. • May not be suitable for DPR in California. • Since this treatment is not currently used in California, would require pilot or demonstration testing to prove that it is provides effective treatment, meets regulatory requirements, and provides for groundwater protection.

6.3 Pathway 1 – GWR with Centralized Treatment

Pathway 1 consists of a centralized AWPF next to the SVAWPC. Recharge would occur at the existing Los Gatos ponds and potentially supplemented by injection wells. Figure 6-12 illustrates the locations of the proposed treatment and recharge facilities, as well as the purified recycled water pipeline from the centralized AWPF to Los Gatos. A potential injection well field (based on SCVWD's earlier work) is also depicted in Figure 6-12; however, an alternative strategy of locating injection wells along the purified recycled water pipeline alignment is being considered as well. It is noted that the inclusion of injection wells in this pathway would require full advanced treatment (Treatment Option 2).

Figure 6-12: Pathway 1 – GWR with Centralized Treatment



Source: DRAFT TM 8B –Los Gatos Groundwater Recharge System Alternative

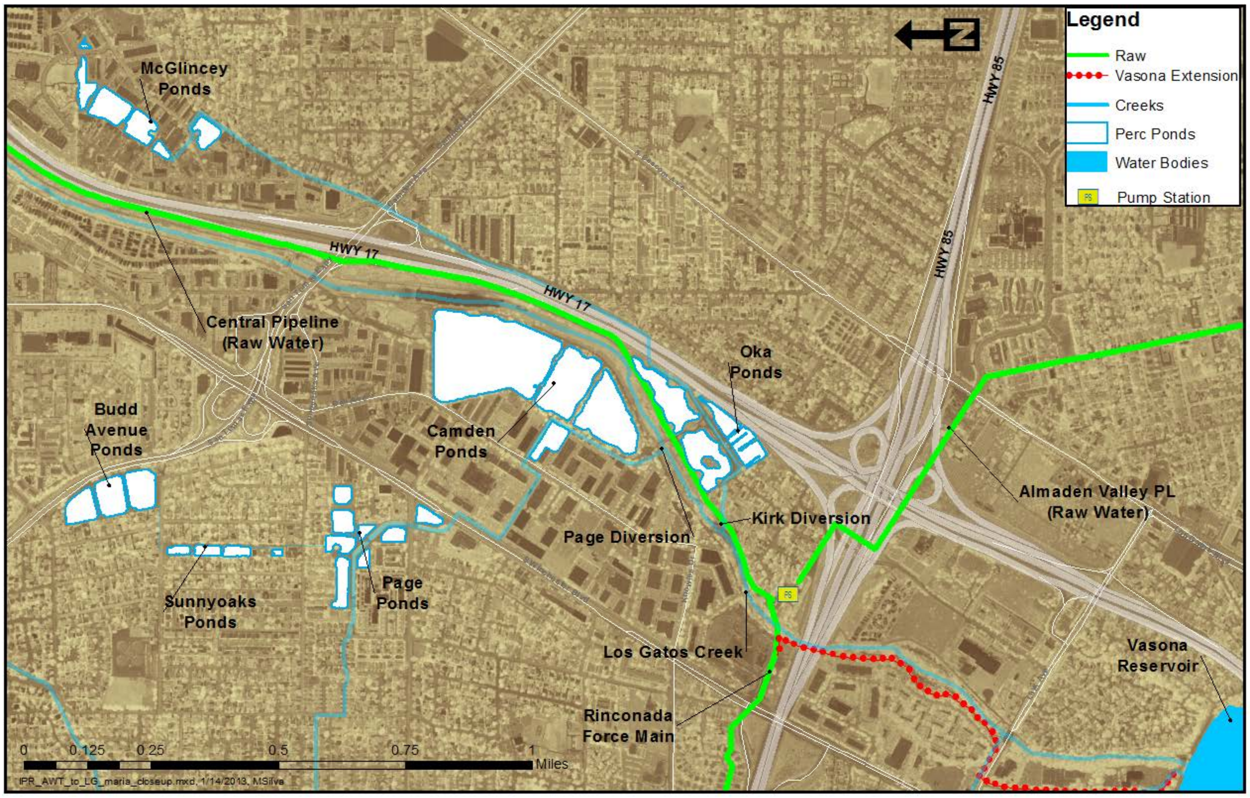
6.3.1 Treatment Facility Location

Based on previous studies performed by SCVWD, the preferred location for a centralized AWPF is on property owned by the City, adjacent to the SVAWPC. The RWF would provide source water for the centralized AWPF. This location is adjacent to the SVAWPC and provides opportunities for joint operations, as well as proximate to potential RO concentrate management strategies (i.e. existing RWF outfall, potential new South Bay outfall, etc.).

6.3.2 Recharge Location

Figure 6-13 provides an overview of the Los Gatos Recharge System. With an average groundwater recharge capacity of approximately 29,700 AFY, Los Gatos is SCVWD's largest recharge system. SCVWD has deemed this recharge system the only system, considering existing and projected stream diversion and carry-over imported water operations management, to have the recharge capacity to sustain a major groundwater replenishment initiative in the valley. Major features of the Los Gatos Recharge System include Lexington and Vasona Reservoirs, Los Gatos Creek in-stream recharge, and several off-stream ponds. The system recharges the Santa Clara Sub-basin.

Figure 6-13: Los Gatos Recharge System



Source: DRAFT TM 8B –Los Gatos Groundwater Recharge System Alternative
Notes: The Vasona Extension shown in this figure is called the Lexington Reservoir Pipeline in the Water Supply Infrastructure Master Plan (SCVWD, October 2012).

The existing percolation ponds have two diversion points off Los Gatos Creek; Kirk and Page Ditches. The Kirk Ditch system consists of the Oka and McGlincey Ponds. The Page Ditch system consists of the Camden, Page, Budd, and Sunnyoaks Ponds. The Camden and Oka Ponds are situated next to Los Gatos Creek and at times recharge seeps back into the creek. Therefore, only the Page, Budd Ave, Sunnyoaks, and McGlincey Ponds with a total recharge capacity of 20,000 AFY are considered for GWR in order to prevent purified recycled water from daylighting in surface water after recharge (see Section 6.1.5 and Appendix 9B for regulatory overview of off-stream percolation and streamflow augmentation, respectively). Table 6-17 provides a summary of the off-stream ponds and recharge capacities.

Table 6-17: Los Gatos Recharge Pond Capacities

Pond	Recharge Capacity (AFY)
Page Ponds	5,300
Budd Ave Ponds	5,000
Sunnyoaks Ponds	2,200
McGlincey Ponds	7,700

Total	20,200

Note: The Camden and Oka Ponds are situated next to Los Gatos Creek and at times recharge seeps back into the creek. Therefore, these four ponds are considered for potable reuse.

Potential injection well locations will be further defined in alternatives development phase of this master plan. Each injection well would have an estimated capacity of 400 gallons per minute (gpm) or 660 AFY. The injection wells would each require approximately one-fourth acre of land, and the well spacing would have to be a minimum of approximately 1,500 linear feet. These potential wells would be in the Santa Clara Plain Sub-basin. The advantage of injection wells when compared to percolation ponds include possible reduction in raw water system reoperation requirements and carryover losses in wet years.

6.3.3 Conveyance

A new 14.4-mile, 30-inch pipeline would be required to convey the purified recycled water through the cities of San José and Campbell to reach an existing junction structure at the Los Gatos recharge system. The preliminary alignment of this pipeline is illustrated in Figure 6-12.

6.3.4 Treatment Options and Recharge Capacities

The AWPF flows and pond recharge capacities that can be anticipated from each respective treatment option are summarized in Table 6-18. The RWC for GWR would be different for each treatment option based on the GWR regulations. It is assumed that full advanced treatment would be allowed a RWC of 100 percent (i.e., no raw water dilution blend required) after a short start-up period of a year or two, while MF/RO with disinfection would is assumed to have a slightly lower RWC of 90 percent because of the absence of AOP. Ozone-BAC is assumed to have a maximum RWC of 50 percent due to its more limited ability to remove TOC, which restricts RWC. In addition to the RWC allowance, the potential yield for each treatment option is also affected by times when the percolation ponds are taken offline for maintenance activities. Based on information provided by SCVWD, a pond online factor of 94 percent was assumed to account for ponds being cleaned every three years over a two month period.

Table 6-18: Pathway 1 GWR with Centralized Treatment

	Treatment Options					
	1		2		3	
Treatment Train	MF, RO and disinfection		Full advanced treatment (MF, RO, and disinfection/AOP)		Alternative treatment (ozone-BAC, MF, and disinfection with sidestream RO)	
Parameter	AFY	mgd	AFY	mgd	AFY	mgd
Recharge Capacity						
Percolation ponds	20,200	18.0	20,200	18.0	20,200	18.0
Injection Wells	0	0.0	16,668[1]	14.9	0	0
Total	20,200	18.0	36,868	32.9	20,200	18.0
RWC, Maximum (assumed)	90%		100%		50%	
Maximum Annual Goal with RWC	18,180	16.2	36,868	32.9	10,100	9.0
AWPF Flows (MF/RO)						
RO Product Water[2]	-	16.2	-	32.9	N/A	N/A
MF Filtrate/RO Influent[3]	-	19.1	-	38.7	N/A	N/A
AWPF Influent	-	19.5	-	39.5	N/A	N/A
Sidestreams						
RO Concentrate	-	2.0	-	5.8	N/A	N/A
MF Backwash	-	1.0	-	2.0	N/A	N/A
AWPF Flows (Ozone-BAC)						
Ozone-BAC Disinfected Product Water[4]	N/A	N/A	N/A	N/A	-	9.0
Ozone-BAC Effluent/MF Influent	N/A	N/A	N/A	N/A	-	9.2
AWPF influent	N/A	N/A	N/A	N/A	-	9.4
Sidestreams						
MF Backwash[2]	N/A	N/A	N/A	N/A	-	0.5
BAC Backwash	N/A	N/A	N/A	N/A	-	1.0
Annual Yield						
Percolation ponds (with 94% online factor)	17,089	-	18,988	-	9,494	-
Injection Wells	0	-	16,688	-	0	-
Total	17,089	-	35,656	-	9,494	-

Notes:

1 – 22 injection wells at 460 gpm/well (758 AFY/well).

2 – RO recovery rate = 85%

3 – MF recovery rate = 95 to 98%

4 – BAC recovery rate = 90 to 98%

Based on the summary provided in Table 6-18, Option 2 (MF/RO/AOP) has the highest potential annual yield based on its higher RWC allowance and the flexibility to augment recharge with injection wells. While MF/RO/AOP results in the highest potential yield, it also results in the highest RO concentrate discharge. Ozone-BAC, while producing the least potential yield, minimizes the RO concentrate discharge as compared to the other two treatment options; ozone-BAC would still require sidestream RO to reduce the TDS concentrations in the RWF source water to the required concentration of 500 mg/L. Option 2 (MF/RO/AOP) with additional use of injection wells is the only way that Pathway 1 can meet the SBWR Strategic Plan 2035 target of 35,000 AFY.

6.3.5 RO Concentrate Management

If the AWPF includes RO treatment, then an approach for RO concentrate disposal needs to be developed. The most straightforward and cost-effective concentrate disposal method for Pathway 1 would be to combine the concentrate with tertiary treated effluent upstream of the chlorine contact tanks for disinfection and discharge to the bay. However, this disposal option would increase the TDS concentration in the RWF final effluent; the City has indicated that it would not support projects that impact the final effluent in this manner. Alternative concentrate discharge locations as well as treatment and minimization strategies are discussed in Appendix 6D. A new, dedicated outfall to Coyote Point is assumed to be the potentially feasible disposal option for the potable reuse alternatives development in Section 7.

6.3.6 Opportunities for Staged Implementation

There may be a benefit to implementing a Phase 1 potable reuse project to start gaining experience with potable reuse prior to implementing a large-scale project. A Phase 1 project should rely on existing availability of recycled water and existing District facilities in order to avoid stranded assets. The SVAWPC, which began operating in March 2014, will provide performance data and provide an opportunity for SCVWD to operate an AWPF and further assess the concentrate impacts on the RWF final effluent. A Phase 1 potable reuse project (including introducing purified recycled water into the region's water supply system), presumably in the 1 to 5 mgd range, would build on this initial operating experience to garner both regulatory and public acceptance in a relatively short timeframe and at less cost than a full-scale project. A smaller Phase 1 project would provide further demonstration of AWPF and groundwater replenishment performance, reducing regulatory and public acceptance uncertainty and accelerating the implementation timeline. Section 7 identifies and discusses the potential Phase 1 projects.

6.3.7 Pathway Assessment

The advantages and disadvantages of Pathway 1 are summarized in Table 6-19.

Table 6-19: Pathway 1 Advantages and Disadvantages

Advantages	Disadvantages
• Achieves the SBWR Strategic Plan target for 35,000 AFY by 2035 if Option 2 (MF/RO/AOP) is used and injection wells are included. • Reliance on a locally controlled, reliable supply provides another tool to manage/optimize basin operation. • Since source water for the AWPF is diverted after secondary treatment at the RWF, the need for RWF improvements to support water recycling is minimal. This may also eliminate future expansion/rehabilitation of the tertiary filters. • Since source water for the AWPF is taken from the RWF, only nominal improvements to SBWR system required. • Potential Phase 1 project could use seasonal excess capacity at SVAWPC, saving need to construct a new centralized AWPF. • Inclusion of injection wells in lieu of percolation ponds reduces raw water system reoperation requirements and carryover losses in wet years.	• The only treatment option that is capable of reaching the SBWR Strategic Plan target is Option 2 (MF/RO/AOP). This option is potentially the most cost and energy intensive among all treatment options. • Option 2 also results in maximum RO concentrate production and associated concentrate management strategies, costs, and toxicity risks. • GWR at Los Gatos ponds requires reoperation of system operations.

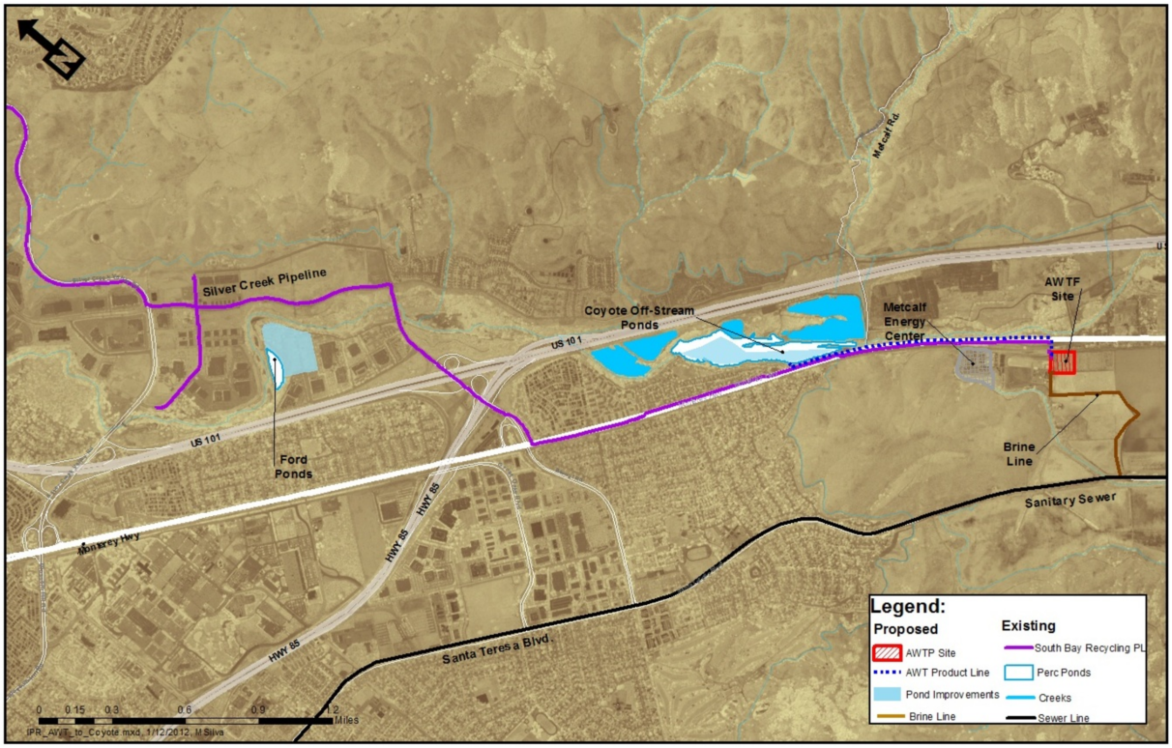
6.4 Pathway 2 – GWR with Satellite Treatment

As an alternative to a centralized treatment facility, SCVWD investigated opportunities to locate satellite advanced treatment facilities closer to the groundwater recharge systems and using the SBWR system to supply recycled water to these satellite treatment facilities. Based on SCVWD analysis, two feasible satellite advanced treatment/groundwater recharge locations were identified; Coyote and Penitencia. As part of this Potable Reuse Assessment, the Los Gatos groundwater recharge system is added as a third satellite AWPF location due to its recharge capacity and the desire to create pathways to achieve the SBWR Strategic Plan recycled water targets.

6.4.1 Coyote Recharge System

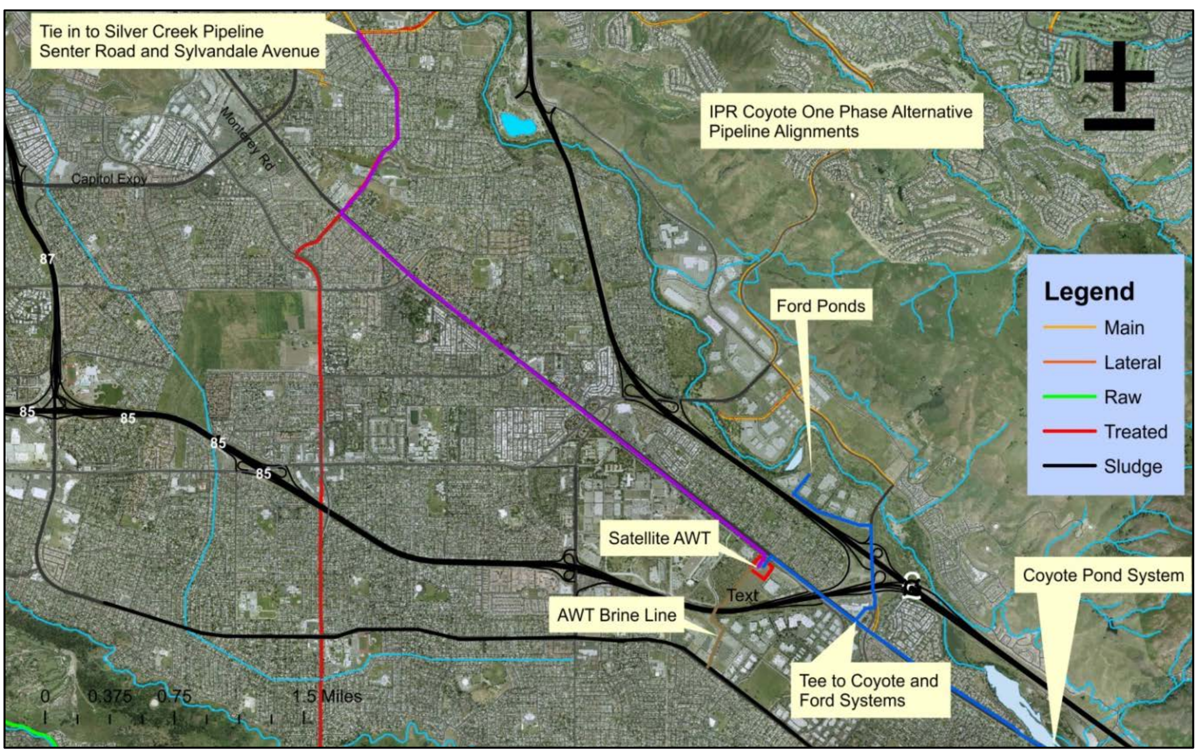
Figure 6-14 and Figure 6-15 show the locations of the proposed AWPF and percolation pond locations for the Coyote satellite system.

Figure 6-14: Pathway 2 – GWR with Satellite Treatment near Coyote Ponds



Source: DRAFT TM 8A – Coyote Groundwater Recharge System Alternative

Figure 6-15: Pathway 2 – GWR with Satellite Treatment near Ford Ponds



Source: DRAFT TM 8A – Coyote Groundwater Recharge System Alternative

The following is a description of the location of treatment, recharge, and conveyance facilities for a Coyote satellite system.

Treatment Facility Location

Based on previous studies performed by SCVWD, two potential locations for a Coyote satellite AWPF have been identified. One potential site is near the Silver Creek Pipeline next to Metcalf Energy Center (MEC) (Figure 6-14). This location is in close proximity to source water, power, and the Coyote percolation ponds. A second potential AWPF location was identified nearer the Ford percolation ponds (Figure 6-15). This latter location better supports a recharge project at the Ford Ponds, and is in closer proximity to a wastewater collection system with adequate capacity for RO concentrate management. Both of these locations would be fed by SBWR's Silver Creek Pipeline.

In 2002, SCVWD and the City entered a 25-year agreement to upsize the SBWR's Silver Creek Pipeline from 24-inch (10 mgd) to 30-inch (15 mgd). In this institutional agreement, SCVWD purchased the additional 5 mgd of capacity as part of the agreement for future use of recycled water. The pipeline delivers tertiary treated recycled water from the RWF to the area near Coyote and Ford Ponds. The agreement identifies two possible points of connection, either at Monterey Road and Old Bernal Road, or at Monterey Road and Blanchard Road. The Silver Creek Pipeline has a 30-inch diameter at these locations.

Recharge Location

As shown in Figure 6-14 and Figure 6-15, the Coyote and Ford Ponds are located along Highway 101 in southern San José. Both ponds are currently in-stream recharge systems on Coyote Creek. Any recharge of purified recycled water would require the ponds to be taken off-stream. If the Ford and Coyote ponds are modified and taken off-stream, their respective recharge capacity would be 5,600 AFY. Either the Coyote Pond or Ford Ponds could be used for GWR of purified recycled water. This concept also assumes that the Main Avenue and Madrone Pipelines Restoration Project, which are part of the WSIMP element to secure existing supplies and infrastructure, move forward.

Conveyance

A new pipeline (length dependent on AWPF location) is required to connect to the nearest Title 22 water source, which has been identified as Silver Creek Pipeline. To assure a constant flow of source water, SCVWD and City have entered an institutional agreement for allowance of 5 mgd of SBWR water for SCVWD use for IPR. Depending on system demands and disinfectant contact time requirements of the SBWR, it is possible SCVWD may not receive a constant flow of Title 22 water, and water storage would be needed to maintain the 24/7 operation to keep the AWPF running at the maximum on-line factor for both operational reasons and economies of scale. Also, a new 18-inch pipeline would be required to convey purified recycled water to either the Coyote or Ford Pond. The Title 22 and purified recycled water pipelines for the Coyote and Ford satellites are summarized in Table 6-20.

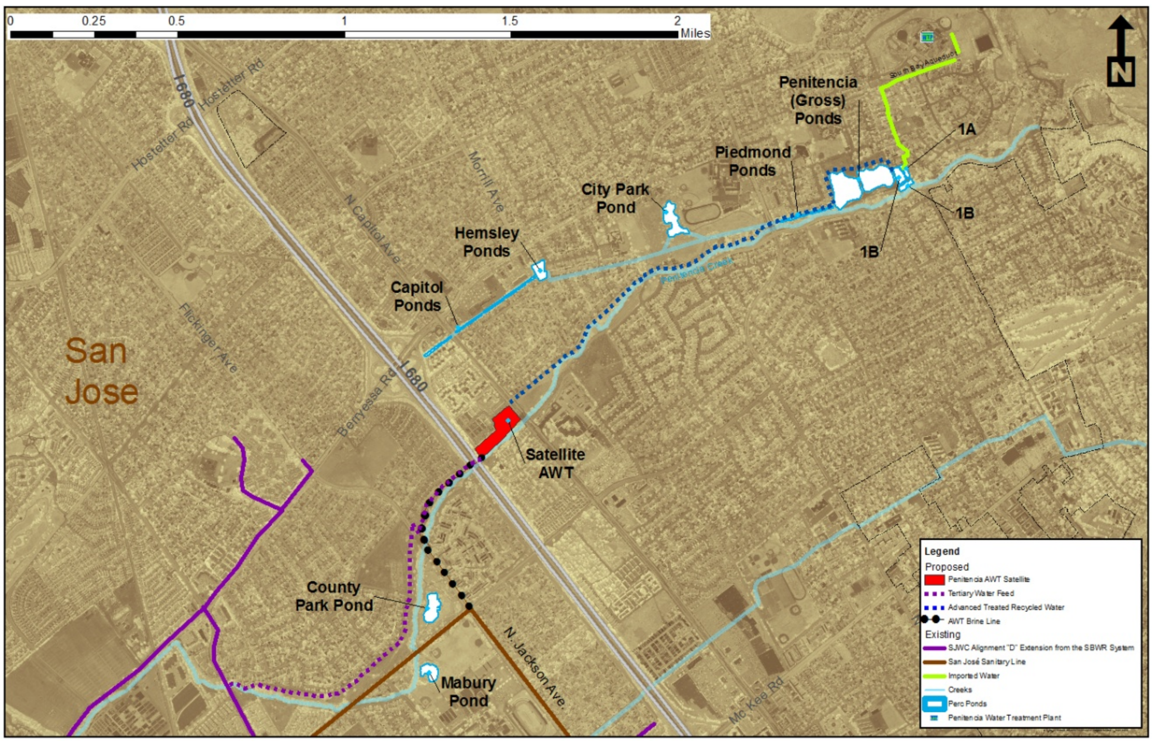
Table 6-20: Conveyance Pipelines for Coyote/Ford

Pipeline	Coyote Satellite	Ford Satellite
Title 22 water	350 LF	23,000 LF
Purified recycled water	5,000 LF	11,000 LF

6.4.2 Penitencia Recharge System

Figure 6-16 shows the locations of the proposed AWPF and percolation ponds for the Penitencia satellite system. The following is a description of the location of treatment and recharge facilities for a Penitencia satellite system.

Figure 6-16: Pathway 2 – GWR with Satellite Treatment at Penitencia



Source: DRAFT TM 8D - Penitencia Groundwater Recharge System Alternative

Treatment Facility Location

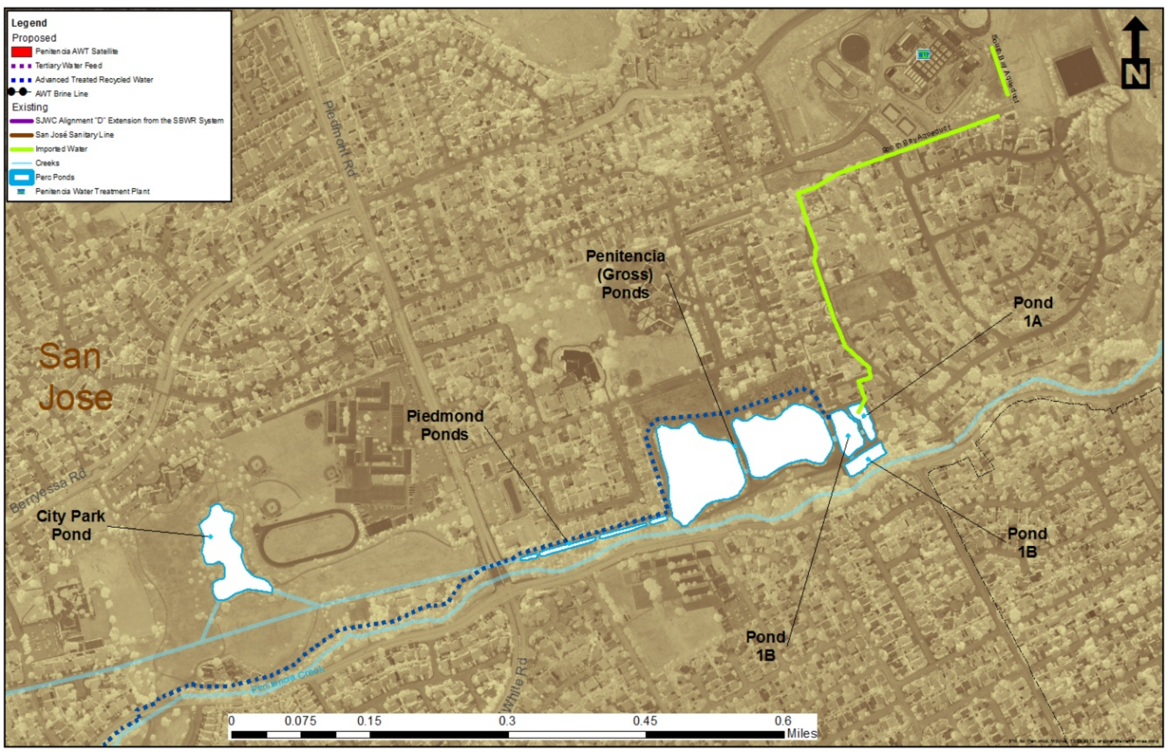
SCVWD has investigated multiple locations for a potential Penitencia satellite AWPF location along with alternative pipeline extensions from the SJWC recycled water pipeline. The preferred AWPF site is located between North Capitol Road and Hwy 680, near the end of Penitencia Creek Road. This site, jointly owned by SCVWD (3.3 acres) and by Santa Clara County (1.7 acres), totals approximately 5 acres. For source water, the AWPF would connect to the SBWR distribution system via SJWC's Alignment D from the SJWC Master Plan. It is assumed that Alignment D would be constructed by the time a satellite facility could be implemented in Penitencia.

Recharge Location

As shown on Figure 6-16, the Penitencia Ponds are located on the east side of San José, adjacent to Penitencia Creek between Noble Avenue and Capitol Avenue in the northeastern San José foothills. Seventeen off-stream ponds interconnect through the Penitencia Canal. The total recharge capacity of the ponds is approximately 4,600 AFY. The Overfelt Ponds, within the Penitencia groundwater recharge system, are operated separately from the main Penitencia Ponds. However, the Overfelt Ponds are not considered suitable candidates for an IPR system; this reduces the recharge potential of IPR in the Penitencia system to approximately 2,500 acre feet per year, according to SCVWD's previous study (DRAFT TM 8D –Penitencia Groundwater Recharge System Alternative).

Penitencia Pond 1A, the uppermost pond in the system, is used for surge overflow from the South Bay Aqueduct (SBA) of the State Water Project. Purified recycled water would be released to Pond 1B as shown in Figure 6-17. A modification to the system between ponds 1A and 1B would need to be made to isolate Pond 1A and provide capacity to capture SBA water.

Figure 6-17: Penitencia Recharge System



Source: DRAFT TM 8D –Penitencia Groundwater Recharge System Alternative

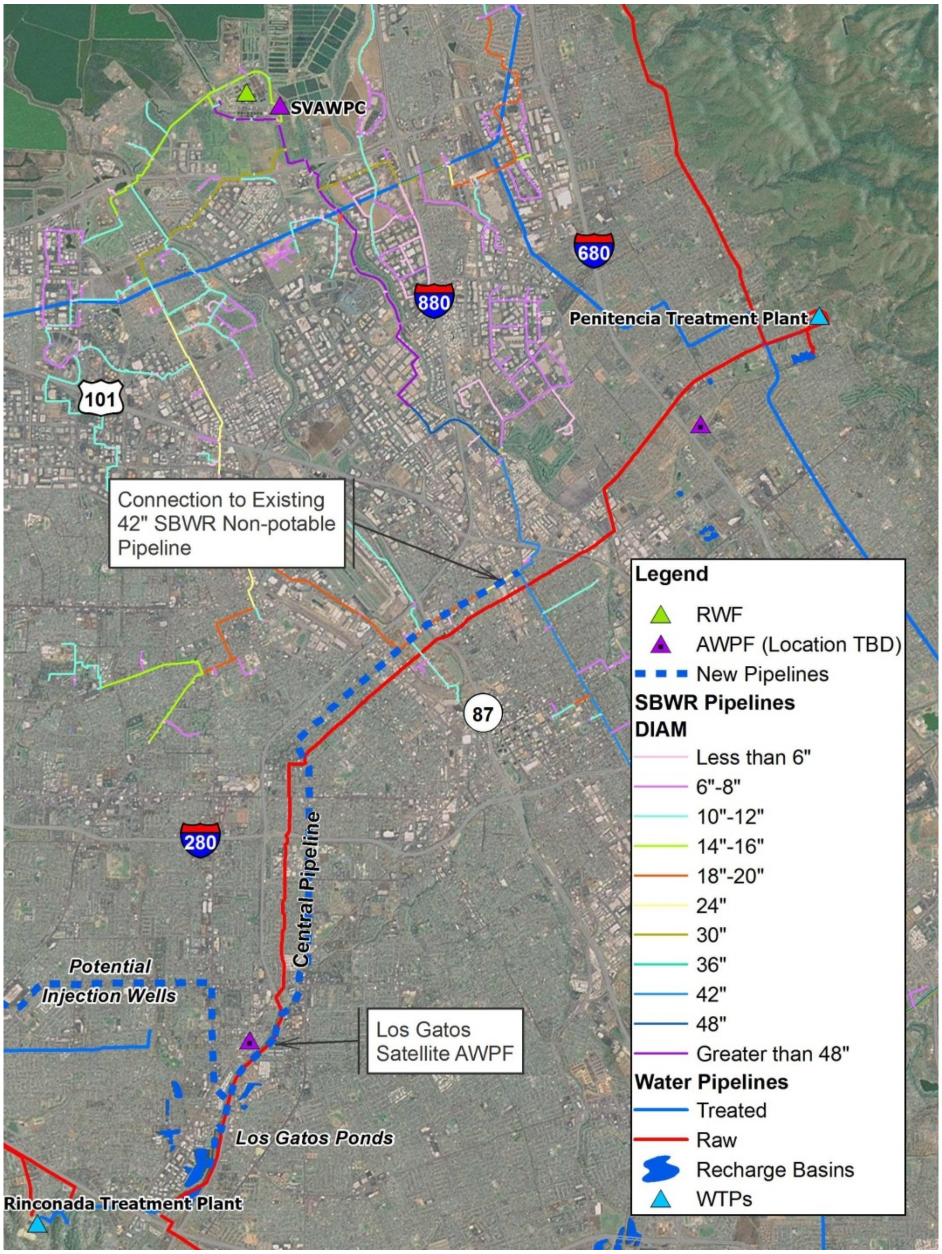
Conveyance

A new 6,500 LF segment of 12-inch pipeline is required to connect to the nearest Title 22 water source, which has been identified as Alignments C and D recycled water extension from the SBWR distribution system in the SJWC Recycled Water Master Plan. However, the delivery of Title 22 water to the AWPF would experience diurnal peak flows. Depending on system demands and disinfectant contact time requirements of the SBWR, it is possible SCVWD may not receive a constant flow of Title 22 water, and water storage would be needed to maintain the 24/7 operation to keep the AWPF running at the maximum on-line factor for both operational reasons and economies of scale. SCVWD could potentially use a portion of their 5 mgd recycled water allotment in the Silver Creek Pipeline to serve the Penitencia AWPF. A new 8,100 LF segment of 12-inch pipeline would be required to convey purified recycled water to Penitencia Pond 1B.

6.4.3 Los Gatos Recharge System

Figure 6-18 shows the locations of the proposed AWPF and percolation ponds for the Los Gatos satellite system. Recharge would occur at the existing Los Gatos ponds and a proposed injection well field (assuming Option 2 (MF/RO/AOP) treatment), similar to Pathway 1. The following is a description of the location of treatment and recharge facilities for a Los Gatos satellite system.

Figure 6-18: Pathway 3 – GWR with Satellite Treatment at Los Gatos



Treatment Facility Location

A satellite treatment facility at Los Gatos could potentially be located in an industrial area near the Los Gatos Ponds. A siting analysis has not been performed for specific locations to site the satellite facility at this time. If this alternative is selected for further analysis, then a siting study should be performed.

Conveyance

Approximately 6 miles of new 30-inch pipeline would be required to connect the satellite AWPF to source water from the nearest SBWR distribution pipeline.

6.4.4 Treatment Options and Recharge Capacities

Table 6-21 summarizes the collective yield of the satellite AWPFs for the respective treatment option that could be utilized at each location. Table 6-22 summarizes the AWPF flows and recharge capacities that can be anticipated from each respective treatment option. Similar to Pathway 1, three treatment options: 1) MF/RO with disinfection, 2) MF/RO/AOP, and 3) ozone-BAC were considered at each satellite system option. The same RWC and pond online factor assumptions were used to estimate the potential yield of each option at the respective satellite location.

Table 6-21: Pathway 2 GWR with Satellite Treatment - Overall Capacities

	Treatment Option		
Parameter	1	2	3
Treatment Train	MF, RO and disinfection	Full advanced treatment (MF, RO, and disinfection/ AOP)	Alternative treatment (ozone-BAC, MF, and disinfection)
Recharge Capacity	AFY	AFY	AFY
Percolation ponds [1]	28,250	28,250	28,250
Injection Wells	0	9,092 [2]	0
Total	28,250	37,342	28,250
RWC, Maximum (assumed)	90%	100%	50%
Maximum Annual Goal with RWC	25,425	37,342	14,125
Annual Yield			
Percolation ponds (with 94% online factor)	23,900	26,555	13,278
Injection Wells	0	9,092	0
Total	**23,900**	**35,647**	**13,278**

Notes:
1 – For the Pathway 2 the purified recycled water would be recharged at the Penitencia, Los Gatos, and Coyote percolation ponds. The amount recharged is an aggregate of the purified recycled water recharged at all three ponds.
2 – Fewer injection wells are needed than for Pathway 1 because there are more percolation ponds assumed for Pathway 2 (i.e., Penitencia, Los Gatos, and Coyote percolation ponds) whereas Pathway 1 only relies on the Los Gatos percolation ponds. Based on 12 injection wells at 460 gpm/well (758 AFY/well).

Table 6-22: Pathway 2 GWR with Satellite Treatment

	Satellite Location																	
	Penitencia						Coyote						Los Gatos					
Treatment Options	1		2		3		1		2		3		1		2		3	
Parameter	AFY	mgd	AFY	mgd	AFY	mgd	AFY	mgd	AFY	mgd	AFY	mgd	AFY	mgd	AFY	mgd	AFY	mgd
Recharge Capacity																		
Percolation ponds	2,450	2.2	2,450	2.2	2,450	2.2	5,600	5.0	5,600	5.0	5,600	5.0	20,200	18.0	20,200	18.0	20,200	18.0
Injection Wells	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	9,091	8.1	0	0.0
Total	2,450	2.2	2,450	2.2	2,450	2.2	5,600	5.0	5,600	5.0	5,600	5.0	20,200	18.0	29,291	29.1	20,200	18.0
RWC, Maximum (assumed)	90%		100%		50%		90%		100%		50%		90%		100%		50%	
Maximum Annual Goal with RWC	2,205	2.0	2,450	2.2	1,225	1.1	5,040	4.5	5,600	5.0	2,800	2.5	18,180	16.2	29,292	26.2	10,100	9.0
AWPF Flows (MF/RO)																		
RO Product Water[1]	-	2.0	-	2.2	N/A	N/A	-	4.5	-	5.0	N/A	N/A	-	16.2	-	26.2	N/A	N/A
MF Filtrate/RO Influent[2]	-	2.3	-	2.6	N/A	N/A	-	5.3	-	5.9	N/A	N/A	-	19.1	-	30.8	N/A	N/A
AWPF Influent	-	2.4	-	2.7	N/A	N/A	-	5.6	-	6.2	N/A	N/A	-	20.1	-	32.4	N/A	N/A
Sidestreams					N/A	N/A					N/A	N/A					N/A	N/A
RO Concentrate	-	0.3	-	0.4	N/A	N/A	-	0.8	-	0.9	N/A	N/A	-	2.9	-	4.6	N/A	N/A
MF Backwash	-	0.1	-	0.1	N/A	N/A	-	0.3	-	0.3	N/A	N/A	-	1.0	-	1.6	N/A	N/A
Total to Sewer	-	0.4	-	0.5	N/A	N/A	-	1.1	-	1.2	N/A	N/A	-	3.9	-	6.2	N/A	N/A
AWPF Flows (Ozone-BAC)																		
Ozone-BAC Disinfected Product Water[3]	N/A	N/A	N/A	N/A	-	1.10	N/A	N/A	N/A	N/A	-	2.50	N/A	N/A	N/A	N/A	-	9.00
Ozone-BAC Effluent/MF Influent	N/A	N/A	N/A	N/A	-	1.15	N/A	N/A	N/A	N/A	-	2.63	N/A	N/A	N/A	N/A	-	9.49
AWPF influent	N/A	N/A	N/A	N/A	-	1.17	N/A	N/A	N/A	N/A	-	2.69	N/A	N/A	N/A	N/A	-	9.69
Sidestreams																		
MF Backwash	N/A	N/A	N/A	N/A	-	0.06	N/A	N/A	N/A	N/A	-	0.13	N/A	N/A	N/A	N/A	-	0.47
BAC Backwash	N/A	N/A	N/A	N/A	-	0.02	N/A	N/A	N/A	N/A	-	0.05	N/A	N/A	N/A	N/A	-	0.19
Total to Sewer	N/A	N/A	N/A	N/A	-	0.06	N/A	N/A	N/A	N/A	-	0.13	N/A	N/A	N/A	N/A	-	0.47
Annual Yield																		
Percolation ponds (with 94% online factor)	2,073	-	2,303	-	1,152	-	4,738	-	5,264	-	2,632	-	17,089	-	18,988	-	9,494	-
Injection Wells	0	-	0	-	0	-	0	-	0	-	0	-	0	-	9,092	-	0	-
Total	**2,073**	**-**	**2,303**	**-**	**1,152**	**-**	**4,738**	**-**	**5,264**	**-**	**2,632**	**-**	**17,089**	**-**	**28,080**	**-**	**9,494**	**-**

Notes:

1 – RO recovery rate = 85%

2 – MF recovery rate = 95 to 98%

3 – BAC recovery rate = 90 to 98%

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Based on Table 6-21, only Option 2 (MF/RO/AOP) is capable of reaching the SBWR Strategic Plan 2035 target of 35,000 AFY. This is largely due to the high RWC anticipated for full advanced treatment product water (low TOC), as well as the flexibility to augment recharge with injection wells. To minimize cost, FAT could be utilized at Los Gatos to take advantage of the potential injection well field, while the Penitencia and Coyote satellite systems use full RO and disinfection. The annual yield of full advanced treatment at Los Gatos and full RO at Penitencia and Coyote would still meet the target of 35,000 AFY in 2035. Although Option 3 (ozone-BAC) does not meet the SBWR Strategic Plan 2035 target, this alternative treatment would minimize RO concentrate management.

6.4.5 RO Concentrate Management

If the AWPF includes RO treatment, then an approach for RO concentrate disposal needs to be developed. The most straightforward and cost-effective concentrate disposal method for satellite treatment is to discharge concentrate into the sewer for treatment at the RWF and discharge to the bay. While sewer discharge is assumed to be the potentially feasible disposal option for the potable reuse alternatives development in Section 7, alternative concentrate discharge locations as well as treatment and minimization strategies are discussed in Appendix 6D. The City has indicated that they would not support large discharge quantities of concentrate to its collection system or directly into the SJ/SC RWF. However, the City is open to discussions for smaller quantities associated with pilot demonstration projects as long as they would not impact collection and wastewater treatment operations nor significantly increase TDS concentration in the final effluent.

6.4.6 Opportunities for Staged Implementation

One of the benefits of this pathway is the ability to implement in stages. By virtue of their size and proximity to the existing recycled water distribution system, both the Coyote and Penitencia options provide an opportunity for a Phase 1 project. AWPF sites have already been identified for both of these options, and starting with a satellite facility at either Coyote or Penitencia does not commit the City/SCVWD to Pathway 2. A Coyote or Penitencia satellite could be combined with a centralized facility to reach the SBWR Strategic Plan's ultimate potable reuse target. Section 7 identifies and discusses the potential Phase 1 projects.

6.4.7 Pathway Assessment

The advantages and disadvantages of Pathway 2 are summarized in Table 6-23.

Table 6-23: Pathway 2 Advantages and Disadvantages

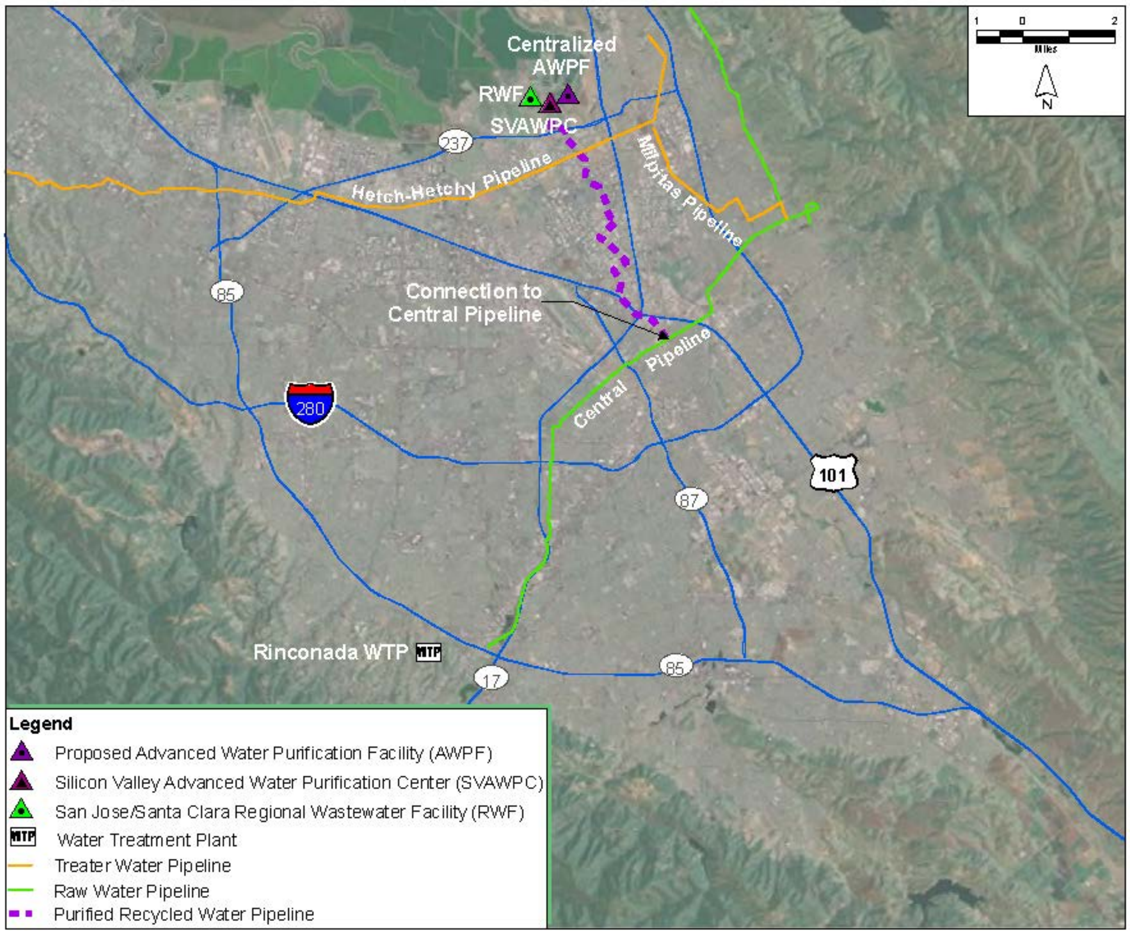
Advantages	Disadvantages
• Use of Option 3 (ozone-BAC) treatment would simplify RO concentrate management since the SBWR distribution system source water TDS concentration is already at 500 mg/L and would require little or no further reduction.	• While Option 3 (ozone-BAC) is the preferred treatment option for satellite AWPFs due to simplified RO concentrate management, this option would not meet the SBWR Strategic Plan target. As an alternative treatment, Option 3 is not

Advantages	Disadvantages
• Leverages the SAT capability of SCVWD percolation ponds for the reduction of TOC and CEC concentrations. • May be more attractive to the public due to the remote AWPF locations and Title 22 water source from the SBWR system. • Flexible implementation schedule, involving phased implementation to achieve planning targets earlier (i.e., the Coyote and Penitencia satellite options have higher potential to be implemented within a shorter time frame). • Provides potential to complement SBWR operations if operated seasonally and coordinated with NPR service. Note that in this scenario the annual yield would be less than noted in Table 6-21; in order to maintain the same annual yield, larger AWPFs would need to be constructed to treat more flow during the winter months.	approved for recharge through injection wells and would be subjected to lower RWC (i.e. higher raw water dilution blend) at percolation ponds. Since Ozone-BAC is considered an alternative treatment technology by DDW, it would have to undergo rigorous piloting/monitoring and permitting challenges. • Achieves the SBWR Strategic Plan planning target for 35,000 AFY by 2035 with combination of Option 1 treatment at Coyote and Penitencia and Option 2 treatment at Los Gatos. This would result in maximum RO concentrate production, which would require concentrate management strategies and associated costs. • Since Option 1 does not have AOP, it does not have a redundant barrier to SAT for trace organics removal. • GWR at Los Gatos ponds requires reoperation of water system operations. • Satellite treatment at Coyote would be dependent on other projects moving ahead in order to facilitate re-operations of percolation ponds and existing raw water supply. • Satellite treatment at Penitencia would be dependent on future SBWR extension as identified in the SJWC Recycled Water Master Plan. • Satellite treatment at Los Gatos would require an extensive extension of the SBWR system, and perhaps paralleling of segments of the existing system. • Satellite plants would require operators to work remotely from other SCVWD or City facilities. • City would not support full-scale satellite treatment option due to salt management impacts.

6.5 Pathway 3 – DPR with Centralized Treatment

Similar to Pathway 1, Pathway 3 consists of a centralized AWPF next to the SVAWPC. Purified recycled water would be introduced to the county-wide raw water conveyance system via connection to SCVWD's Central Pipeline. The Central Pipeline generally conveys State Water Project water from the Penitencia Water Treatment Plant (northeast side of the valley) to the Rinconada Water Treatment Plant (western side of the valley). See Figure 6-19 for the locations of the proposed treatment facility and conveyance alignment.

Figure 6-19: Pathway 3 – DPR with Centralized Treatment



6.5.1 Conveyance

The proposed purified recycled water pipeline alignment from the centralized AWPF to the Central Pipeline as shown in Figure 6-19 was identified by SCVWD through its previous studies. . A new 4,500 HP pump station and 6.6-mile, 42-inch pipeline would be required to convey the purified recycled water to the Central Pipeline, based on the AWPF capacity assumptions discussed in the next section.

6.5.2 Treatment Options and Recharge Capacity

Supplying purified recycled water to the Central Pipeline would require coordination with the operation of that raw water system, including balancing this input with that from the SBA and the operation of both the Penitencia and Rinconada Water Treatment Plants. During the early development of this alternative, SCVWD used its system model to investigate the potential implication of this purified recycled water input to its raw water system. That initial assessment determined that a long-term average of 15,000 AFY could be introduced to the Central Pipeline without impacting the raw water system performance or its ability to take available South Bay Aqueduct imported supplies. This analysis was based on a 32-mgd AWPF and determined that the AWPF could be used at full capacity for about 20 percent of years analyzed with no available system capacity in nearly 25 percent of the years analyzed.

The ability of the Central Pipeline to receive up to 35,000 AFY of purified recycled water consistently every year has not been assessed relative to reoperation/reprioritization implications. As a basis for this technical assessment, it is assumed that 15,000 AFY produced from 32-mgd AWPF could be accommodated on a long-term average based on the SCVWD's analysis. The full amount (35,000 AFY) could be accommodated in drought years and a lesser amount could be accommodated in wet or normal years.

Table 6-24 summarizes the AWPF flows and recharge capacities that can be anticipated from the advanced treatment option, which is likely the only treatment option that would be considered feasible for DPR at this time.

Table 6-24: Pathway 3 Treatment Option

Treatment Train		
Full advanced treatment (MF, RO, and disinfection/AOP)		
Parameter	AFY	mgd
Recharge Capacity		
Percolation ponds	0	0.0
Injection Wells	0	0.0
Raw Water Pipeline	35,000	31.3
Total	35,000	31.3
RWC, Maximum (assumed)	100%	
Maximum Annual Goal with RWC	35,000	31.3
AWPF Flows		
RO Product Water	-	31.3
MF Filtrate/RO Influent	-	36.8
AWPF Influent	-	37.5
Sidestreams		
RO Concentrate	-	5.5
MF Backwash	-	1.9
Annual Yield		
Raw Water Pipeline	15,000 – 35,000[1]	-
Total	15,000 – 35,000[1]	-

Note:
1 – Long-term Annual Yield was estimated by the District at 15,000 AFY. It is assumed that in the future more water could potentially be used for DPR with reoperations.

6.5.3 RO Concentrate Management

The RO concentrate management for Pathway 3 is the same as Pathway 1. Refer to Section 6.3.5 for more information.

6.5.4 Opportunities for Staged Implementation

Since DPR is currently not an approved potable reuse strategy in California, the pathway to a future DPR project is to start with an IPR project. An initial IPR project would provide operational and performance data to foster public acceptance of the treatment technology while DDW investigates the feasibility of developing uniform criteria for DPR. Therefore, the opportunities for staged implementation of Pathway 3 are the similar to Pathway 1. Section 7 identifies and discusses the potential Phase 1 projects.

6.5.5 Pathway Assessment

The advantages and disadvantages of Pathway 3 are summarized in Table 6-25 below.

Table 6-25: Pathway 3 Advantages and Disadvantages

Advantages	Disadvantages
• Since source water for the AWPF is diverted after secondary treatment at the RWF, the need for RWF improvements to support water recycling is minimal. This may also eliminate future expansion/rehabilitation of the tertiary filters. • Since source water for the AWPF is taken from the RWF, only nominal improvements to SBWR system required. • Option 2 (MF/RO/AOP) is the only treatment option assumed acceptable for DPR at this time, which provides the best water quality compared to other options, e.g. lower TDS concentration, destruction of CECs. • Could be partnered with Phase 1 GWR injection project along the pipeline alignment, providing opportunity to build initial segment of conveyance pipeline and gain experience with an IPR project before implementing DPR. • As with all RO projects, provides opportunity to support regional salt/nutrient management through RO concentrate export. • Provides most direct raw water source supplement during drought years when need is greatest.	• Direct connection to key raw water conveyance system and potential impact to SBA supply operation could limit the project's long-term annual average yield to 15,000 AFY. • Option 2 (MF/RO/AOP) is the only treatment option assumed for DPR. This option is potentially the most cost and energy intensive among all treatment options. • Option 2 also results in maximum RO concentrate production and associated concentrate management strategies and costs. • Currently there are no approved DPR projects in California. DPR may require supplemental treatment (additional pathogen barrier) because no specific pathogen removal credits have been approved by DDW for DPR. It may also require additional monitoring for identifying unknown requirements that will need to be incorporated for approval. These requirements could have a significant impact on the type and cost of the facilities.

6.6 Pathways for Alternative Development

A combination of NPR and IPR is envisioned to meet the SBWR Strategic Plan targets. The purpose of this TM is to provide an overview of the potable reuse pathways to be considered in the alternatives development. Three generalized potable reuse pathways were identified as follows:

- Pathway 1: GWR with Centralized Treatment
- Pathway 2: GWR with Satellite Treatment
- Pathway 3: DPR with Centralized Treatment

There are three potential treatment options under consideration:

- Option 1: MF/RO with UV disinfection (Pathways 1 and 2 only)
- Option 2: Full Advanced Treatment (MF/RO and UV/peroxide) (Pathways 1, 2, and 3)
- Option 3: Alternative treatment: Ozone- BAC and UV disinfection (Pathways 1 and 2 only)

The three potable reuse pathways, coupled with treatment options, will be used to generate a range of alternatives to meet the City and SCVWD recycled water targets summarized in Section 1. The range of alternatives will include maximizing NPR, maximizing potable reuse, and hybrid approaches with varying amounts of non-potable and potable reuse. The amount of purified recycled water that can be recharged varies for each combination of pathway and treatment option. The main findings are summarized in Table 6-26.

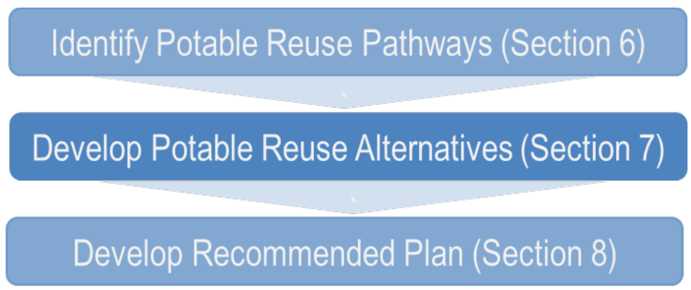
Table 6-26: Potable Reuse Pathway Options – Summary of Findings

Pathway 1	Pathway 2	Pathway 3
Potable Reuse Target		
• To meet the SBWR Strategic Plan 2025 target of 25,000 AFY and 2035 target of 35,000 AFY, injection wells have to be added on top of recharge at the Los Gatos percolation ponds. Only Option 2 (MF/RO/AOP) is allowed to augment recharge with injection wells based on the current GWR regulations.	• To meet the SBWR Strategic Plan 2025 target of 25,000 AFY and 2035 target of 35,000 AFY, either or both of the satellite options at Coyote and Penitencia would have to be paired with either Pathway 1 or Pathway 3 in order to take advantage of injection well augmentation and/or DPR.	• For DPR, Option 2 (MF/RO/AOP) is assumed to be permissible, therefore this pathway would meet the SBWR Strategic Plan 2025 target of 25,000 AFY and 2035 target of 35,000 AFY. SBA supply operation could limit the project's long-term average annual yield to 15,000 AFY. DPR may ultimately be a strategy to enhance dry-year response and capabilities.
RO Concentrate Management		
• RO concentrate disposal would require concentrate management strategies and associated costs.	• Option 3 would result in minimal RO concentrate, which is preferred. However, Option 3 would	• RO concentrate disposal would require concentrate management strategies and associated costs.

Pathway 1	Pathway 2	Pathway 3
	have inferior water quality and lower RWC for percolation pond recharge. • The City has indicated that it would not support full scale satellite treatment option due to salt management impacts.	
Phased Implementation		
• Near-term implementation schedule would include injection wells be constructed closer to the RWF in concert with initial pipeline segment. • Original concept would be to construct injection wells as a last increment to postpone and optimize injection strategy based on early results of percolation pond operation.	• Capacity expansion of SBWR system (including the SVAWPC) would be required to support this pathway. Coyote is a prime candidate for near-term implementation since a satellite site has been located and SBWR connection identified. Penitencia could be a near-term candidate as well.	• Similar flexible implementation schedule as Pathway 1, involving phased implementation to achieve planning targets earlier (i.e., initial segments of pipeline, expansion of SVAWPC with UV/peroxide to produce purified recycled water for injection wells located along initial pipeline segment).
<u>Operations</u>		
• Since source water for the AWPF is diverted after secondary treatment at the RWF, the need for RWF improvements to support water recycling is minimal. This may also eliminate future expansion or rehabilitation of the tertiary filters. • Only nominal improvements to SBWR system required.	• Certain SBWR improvements prompted by service to satellite systems could support improved SBWR operation overall if operated seasonally and coordinated with NPR service. • Satellite online factors are affected by the availability of source water from SBWR and online factor of respective percolation ponds.	• Potentially the most energy intensive pathway due to pumping into raw water pipeline and potential additional treatment process(es). • Potentially provides the lowest online factor due to potential implications on Central Pipeline operations and desire to maximize SBA draw.

7. Potable Reuse Alternatives

Section 6 identified three potential potable reuse pathways; in Section 7, these pathways are developed into three potable reuse alternatives. Both near-term and long-term potable reuse alternatives were developed to meet SBWR Strategic Plan recycled water planning targets. Near-term projects (also referred to as Phase 1 projects) are the initial potable reuse projects that could be implemented following the completion of this Strategic and Master plan, i.e., within the next 5 to 7 years. The long-term projects are the projects that could be implemented by 2025 and 2035 to meet the interim and final recycled water planning targets. The evaluations of the two near-term and three long-term potable reuse alternatives will be presented in Section 8.



The District completed initial reoperations evaluations for the potable reuse concepts identified in the District's initial potable reuse studies, which are identified in this section. As the District expands recycled water use, including implementing potable reuse projects, a policy discussion and decision will be needed regarding recycled water and how it will be utilized in the District's water supply plan, i.e., will recycled water be base loaded or only used as supplemental water during dry years. The economics for recycled water projects are more favorable if they are used as base water supply than a supplemental water supply, but this needs to be evaluated in context with the rest of the District's water supply system. The reoperations study and policy decision will help guide the implementation of potable reuse projects.

For this evaluation, it is assumed that reoperations projects would be implemented by the District to fully utilize the recycled water for the groundwater replenishment projects (recharge ponds and injection wells). Since the WEAP modeling completed for the District's initial concept for DPR demonstrated that the full quantity of recycled water would not be utilized in the long-term, the costs for the long-term DPR alternative are shown two ways: assuming that the water use is limited as determined by modeling and that the water is fully utilized. These costs demonstrate the economic viability of potable reuse when local and imported water supplies are limited. Additionally, since the reoperations are required for all potable reuse alternatives and will allow the District to utilize local water supplies more efficiently to provide county-wide water supply benefits, the costs of these infrastructure improvements are not included in this report.

7.1 Near-Term Potable Reuse Alternatives

As described to in Section 6, there are many benefits to implementing a smaller near-term project, including further demonstration of AWPF and groundwater replenishment performance, reducing regulatory and public acceptance uncertainty for the larger potable reuse projects, and accelerating the implementation timeline for the long-term projects.

Table 7-1 summarizes the potential Phase 1 project options that have been identified based on the pathways described in Section 6. Note that the terms "near-term" and "Phase 1" are interchangeable and both are used in this context to describe the initial potable reuse projects.

Table 7-1: Potential Phase 1 Projects

Phase 1 Project Option	Project Name	Source Water	Treatment	Recharge Location
1	Mid-Basin Injection	SVAWPC	Add AOP	Main basin aquifer
2	Penitencia 1a	SBWR	Satellite MF/RO	Recharge ponds
3	Penitencia 1b	SBWR	Satellite Ozone-BAC	Recharge ponds
4	Penitencia 2	SVAWPC	No additional treatment	Recharge ponds
5	Coyote/Ford 1a	SBWR	Satellite MF/RO	Recharge ponds
6	Coyote/Ford 1b	SBWR	Satellite Ozone-BAC	Recharge ponds

7.1.1 Phase 1 Project Option 1 – Mid-Basin Injection

For Pathways 1 and 3, where a substantial conveyance system to either the Los Gatos recharge ponds or the Central Pipeline is required, injection wells could be constructed along an initial portion of the conveyance pipeline and served by the SVAWPC. Since the SVAWPC is designed to manage the level of salinity in the SBWR recycled water, its peak production requirement will be during the summer. The SVAWPC would have excess capacity during winter and shoulder months, and could support a seasonal supply of purified recycled water to this Phase 1 project. Table 7-2 lists the projected excess capacity at the SVAWPC starting in 2015 that could be used as source water for a potential Phase 1 project, which averages 2.3 mgd (2,600 AFY) over the year.

Table 7-2: Projected SVAWPC Available Capacity for IPR (2015)

Excess SVAWPC Capacity for IPR (mgd)											
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
4.93	3.93	3.66	1.52	N/A	N/A	N/A	0.53	1.53	2.80	3.79	5.35

Since the SVAWPC only has UV disinfection, UV/peroxide would need to be added to provide full advanced treatment, which is required for injection wells. Ideally injection wells could be located relatively close to the RWF/SVAWPC to minimize Phase 1 piping and pumping requirements while allowing recovery by production wells. Appendix 7A provides a preliminary evaluation of the feasibility of utilizing injection well(s) for this purpose. The analysis assumes that 2,000 AFY of purified recycled water would be injected and retained underground for a minimum of three months prior to recovery at any production well, as required to meet DDW requirements. Locating injection well(s) very near to the SVAWPC is limited by the currently high (above the ground surface) potentiometric surface and the lack of nearby active production wells to recover the recharged water. Accordingly, under current conditions, injected purified recycled water very near the SVAWPC would ultimately discharge to San Francisco Bay without recovery and beneficial use.

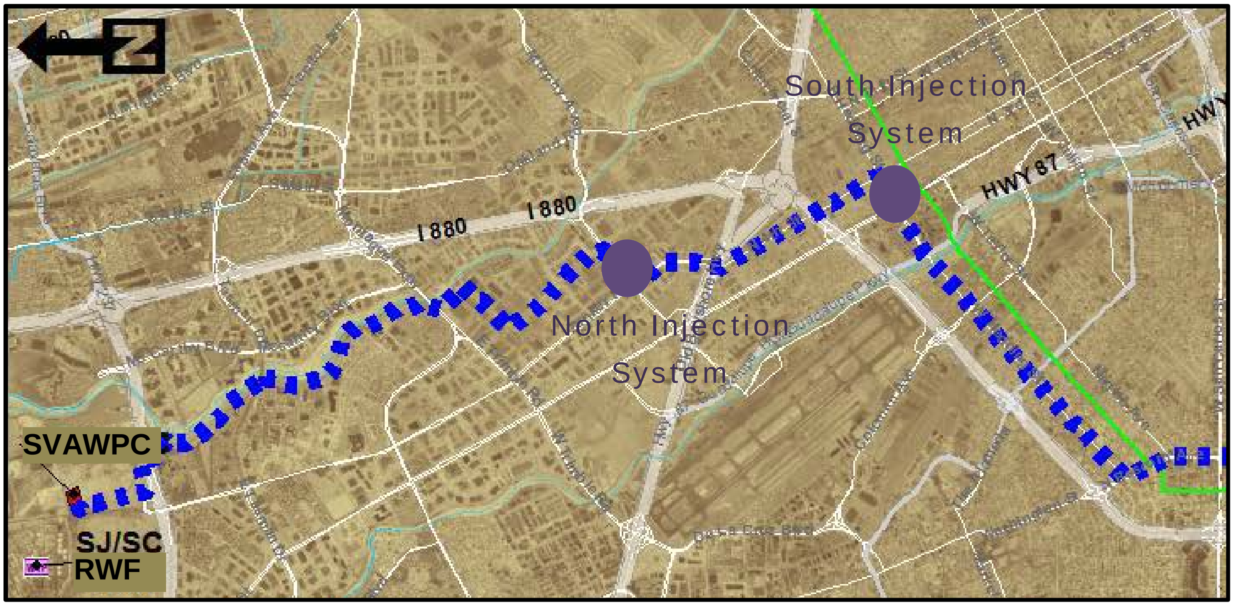
The preliminary evaluation assumed that existing inactive wells owned by San José, Santa Clara, or SJWC could be operated to increase aquifer storage capacity and capture some portion of the injected purified recycled water. Figure 7-1 shows the location of the two potential injection well locations: the North and South San José Injection Systems. The North San José Injection System is located near the Montague Expressway, east of Highway 880 and north of Highway 101. The South San José Injection System is located near the AWT pipeline east of Highway 880/17 and south of Highway 101.

The preliminary evaluation concludes that there is limited existing available storage capacity near the potential injection wells sites. In order for a Phase 1 injection well project to be feasible along the northern portion of the potential pipeline alignment to the Los Gatos recharge system, the existing City production wells near the northern site would need to be pumped to reduce groundwater levels and increase available storage capacity. At the southern potential site, there is available storage capacity despite the absence of no nearby existing production wells. A more detailed study of local groundwater conditions would be required.

Phase 1 Project Option 1 would include the following preliminary infrastructure requirements:

- Addition of UV/peroxide to the SVAWPC treatment train.
- Approximately 6 miles of 42-inch diameter pipeline from the SVAWPC to injection wells.
- Up to 8 injection wells and associated pipeline laterals.

Figure 7-1: Location of North and South Injection Well Sites



7.1.2 Phase 1 Project Option 2 – Penitencia 1a

This option would involve the construction of a satellite AWPF in the Penitencia service area, treating water sourced from the SBWR system with full advanced treatment before recharge at the Penitencia recharge ponds. The hydrostratigraphy beneath the ponds is relatively complex compared to other recharge systems, with inter-bedded heterogeneous and discontinuous aquifer and aquitard units. This results in localized poor recharge, which makes replenishment at the Penitencia recharge ponds less desirable than other areas. Based on information in Section 6, the potential yield for this option is 2,300 AFY.

A site has already been identified for a satellite AWPF in this area; however, availability of source water is contingent on SJWC extending the SBWR to the vicinity based on the SJWC Master Plan. As of December 2013, SJWC's extension of SBWR pipelines to Penitencia pond area is on hold and would possibly not be available in the Phase 1 timeframe.

As identified in the District's initial IPR studies, IPR recharge in the Penitencia off-stream recharge ponds would displace imported water. The imported water could then be used in other recharge facilities or sent to a water treatment plant or used for in-stream recharge.

Phase 1 Project Option 2 would include the following preliminary infrastructure requirements:

- A satellite AWPF with MF-RO.

- Approximately 1.2 miles of 12-inch diameter pipeline to deliver source water from the expanded SBWR system to the satellite AWPF.
- Approximately 1.5 miles of 12-inch diameter pipeline to deliver product water the Penitencia Ponds for recharge.
- Approximately 0.7 miles of 12-inch diameter pipeline to convey RO concentrate from the satellite AWPF to the nearest sewer with available capacity.

7.1.3 Phase 1 Project Option 3 – Penitencia 1b

This option is similar to Option 2 with Ozone-BAC replacing MF-RO. While this option results in less RO concentrate management compared to Option 2, the potential yield for this option is only 1,200 AFY because of lower RWC due to the lack of full advanced treatment (see Section 6). Additionally, the TDS concentrations of the purified recycled water in this option will be higher than that produced in Option 2.

Phase 1 Project Option 3 would include the following preliminary infrastructure requirements:

- A satellite AWPF with Ozone-BAC.
- Approximately 1.2 miles of 12-inch diameter pipeline to deliver source water from the expanded SBWR system to the satellite AWPF.
- Approximately 1.5 miles of 12-inch diameter pipeline to deliver product water the Penitencia Ponds for recharge.
- Approximately 0.7 miles of 12-inch diameter pipeline to convey backwash waste from the satellite AWPF to the nearest sewer with available capacity.

7.1.4 Phase 1 Project Option 4 – Penitencia 2

As mentioned, since the SVAWPC is designed to manage the level of salinity in the SBWR recycled water, its peak production requirement will be during the summer. The SVAWPC would have excess capacity during winter and shoulder months (see Table 7-2) and could support a seasonal supply of purified recycled water without treatment modifications to a Phase 1 project that does not involve injection wells. Therefore, alternative to constructing a satellite AWPF at Penitencia would be to construct a pipeline to deliver excess water from the SVAWPC to the Penitencia recharge ponds during winter and shoulder months. Compared to Option 1, the potential yield for this option is limited to 2,200 AFY since it is constrained by the recharge capacity at the Penitencia recharge ponds.

Option 4 would require the construction of a pump station and approximately 8.5 miles of 18-inch diameter pipeline from the SVAWPC to the Penitencia Ponds. Figure 7-2 illustrates the potential pipeline alignment that could be constructed between the SVAWPC and the Penitencia recharge ponds.

7.1.5 Phase 1 Project Option 5 – Coyote/Ford 1a

This option would involve the construction of a satellite AWPF in the Coyote/Ford service area, treating water sourced from the SBWR system with full advanced treatment before recharge at the Coyote/Ford recharge ponds. A 5-mgd SBWR capacity has been allotted to SCVWD from the Silver Creek Pipeline, which would serve a satellite AWPF constructed at either of two locations identified in Figure 7-3. Based on information in Section 6, the potential yield for this option is 5,300 AFY.

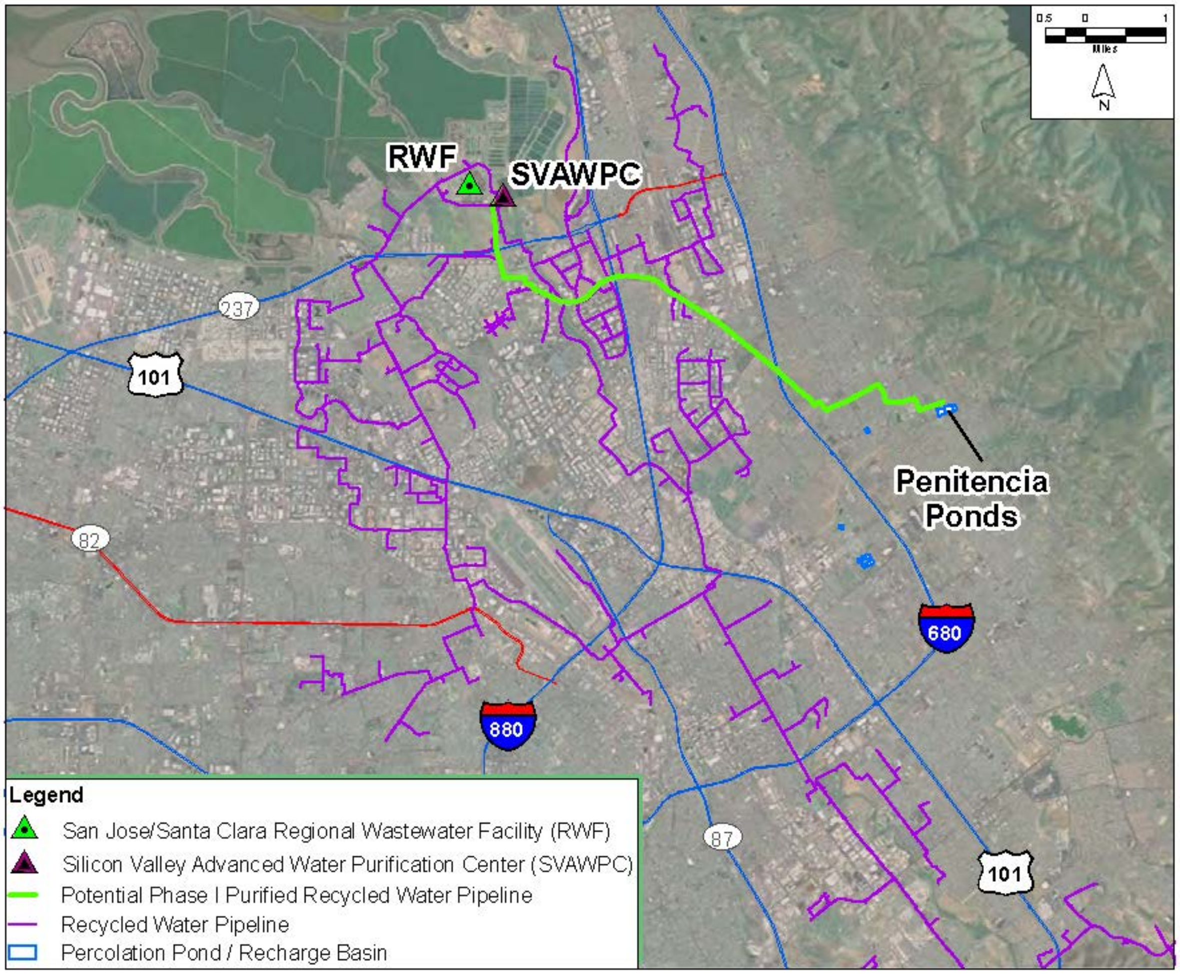
The Anderson Reservoir, upstream of the Coyote groundwater recharge system, stores both local and imported water and flexibility with end uses for Anderson Reservoir water frees up the Coyote Pond for an IPR project. As identified in the District's initial IPR studies, the concept of recharging water in this area assumes that the Main Avenue and Madrone Pipelines Restoration Project (part of the WSIMP) moves forward. This project will allow water from Anderson Reservoir to be delivered to South County recharge facilities, which will allow for beneficial use of local and imported water supplies that would be replaced by purified water in the Coyote recharge ponds.

Recharge at the existing and expanded Ford Pond was not analyzed for reoperations in the District's initial IPR studies. The Ford Pond is not currently used to recharge local or imported water which allows the Ford Pond to be used for an IPR project without offsetting local or imported water. The long-term storage level in the groundwater basin will need to be addressed as part of a detailed reoperations evaluation.

Phase 1 Project Option 5 would include the following preliminary infrastructure requirements (based on site near Metcalf Energy Center):

- A satellite AWPF with MF-RO.
- Approximately 350 feet of 18-inch diameter pipeline to deliver source water from the Silver Creek Pipeline to the satellite AWPF.
- Approximately 0.9 miles of 18-inch diameter pipeline to deliver product water the Coyote Ponds for recharge.
- Approximately 0.5 miles of 8-inch diameter pipeline to convey RO concentrate from the satellite AWPF to the nearest sewer with available capacity.
- Coyote or Ford recharge ponds need to be converted to off-stream ponds.

Figure 7-2: Potential Pipeline Alignment for Penitencia—Option 4



7.1.6 Phase 1 Project Option 6 – Coyote/Ford 1b

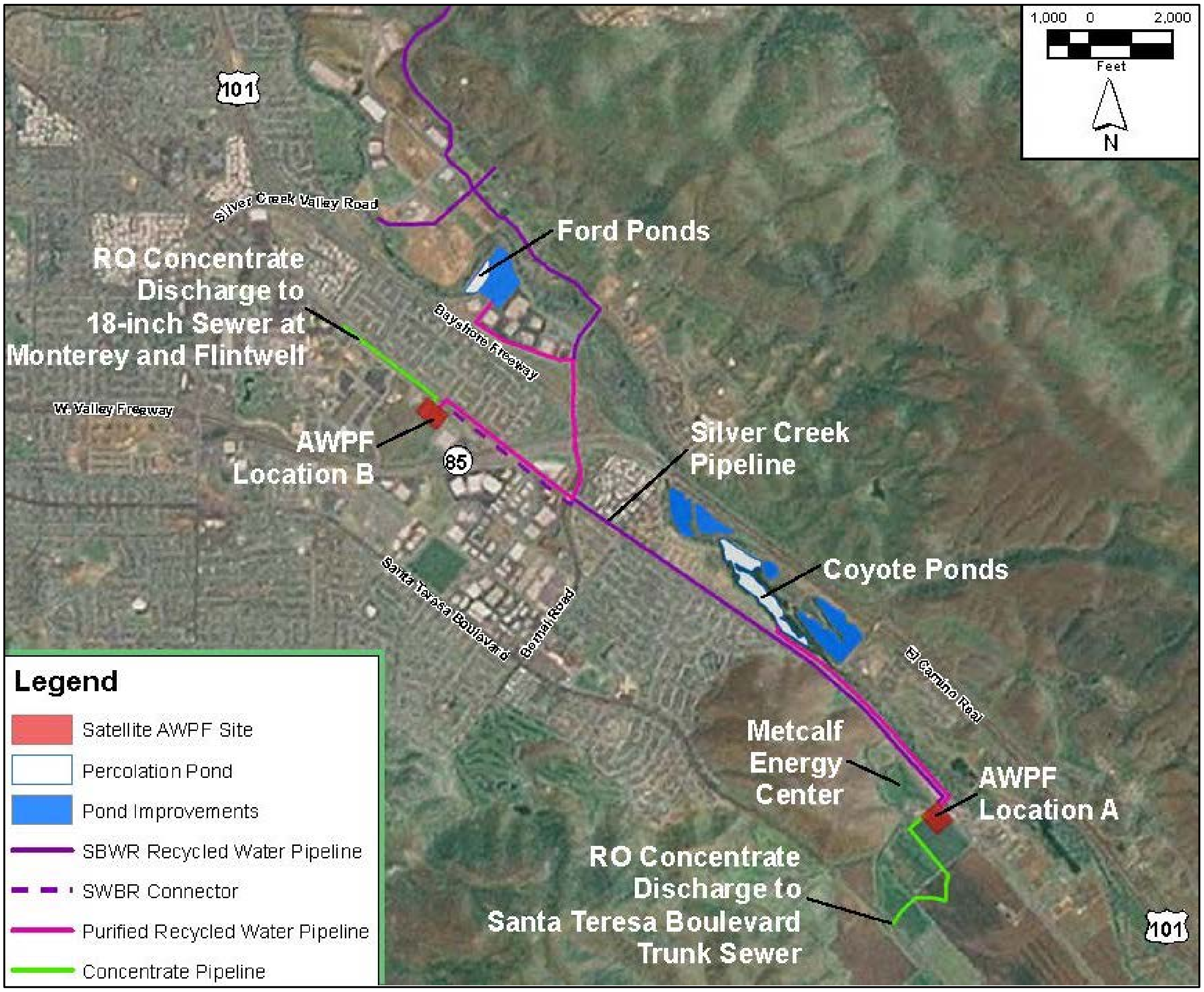
This option is similar to Option 5 with Ozone-BAC replacing MF-RO. While this option results in less RO concentrate management compared to Option 5, the potential yield for this option is only 2,800 AFY because of lower RWC due to the lack of full advanced. The yield could potentially be increased if the Ford/Coyote ponds are expanded. Additionally, the TDS concentrations of the purified recycled water in this option will be higher than that produced in Option 5.

Phase 1 Project Option 6 would include the following preliminary infrastructure requirements (based on site near Metcalf Energy Center):

- A satellite AWPF with Ozone-BAC.
- Approximately 350 feet of 18-inch diameter pipeline to deliver source water from the Silver Creek Pipeline to the satellite AWPF.
- Approximately 0.9 miles of 18-inch diameter pipeline to deliver product water the Coyote Ponds for recharge. (1.8

- Approximately 0.5 miles of 8-inch diameter pipeline to convey backwash waste from the satellite AWPF to the nearest sewer with available capacity.
- Coyote or Ford recharge ponds need to be converted to off-stream ponds.

Figure 7-3: Potential Coyote/Ford Improvements—Option 5 and 6



7.1.7 Summary of Phase 1 Project Options

Hybrid pathways and phasing would help SCVWD meet its targets while minimizing disadvantages identified for the respective pathways. e.g., Phase 1 satellite projects at Coyote and Penitencia with treatment Option 3 (ozone-BAC) would begin recharging via recharge ponds while minimizing concentrate management requirements. While GWR operations are ongoing at Coyote and Penitencia, a centralized facility could be developed for subsequent implementation of GWR at the Los Gatos Ponds or DPR at the Central Pipeline. Phase 1 projects will be evaluated and recommended in Section 8.

Table 7-3 summarizes the preliminary order-of-magnitude cost estimates for each of the six Phase 1 project options.

Table 7-3: Summary of Phase 1 Project Options

Phase 1 Project Option	Project Name	Yield (AFY)	Capital Cost ($M)	Annual O&M Cost ($M)	Total Annual Cost ($M)	Cost ($/AF)
1	Mid-Basin Injection	2,600	$74.3	$1.6	$6.7	$2,700
2	Penitencia – Option 1a	2,300 [1]	$30.9 [2]	$1.9	$4.0	$1,900
3	Penitencia – Option 1b	1,200 [1]	$21.5 [2]	$1.1	$2.6	$2,200
4	Penitencia – Option 2	2,200	$32.6	$1.4	$3.6	$1,700
5	Coyote/Ford – Option 1a	5,300 [1]	$56.7 [3]	$2.7	$6.6	$1,500
6	Coyote/Ford –Option 1b	2,800 [1]	$34.6 [3]	$1.3	$3.7	$1,400

Notes:
1– See Section 6.
2 – Costs do not include land purchase cost (1.7 acres need to be purchased from Santa Clara County)
3 – Costs do not include the costs to convert the Ford Ponds to off-stream ponds.
4 – Costs do not include the costs to purchase recycled water from the SVAWPC (Options 1, 4) or SBWR (Options 2, 3, 5, 6).

The District assessed these six Phase 1 project options based on how they maximize IPR while relying on existing availability of recycled water and existing District facilities in order to avoid stranded assets. The Penitencia recharge ponds have relatively poor localized recharge, which makes replenishment at the Penitencia recharge ponds less desirable than other areas, which is a disadvantage for Phase 1 Project Options 2, 3, and 4. Phase 1 Project Option 6, Coyote/Ford Option 1b, which assumes ozone-BAC for the treatment process, would result in a smaller project than Phase 1 Project Option 5, Coyote/Ford Option 1b. Therefore, the District short-listed the following two project options for further refinement and evaluation:

- Option 1 – Mid-Basin Injection (referred to as Phase 1 Option A moving forward)
- Option 5 – Coyote/Ford Ponds – Option 1 (referred to as Phase 1 Option B moving forward)

7.1.8 Short-Listed Near-Term Capital Projects

This section provides detailed descriptions of the short-listed Phase 1 capital projects.

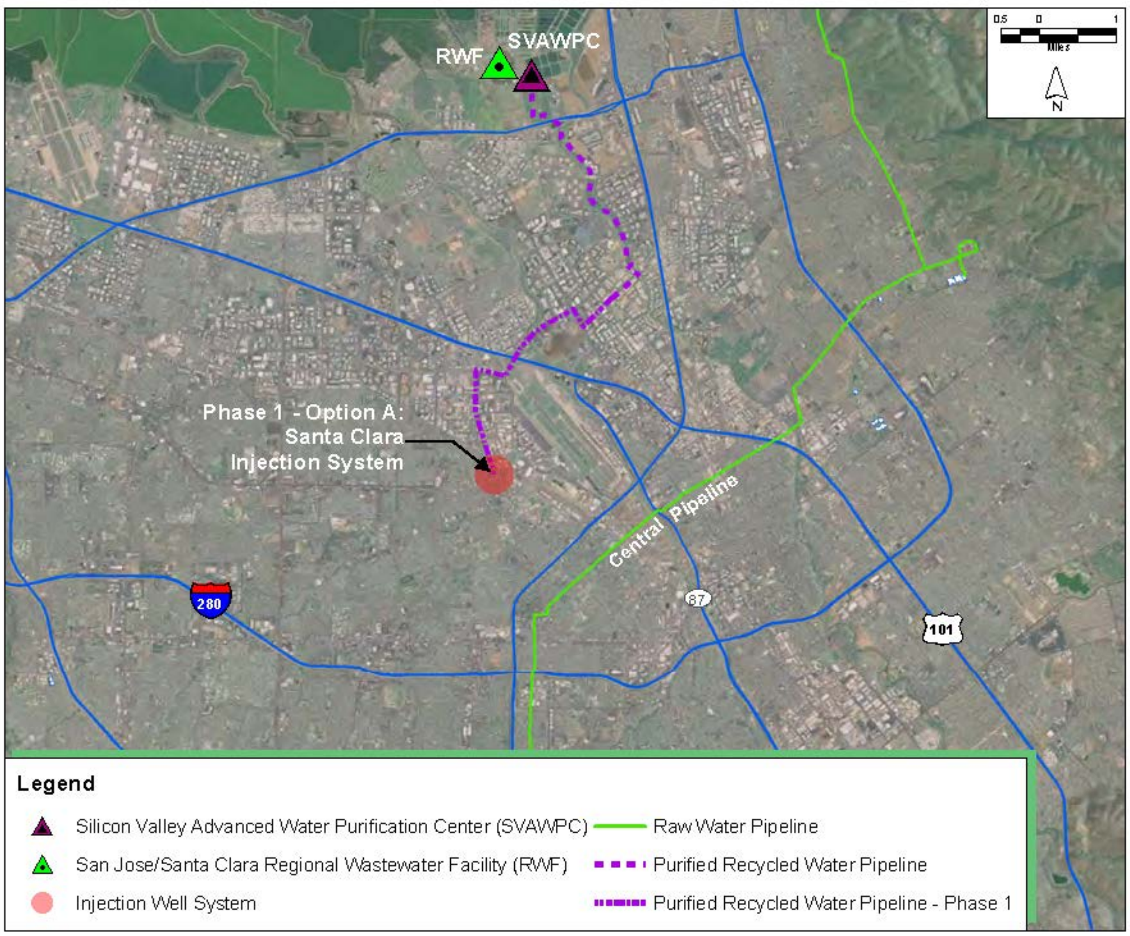
Phase 1 Project Option A – Mid-Basin Injection IPR

The concept for Phase 1 Option A Mid-Basin Injection is to construct injection wells along a portion of the conveyance pipeline that would be needed for either IPR at the Los Gatos recharge ponds and new injection wells, or DPR at the Central Pipeline). Ideally injection wells could be located relatively close to the RWF/SVAWPC to minimize Phase 1 piping and pumping requirements. A mid-basin injection project likely would be phased in starting with one or two injection wells to confirm that the program will demonstrate the viability of a larger program (perhaps 5-10 mgd).

The project concept was presented to both the City of San Jose Municipal Water Department (Muni Water) and the City of Santa Clara. Muni Water has some existing groundwater production wells in the areas near the SJ/SC RWF and along the proposed alignment of the conveyance pipeline; however, Muni Water is not currently pumping groundwater and would not be able to commit to groundwater pumping until 2018 at the earliest. The City of Santa Clara relies heavily on groundwater and pumps groundwater in its jurisdiction west of the proposed purified recycled water pipeline alignment. Nevertheless, all groundwater replenishment projects would be beneficial to all groundwater producers within the entire zone of benefit. Groundwater impacts in the project area would need to be assessed with groundwater modeling.

Figure 7-4 presents a potential location of mid-basin injection wells located in the City of Santa Clara.

Figure 7-4: Phase 1 Option A Mid-Basin Injection



Phase 1 Project Option A would include the following preliminary infrastructure requirements:

- Addition of UV/peroxide to the SVAWPC treatment train and associated chemical storage and delivery system.
- Product water pump station (PWPS) (200 hp).

- Approximately 3.2 miles of 42-inch pipeline from the SVAWPC towards Los Gatos.
- Approximately 4.4 miles of 18-inch pipeline laterals and easements to the injection well field.
- Up to 8 injection wells and associated pipeline laterals. It is assumed that the injection wells have a capacity of approximately 400 gallons per minute.
- Land purchase for injection wells.

Phase 1 Project Option A would also incur the following annual O&M elements:

- Additional power consumption at the SVAWPC, i.e. PWPS and AOP.
- Chemical consumption for AOP.
- Equipment replacement and maintenance of PWPS, AOP, and injection well systems.
- Pipeline maintenance.

Phase 1 Project Option B –Ford Ponds IPR

The two potential locations for the AWPF are south of the Coyote Recharge Ponds near the Metcalf Energy Center (if the purified recycled water is recharged at the Coyote Recharge Ponds) or on Great Oaks Boulevard (if the purified recycled water is recharged at the Ford Recharge Ponds). The potential AWPF locations and recharge areas are shown in Figure 7-5. After further discussions with SCVWD, it was determined that this project would rely on the existing and new Ford Recharge Ponds. Therefore, the AWPF is assumed to be located on vacant land on Great Oaks Boulevard. Groundwater impacts in the project area would need to be assessed with groundwater modeling.

Based on an estimated AWPF recovery rate of 80 percent (MF recovery of 94 percent and RO recovery of 85 percent) and AWPF annual online factor (94 percent), the potential yield for this option is approximately 4,200 AFY. It is assumed that MF backwash waste and RO concentrate would be discharged to the nearby sanitary sewer to be returned to the RWF for treatment. The Ford Ponds IPR project is anticipated to increase the TDS concentration of the RWF influent by 15 mg/L. At the time that this analysis was completed, the influent TDS concentration was approximately 720 mg/L. Concentrate disposal from the Ford Ponds IPR project would increase the RWF influent concentration to 735 mg/L, which is a 2 percent increase.

These wastes would be managed as an industrial discharge and would incur sewer-related fees for capital cost and O&M cost recovery. In addition, a sanitary sewer/treatment plant connection fee would also be incurred for the project. Based on the AWPF design capacity, the discharge and connection fees can be rather substantial; RO concentrate discharge flow reduction strategies (e.g., high-recovery RO) should be further studied in more detail to determine whether or not there will be overall cost reductions with a higher capital cost in combination with lower discharge and connection fees.

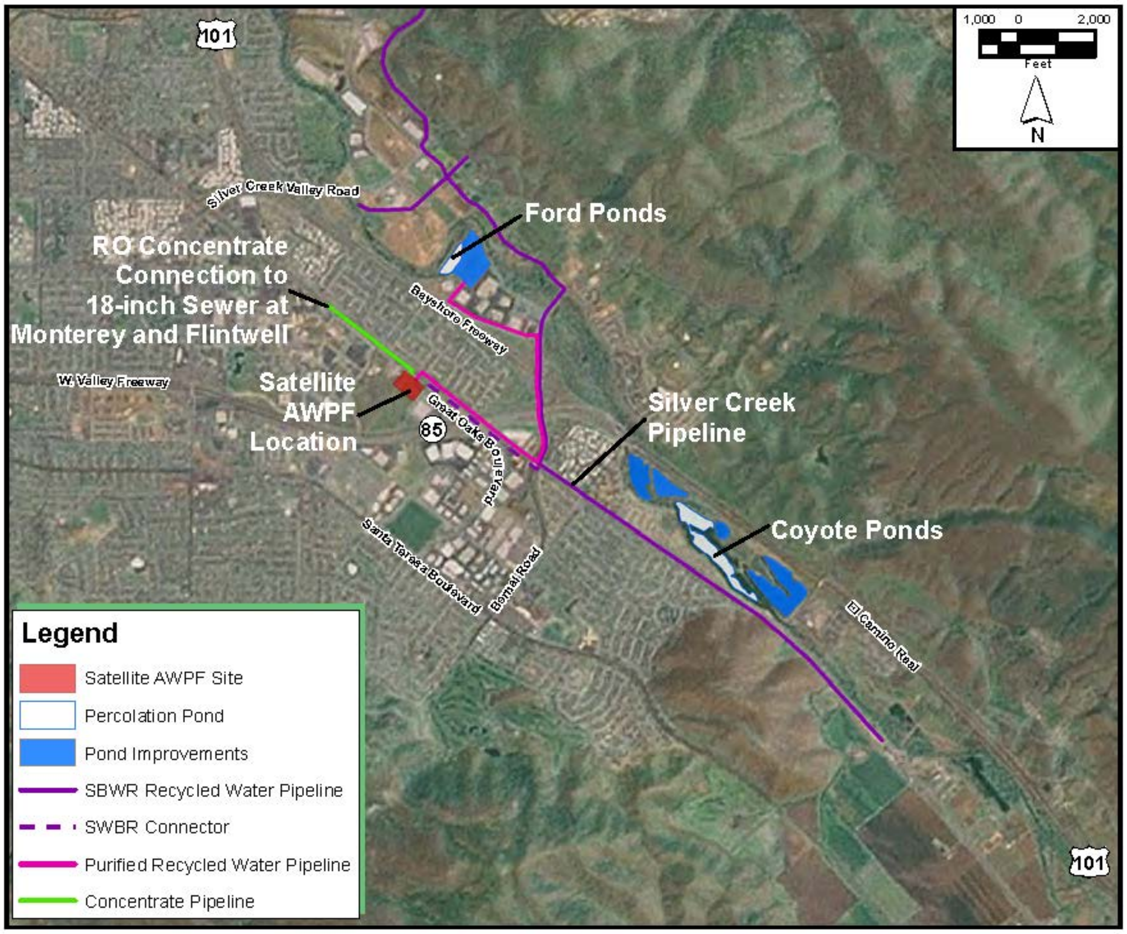
A preliminary evaluation of the hydrogeology and regulatory requirements for this near-term option is presented in Appendix 7B, the Ford Pond IPR Project Preliminary Hydrogeologic and Regulatory Evaluation TM (Administrative Draft). Based on this preliminary analysis, the proposed Ford Pond IPR project appears feasible and a 4,200-AFY recharge project can likely meet DDW GWR regulatory requirements. If this option is selected for implementation, then a more detailed groundwater evaluation, including modeling, will need to be completed. Potential impacts to nearby production wells will need to be assessed and addressed. Prior to moving forward with the project, additional analysis of potential water quality impacts will need to be addressed including the potential for:

- Contamination mobilization due to geochemical reactions between recharged purified water and native groundwater,
- Soil aquifer plugging due to differences in water quality between purified water and native groundwater, and
- Recharge mounding to impact environmental release sites.

Phase 1 Project Option B would include the following preliminary infrastructure requirements:

- A satellite AWPF with 4-mgd production capacity.
- Product water pump station (75 hp).
- Approximately 0.7 miles of 14-inch pipeline and easements to deliver source water from the Silver Creek Pipeline to the satellite AWPF.
- Approximately 1.8 miles of 14-inch pipeline and easements to deliver product water to the Ford Ponds for recharge.
- Approximately 0.5 miles of 8-inch pipeline and easements to convey RO concentrate from the satellite AWPF to the existing sewer system at Monterey Road and Flintwell Way.
- Assuming a recharge capacity of 1 to 2 cubic feet per second (cfs) for the existing 4-acre Ford Road pond, an additional area of up to 15 acres would be needed adjacent to the existing Ford Pond to be converted to additional ponds.
- City of San José sanitary sewer/treatment plant connection fee allowance based on connection fee incurred for the MEC project.
- Land purchase for satellite AWPF and additional off-stream ponds.

Figure 7-5: Phase 1 Option B Ford Ponds IPR



Phase 1 Option B would also incur the following annual O&M elements:

- Power consumption at the satellite AWPF.
- Chemical consumption at the satellite AWPF.
- Equipment replacement and maintenance at the satellite AWPF.
- Pipeline maintenance for pressure and gravity sewer pipelines.
- Staffing (labor) at the satellite AWPF.
- Industrial sewer service and use charge – The satellite AWPF would discharge up to 1 mgd of MF backwash waste and RO concentrate into the nearest sewer for treatment at the RWF. This would incur City industrial discharge fees for capital and O&M cost recovery based on the flow quantity and water quality of the discharge.[18] The City has indicated that it would be amenable to a satellite project whose waste discharges would not impact the wastewater collection system and treatment operations, and not significantly impact the TDS concentration of the RWF final effluent.

[18] http://www.sanjoseca.gov/index.aspx?NID=1649

- SBWR recycled water purchase – SCVWD and SBWR will negotiate a price for the SBWR recycled water. Since this price is unknown at this time, it is not included in the cost evaluation. Once the cost is negotiated, then it will need to be added to further refinements of the cost estimates.
- Recharge pond operation and maintenance – This cost element will need to be added to further refinements of the cost estimates.

Conceptual Cost Estimates

The capital cost estimates for the two short-listed Phase 1 capital projects options were developed based on previous District estimates, other similar IPR projects, equipment cost quotations from vendors, industry publications, and typical pipeline installation costs in terms of cost per inch of pipeline length and inch diameter. Depending on the stage of the project and the level of detail understood, different estimating accuracies can be assumed. Since the SBWR Strategic and Master Planning project is a preliminary planning phase project, these estimates are considered Class 5 estimates based on the AACE International Recommended Practice No. 18R-97, Cost Estimate Classification System – As Applied in Engineering, Procurement, and Construction for the Process Industries (2005). Class 5 estimates are based on a level of project definition of 0 to 2 percent and are suitable for alternatives analysis. The typical accuracy ranges for a Class 5 estimate is -20 to -50 percent on the low end, and +30 to +100 on the high end. In addition, the capital costs include the following contingency and markups:

- 20 percent contingency to account for unknown or unforeseen construction costs.
- 30 percent implementation factor to account for the costs for program management, planning and environmental documentation, permits, engineering, design and construction services, construction management and inspections, and typical overhead items such and legal and administration services.
- 10 percent project contingency to account for the level of detail of the project concept.

O&M costs are the recurring annual expense to operate and maintain the facilities after construction is completed. The O&M cost elements include items such as power, labor, chemicals, replacement of consumables (membranes, cartridge filters), maintenance, and brine management for potable reuse alternatives. The O&M cost estimates for the potable reuse alternatives are developed based on previous District estimates, other similar IPR projects, replacement equipment cost quotations from vendors, industry publications, and pumping horsepower estimates. A contingency is not applied to O&M costs.

Table 7-4, Table 7-5, and Table 7-6 present the conceptual cost estimate breakdown as well as an annualized cost comparison of the short-listed Phase 1 Capital Project options. The detailed cost estimates are presented in Appendix 7C. The evaluation of the short-listed near-term potable projects will be discussed in Section 8.

Table 7-4: Phase 1 Capital Projects Conceptual Cost Estimates – Option A Mid-Basin Injection IPR[1]

Parameter	Quantity/Capacity	Cost ($M)
Yield (AFY)		**2,600**
Capital Cost		$76.9
Addition of UV/peroxide to SVAWPC	5.4 mgd	$9.2
Product Water Pump Station	300 hp	$3.4
42-inch product water pipeline towards Central Pipeline	3.2 miles	$20.2
18-inch product water pipeline to wellfield	4.4 miles	$12.5
Easements to wellfield	7.6 miles	$0.1
8 Injection wells	400 gpm	$24.7
Land purchase for injection wells	8.4 acres	$6.8
Annualized Capital Costs [2]		$3.9
Annual O&M Costs		$2.3
Total Annualized Cost		$6.2
Unit Cost		$2,400

Notes:
1 – Considered an AACE International Class 5 estimate, which has an accuracy range of -20 to -50 percent on the low end and +30 to +100 on the high end.
2 – Capital costs are annualized over 30 years assuming financing rate of 5.5%, inflation rate of 2.5% for a net interest rate of 3%.

Table 7-5: Phase 1 Capital Projects Conceptual Cost Estimates – Option B Ford Ponds IPR[1]

Parameter	Quantity/Capacity	Cost ($M)
Yield (AFY)		**4,200**
Capital Cost		$64.4
Satellite Advanced Water Purification Facility	4 mgd	$36.4
Product Water Pump Station	75 hp	$1.4
14-inch SBWR source water pipeline and easements	0.7 miles	$1.8
14-inch product water pipeline and easements	1.8 miles	$4.1
8-inch concentrate disposal pipeline and easements	0.5 miles	$1.0
Civil allowance to construct new recharge ponds	15 acres	$8.8
Land purchase for new recharge ponds	15 acres	$7.0
Sanitary sewer/treatment plant connection[3]	1 mgd	$4
Annualized Capital Costs[4]		$3.3
Annual O&M Costs		$4.1[2]
Total Annualized Cost		$7.2
Unit Cost		$1,750[5]

Notes:
1 – Considered an AACE International Class 5 estimate, which has an accuracy range of -20 to -50 percent on the low end and +30 to +100 on the high end.
2 –O&M costs do not include SBWR recycled water rate, which need to be determined. O&M costs do include a placeholder for the San José industrial sewer discharge fee, which was estimated using the Monitored Industrial Sewer Service and Use Charge unit rates from the City's website and estimated brine quality. The fees need to be coordinated and confirmed with the City during project implementation.
3 – Sanitary sewer/treatment plant connection fee allowance based on MEC connection fees. The specific fee applicable to this project would have to be determined in consultation with the City during project implementation.
4 – Capital costs are annualized over 30 years assuming financing rate of 5.5%, inflation rate of 2.5% for a net interest rate of 3%.
5 – Unit cost will increase once the O&M cost elements identified in Note 2 are included in the estimate.

Table 7-6: Comparison of Short-Listed Phase 1 Capital Projects Conceptual Cost Estimates[1]

Parameter	Phase 1 Option A Mid-Basin Injection	Phase 1 Option B Ford Pond IPR
Yield (AFY)	**2,600**	**4,200**
Capital Cost ($M)	$76.9	$64.4
Treatment ($M)	$9.2	$40.4
Conveyance ($M)	$36.2	$8.2
Recharge ($M)	$31.5	$15.8
Annualized Capital Costs ($M)[3]	$3.9	$3.3
Annual O&M Costs ($M)	$2.3	$4.1[2]
Total Annualized Cost ($M)	$6.2	$7.4
Unit Cost ($/AF)	$2,400	$1,750[4]

Notes:
1 – Considered an AACE International Class 5 estimate, which has an accuracy range of -20 to -50 percent on the low end and +30 to +100 on the high end.
2 – Option B O&M costs do not include SBWR recycled water rate, which needs to be determined. Option B O&M costs do include a placeholder for the San José industrial sewer discharge fee, which was estimated using the Monitored Industrial Sewer Service and Use Charge unit rates from the City's website and estimated brine quality. The fees need to be coordinated and confirmed with the City during project implementation.
3 – Capital costs are annualized over 30 years assuming financing rate of 5.5%, inflation rate of 2.5% for a net interest rate of 3%.
4 – Option B unit cost will increase once the O&M cost elements identified in Note 2 are included in the estimate.

7.2 Long-Term Potable Reuse Alternatives

Based on the potable reuse pathways described in Section 6, three potable reuse alternatives were identified to incorporate the pathways described and evaluate a range of IPR and DPR applications to meet the SBWR Strategic Plan potable reuse targets in 2025 (Phase 2) and 2035 (Phase 3). Potable reuse alternatives assume that the near-term (Phase 1) capital project is IPR at the Ford Ponds.

As described in the introduction of Section 6, the potable reuse alternatives are developed assuming the maximum potable reuse targets of 25,000 AFY by 2025 and 35,000 AFY by 2035, which are based on the Strategic Plan recycled water targets and a baseline NPR demand of 15,000 AFY. The potable reuse targets will decrease with increased NPR demands.

7.2.1 Descriptions of Alternatives

The three alternatives that are considered for potable reuse include the following:

- Alternative 1: Los Gatos Recharge Ponds (Phase 2) and Westside Injection Wells IPR (Phase 3)
- Alternative 2: Los Gatos Recharge Ponds IPR (Phase 2) and Central Pipeline DPR (Phase 3)
- Alternative 3: Central Pipeline DPR (Phases 2 & 3)

These three alternatives are further defined in this section.

Alternative 1 Los Gatos Recharge Ponds and Westside Injection Wells IPR

Alternative 1 includes IPR at the Los Gatos recharge ponds and the Westside injection wells. Table 7-7 describes the phased approach for Alternative 1. See Figure 7-6 for an overview of Alternative 1 project components in each phase.

Table 7-7: Alternative 1 Description

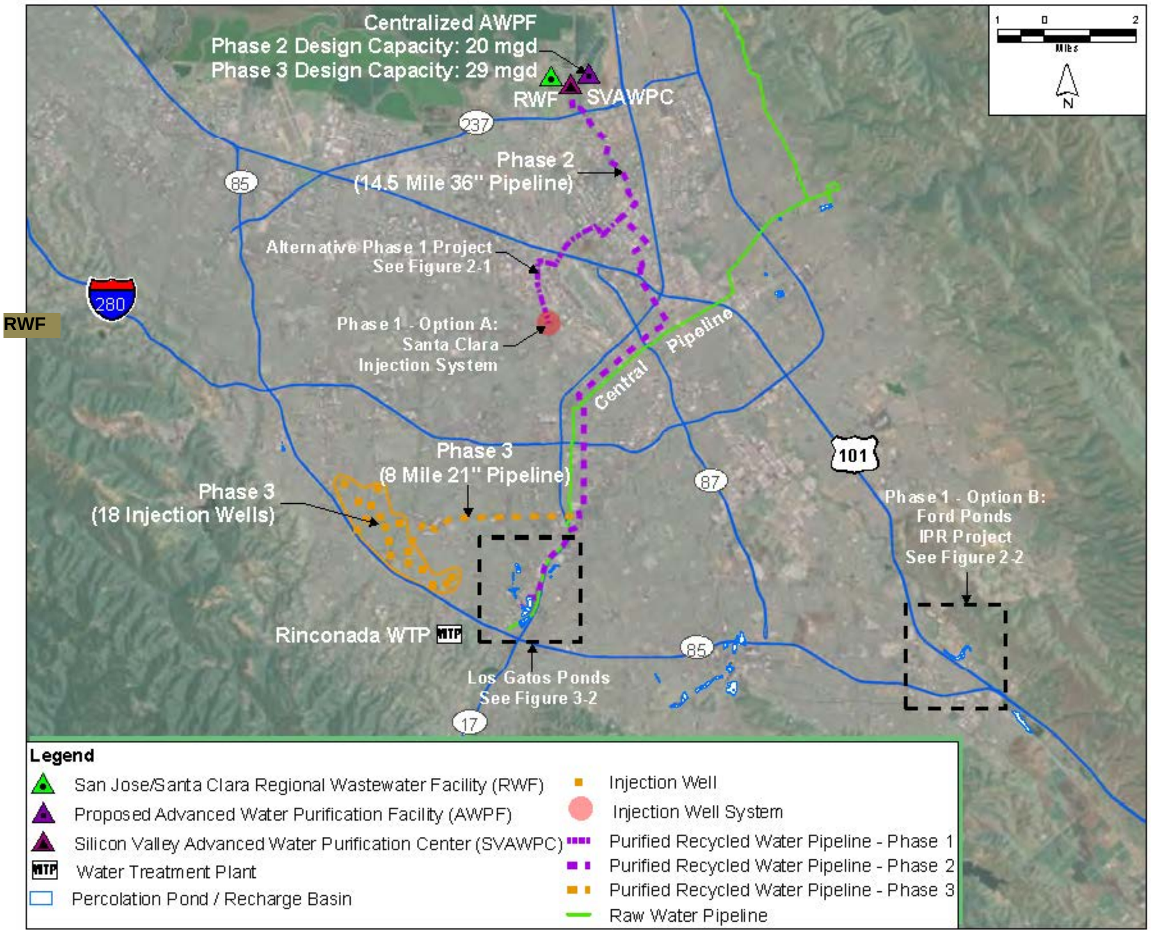
Phase	Year	Yield (AFY)		Project Description
		Incremental	Cumulative	
1	2018	4,200	4,200	Ford Pond IPR
2	2025	20,200	24,400	Los Gatos IPR
3	2035	10,600	35,000	Expand Los Gatos IPR to Westside Injection Wells

Phase 1 would consist of a Ford Pond IPR project to be able to recharge up to 4,200 AFY in the near term. See Section 7.1.8 for a description of this near-term alternative.

For Phase 2, a centralized AWPF would be constructed next to the SVAWPC. Purified recycled water would be conveyed to the Los Gatos groundwater recharge system via a 14.5-mile 36-inch pipeline (see Figure 7-6). The centralized AWPF would have a capacity of 20-mgd and would consist of FAT, which is assumed to allow the percolation of purified recycled water without raw water dilution blend after a short start-up period of a year or two. (FAT would also allow the project to be expanded to direct injection in Phase 3; FAT is the only treatment train that would be accepted by regulators for direct injection). A new 2,000-hp PWPS would be required to convey the purified recycled water to the Los Gatos Ponds. As described in Section 6 the Los Gatos recharge ponds have an overall recharge capacity of 20,200 AFY. Figure 7-7 shows how the purified recycled water could be distributed to the four off-stream ponds at Los Gatos. A new lateral from the main pipeline would serve the McGlincey Ponds via Camden Avenue. The remaining three ponds – Budd, Sunnyoaks, and Page – would be served via a connection to Page Ditch. Note that the IPR via the Los Gatos ponds would mean that the cumulative yield from Phase 1 and Phase 2 projects would be 24,400 AFY, which is 600 AFY less than the SBWR Strategic and Master Planning 2025 target of 25,000 AFY.

In Phase 3, the centralized AWPF would be expanded to 29 mgd in order to supply the additional 10,600 AFY of purified recycled water needed to meet the SBWR Strategic Plan 2035 target of 35,000 AFY. The PWPS would be expanded to 3,750-hp to deliver the additional flows to Los Gatos; an additional 750-hp booster pump station located at Los Gatos would transfer 9.5 mgd of flow to the injection well field via approximately 8 miles of 21-inch pipeline (see Figure 7-6). Purified recycled water would be injected into the basin via 18 injection wells.

Figure 7-6: Alternative 1 Overview



The District's initial IPR studies included a reoperations assessment for the Los Gatos recharge project. The Los Gatos recharge system currently receives local water from Los Gatos Creek and imported water from the Central Pipeline. Water released by the Vasona and Lexington Reservoirs are used for groundwater recharge at the recharge ponds. Under existing operations, there is little to no available capacity for IPR recharge, therefore a change in operations and new infrastructure is required to integrate IPR with existing water supplies. To accomplish this, a pipeline connection from Los Gatos Creek/Vasona Reservoir to the raw water conveyance system would be required. With this modification, water that normally is conveyed from Lexington Reservoir to the percolations ponds could be transferred to a water treatment plant (WTP) or used in other parts of the Westside recharge system.

For the Westside injection wells, the District's initial IPR studies did not include a reoperations evaluation and noted that the injection rate could be throttled back under high groundwater conditions. This project should be evaluated in more detail as part of further reoperations evaluations to determine how local and imported water supplies can be utilized to maximize the use of recycled water. Having multiple projects to utilize recycled water for potable reuse will also help maximize recycled water use.

Figure 7-7: Los Gatos Ponds Connections for Alternative 1

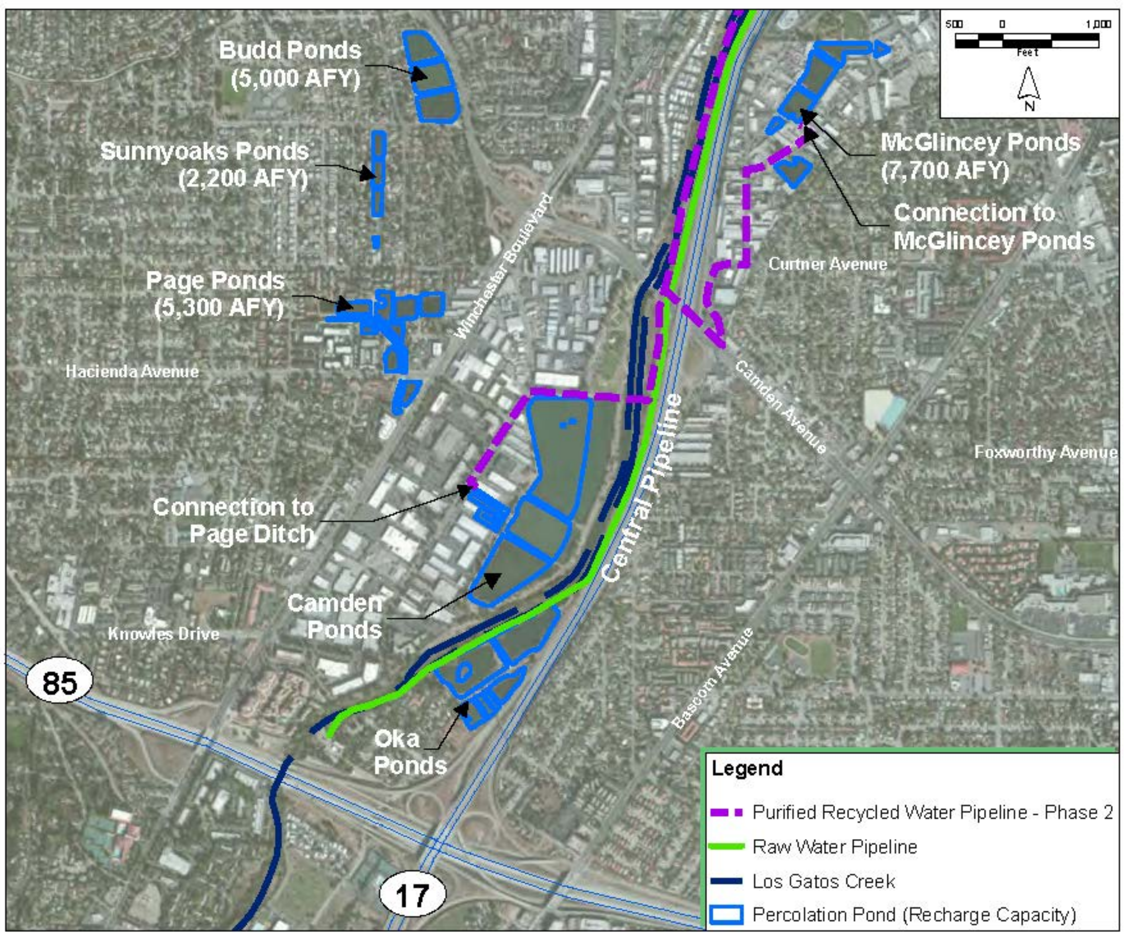


Table 7-8 summarizes the project elements required for Alternative 1.

Table 7-8: Alternative 1 Project Elements in Phase 2 and 3

	Project Elements
Phase 2	**Capital Elements** • 20-mgd centralized AWPF with FAT located adjacent to the SVAWPC • 2,000-hp PWPS • 14.5 miles of 36" pipeline from the AWPF to the Los Gatos recharge ponds • Los Gatos off-stream pond connections and infrastructure improvements • RO concentrate management **O&M Elements** • Power consumption for centralized AWPF operations and PWPS • Chemical consumption at centralized AWPF • Equipment replacement and maintenance • Pipeline maintenance • Recharge pond maintenance • RO concentrate management • Staffing (labor) at centralized AWPF
Phase 3	**Capital Elements** • AWPF expansion to 29 mgd • PWPS expansion to 3,750-hp • 750-hp booster pump station to transfer flows to Los Gatos injection well field • 8 miles of 21" pipeline to Westside Injection well field • 18 injection wells • RO concentrate management **O&M Elements** • Power consumption for centralized AWPF, PWPS, and booster pump station • Chemical consumption at centralized AWPF • Equipment replacement and maintenance • Pipeline maintenance • Recharge pond and injection well maintenance • RO concentrate management • Staffing (labor) at centralized AWPF

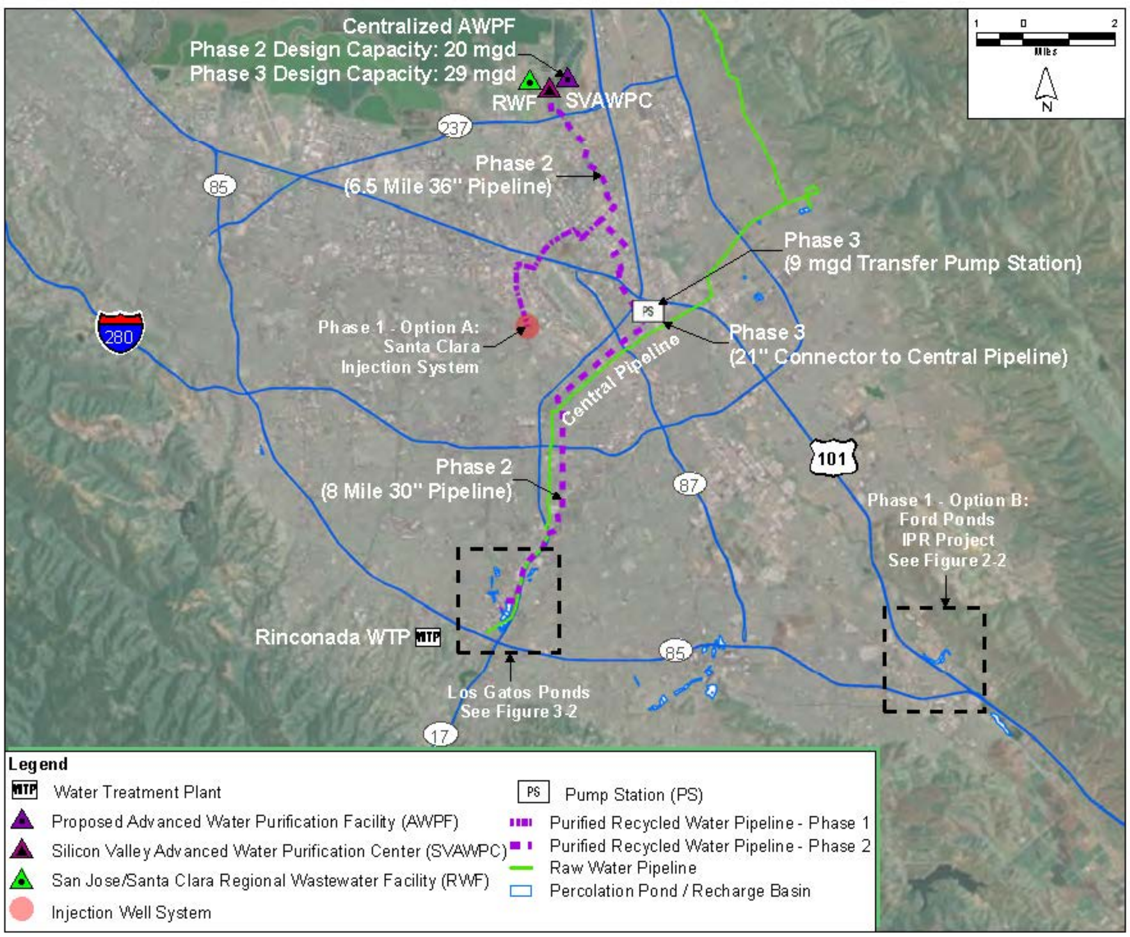
Alternative 2 Los Gatos Recharge Ponds and Central Pipeline DPR

Alternative 2 includes IPR at the Los Gatos recharge ponds and DPR in the Central Pipeline. Table 7-9 describes the phased approach for Alternative 2. See Figure 7-8 for an overview of Alternative 2 project components in each phase.

Table 7-9: Alternative 2 Description

Phase	Year	Yield (AFY)		Project Description
		Incremental	Cumulative	
1	2018	4,200	4,200	Ford Pond IPR
2	2025	20,200	24,400	Add Los Gatos IPR
3	2035	10,600	35,000	Add Central Pipeline DPR

Figure 7-8: Alternative 2 Overview



Similar to Alternative 1, Alternative 2 will consist of a Phase 1 Ford Pond IPR project to be able to recharge up to 4,200 AFY in the near term, and a Phase 2 project to recharge 20,200 AFY at the Los Gatos recharge ponds for a cumulative yield from Phase 1 and Phase 2 projects would be 24,400 AFY, which is 600 AFY less than the SBWR Strategic and Master Planning 2025 target of 25,000 AFY.

In Phase 3, the centralized AWPF would be expanded to 29 mgd in order to supply the additional 10,600 AFY of purified recycled water needed to meet the SBWR Strategic and Master Planning 2035 target of 35,000 AFY. The PWPS would be expanded to 3,000-hp to deliver the additional flows to the Central Pipeline; an additional 1,000-hp booster pump station would transfer 9.5 mgd of flow to the high-pressure raw water conveyance pipeline (see Figure 7-8). A chlorine storage and feed system would be added at the centralized AWPF to provide free chlorine disinfection (an additional pathogen barrier included to meet anticipated DPR regulations) in the purified recycled water prior to connection to the Central Pipeline.

The District’s initial IPR studies included an assessment of using purified recycled water in the raw water system. That initial assessment determined that a long-term average of 15,000 AFY could be introduced to the Central Pipeline without impacting the raw water system performance or its ability to take available South Bay Aqueduct imported supplies. This analysis was based on a 32-mgd AWPF and determined that the AWPF could be used at full capacity for about 20 percent of years analyzed with no available system capacity in nearly 25 percent of the years analyzed. The ability to utilize 10,600 AFY of purified recycled water for DPR would need to be evaluated further if this alternative is selected.

Table 7-10 summarizes the project elements required for Alternative 1.

Table 7-10: Alternative 2 Project Elements in Phase 2 and 3

	Project Elements
Phase 2	**<u>Capital Elements</u>** • 20-mgd centralized AWPF with FAT located adjacent to the SVAWPC • 2,000-hp PWPS • 14.5 miles of 36" pipeline from the AWPF to the Los Gatos recharge ponds • Los Gatos off-stream pond connections and infrastructure improvements • RO concentrate management **<u>O&M Elements</u>** • Power consumption for centralized AWPF operations and PWPS • Chemical consumption at centralized AWPF • Equipment replacement and maintenance • Pipeline maintenance • Recharge pond maintenance • RO concentrate management • Staffing (labor) at centralized AWPF
Phase 3	**<u>Capital Elements</u>** • AWPF expansion to 29 mgd • PWPS expansion to 3,000-hp • Chlorine storage and feed system for free chlorine disinfection of the purified recycled water added to the Central Pipeline • 1,000-hp booster pump station to transfer flows into the Central Pipeline • Short 21" pipeline to connect to Central Pipeline • RO concentrate management **<u>O&M Elements</u>** • Power consumption for centralized AWPF, PWPS, and booster pump station • Chemical consumption at centralized AWPF and remove chlorine feed station • Equipment replacement and maintenance • Pipeline maintenance • Recharge pond maintenance • RO concentrate management • Staffing (labor) at centralized AWPF

Alternative 3 Central Pipeline DPR

Alternative 3 includes DPR in the Central Pipeline. Table 7-11 describes the phased approach for Alternative 3. See Figure 7-9 for an overview of Alternative 3 project components in each phase.

Table 7-11: Alternative 3 Description

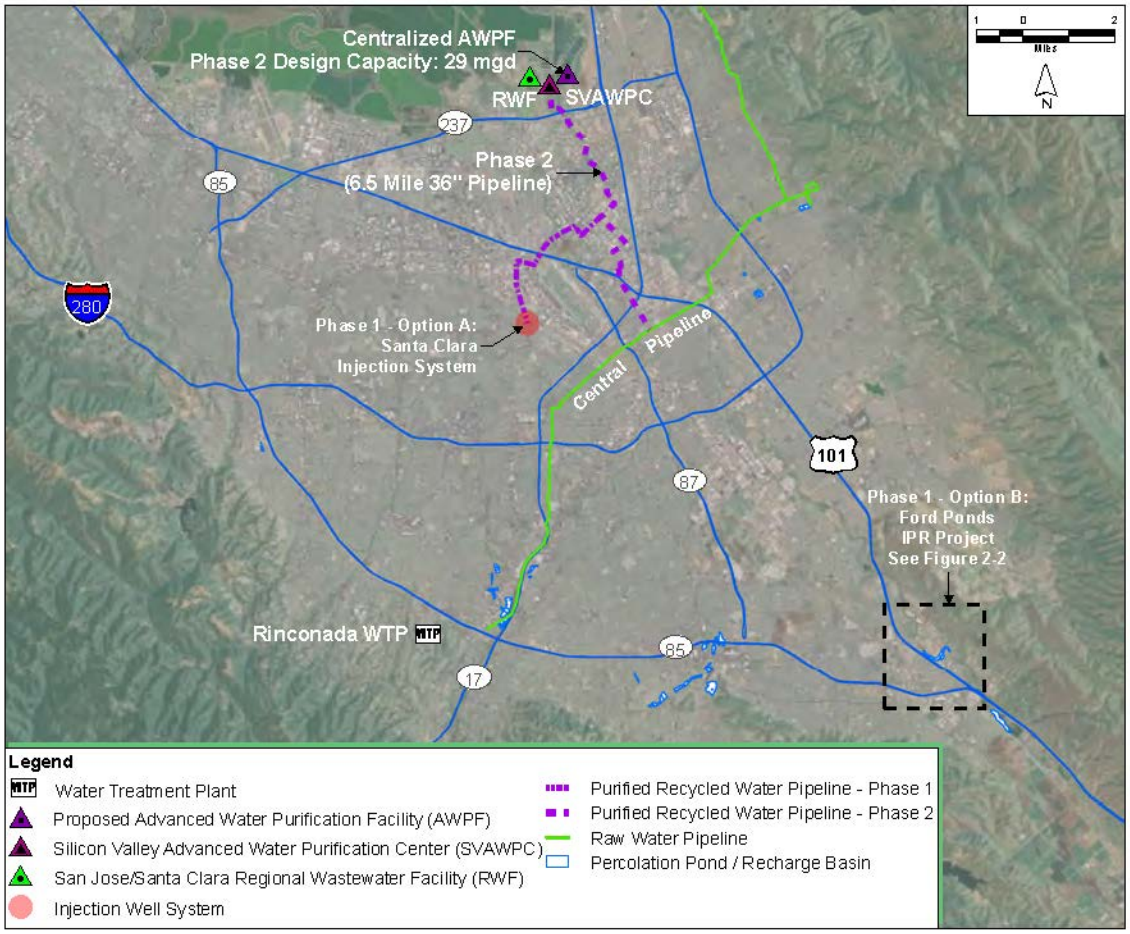
Phase	Year	Yield (AFY)		Project Description
		Incremental	Cumulative	
1	Near-term	4,200	4,200	Ford Pond IPR
2	2025	20,800	25,000	Add Central Pipeline DPR
3	2035	10,000	35,000	Increase Central Pipeline DPR

Similar to other alternatives, Alternative 3 will consist of a Phase 1 Ford Pond IPR project to be able to recharge up to 4,200 AFY in the near term.

In Phase 2, a centralized AWPF would be constructed next to the SVAWPC. Purified recycled water would be introduced to the county-wide raw water conveyance system via a 6.5-mile 36-inch pipeline to connect to SCVWD's Central Pipeline. The centralized AWPF would consist of FAT, which is assumed to be the only treatment train that would be accepted by regulators for a DPR application, plus free chlorine disinfection for additional virus inactivation to provide an additional barrier in the treatment train. The AWPF would be built-out to its ultimate production capacity of 29 mgd so that no expansion is required in Phase 3. A new 4,500-hp product water pump station would be required to convey the purified recycled water to the Central Pipeline

Between 2025 and 2034, the AWPF would need to produce an average of 20,800 AFY of purified recycled water for DPR to achieve the SBWR Strategic and Master Planning 2025 target of 25,000 AFY (68 percent of the AWPF design production capacity of 30,800 AFY). Since the AWPF will be oversized in Phase 2, SCVWD can vary the amount of purified recycled water in the Central Pipeline to provide more purified recycled water when imported water allocations are low and less water when imported water allocations are high.

Figure 7-9: Alternative 3 Overview



In Phase 3, production of purified recycled water would increase to add another 10,000 AFY into the raw water conveyance system in order to meet the SBWR Strategic and Master Planning 2035 target of 35,000 AFY. The centralized AWPF would ramp up to 100 percent to convey 30,800 AFY of purified recycled water to the Central Pipeline. The Central Pipeline typically conveys imported SBA water between both the Penitencia and Rinconada WTPs. The ability of the Central Pipeline to receive up to 35,000 AFY of purified recycled water has not been assessed. For this alternative, it is assumed that flows above the long-term average of 15,000 AFY, studied by SCVWD, could be fully accommodated in the raw water conveyance system. SCVWD's raw water system and annual interplay with SCVWD's groundwater banking program would enable SCVWD to create the capacity to accommodate imported SBA water. Note that in Section 7.3, costs for Alternative 3 are shown for both a long-term average of 15,000 AFY as well as 35,000 AFY to cover the range of potential DPR in the Central Pipeline.

Table 7-12 summarizes the project elements required for Alternative 3.

7-12: Alternative 3 Project Elements in Phase 2 and 3

	Project Elements
Phase 2	**Capital Elements** • 29-mgd centralized AWPF with FAT located adjacent to the SVAWPC • 4,500 -hp PWPS • Chlorine storage and feed system • 6.5 miles of 36" pipeline from the AWPF to the Central Pipeline • RO concentrate management **O&M Elements** • Power consumption for centralized AWPF operations and PWPS • Chemical consumption at centralized AWPF • Equipment replacement and maintenance • Pipeline maintenance • RO concentrate management • Staffing (labor) at centralized AWPF
Phase 3	**Capital Elements** • Since the full capacity AWPF would be constructed in Phase 2, no additional facilities are required in Phase 3 **O&M Elements** • Power consumption for centralized AWPF and PWPS • Chemical consumption at centralized AWPF • Equipment replacement and maintenance • Pipeline maintenance • RO concentrate management • Staffing (labor) at centralized AWPF

7.2.2 Blending Water Quality Impacts for DPR

This section discusses the water quality considerations/impacts for blending the purified recycled water with raw water in the Central Pipeline for the DPR alternatives (Alternative 2 Phase 3 and Alternative 3 Phases 2 and 3). Because of the level of treatment employed by the AWPF, the purified water is expected to improve the already excellent quality of the current raw water supplied to SCVWD's drinking water treatment facilities. The TDS concentration of the purified water is expected to be below 50 mg/L and TOC less than 0.1 mg/L. Blending imported water with purified water will reduce arsenic, bromide, chloride, hardness, and the formation potential of THMs and haloacetic acids (HAAs), along with numerous trace organic constituents below the levels in the current drinking water supply. Table 7-13 presents anticipated water quality for key parameters in the purified water, compared with raw and treated water from the Rinconada Water Treatment Plant (RWTP).

Table 7-13: Selected Water Quality Parameters in AWPF Purified Recycled Water and Imported Water

Parameter	Units	AWPF Purified Recycled Water[1]	RWTP Raw Water[2]	RWTP Treated Water[2]	Maximum Contaminant Level (MCL)
Alkalinity	mg/L	5[3]	85	82	--
Ammonia, Total	mg/L	0.5	<0.05	0.4	--
Arsenic	µg/L	<0.2	2.0	<2	10
Boron	mg/L	0.4	0.2	0.2	--
Bromide	mg/L	0.004	0.35	0.09	--
Chloride	mg/L	3	120	124	500
Chlorine, Total	mg/L	3.0	<0.2	2.1	4.0
HAA5	µg/L	<0.5	NA	17	60
Hardness, Total	mg/L	1.63	132	133	--
pH	--	9.0[3]	8.1	7.8	8.5
TDS	mg/L	50	374	404	500
THM, Total	µg/L	12	NA	40	80
TOC	mg/L	>0.1	3.1	1.8	--
Turbidity	NTU	>0.02	2.5	0.08	--

Notes:
µg/L = micrograms per liter
mg/L = milligrams per liter
pCi/L = PicoCuries per liter
NA = not available
1 – Based on water quality projections from similar AWPFs
2 – Based on January 2014 Water Quality Report for RWTP.
3 – Assumes product water stabilization to achieve LSI > -1.0

While the concentrations of most constituents in the purified water are expected to be lower than in imported water, a few constituents will likely be higher in the purified water. These could potentially cause complications in the blended water if not addressed adequately. These constituents include pH, ammonia, boron, and chlorine. The potential impacts these could have will depend on how and at what location the purified water is introduced. The following discussion focuses on these four constituents and the potential impacts of each.

pH

The pH of RO treated water is typically less than 6.0, however, purified recycled water generally undergoes post-treatment to stabilize the water and prevent corrosion in storage tanks, pumps, and piping. Indirect potable reuse facilities in southern California universally adjust the finished water pH to between 8.5 and 9.0, using various combinations of caustic soda, lime, and carbon dioxide stripping. The target pH and stabilization approach differ by facility, however, they generally target a specific Langelier Saturation Index (LSI) or Aggressiveness Index (AI) as a measure of the product water stability.

pH is a concern for the RWTP due to the use of ozone, the use of aluminum sulfate as a coagulant (which works best at a pH of 6.5), the presence of bromide in imported water, and the increased risk of bromate formation at higher pH. Depression of pH is common at ozone facilities where bromate formation is a concern, and blending high pH purified water could push the blended water pH higher. The impact on blended water pH, however, is expected to be minimal, due to the low buffering capacity of the purified water, projected to have an alkalinity less than 10 mg/L as calcium carbonate. In addition, the low bromide levels in the purified water would be expected to reduce the risk of bromate formation, further reducing negative impacts from the high pH purified water.

Ammonia

Free ammonia is well rejected by the advanced treatment processes; however, the concentrations of total ammonia are expected to be higher than current levels in the raw water supply for RWTP. While ammonia may be present in the tertiary source water at concentrations less than 0.5 mg/L, it will likely be added prior to microfiltration to aid in the formation of chloramines used to control biological fouling on the membranes. Chloramines are poorly rejected by RO membranes, resulting in a total ammonia concentration that typically averaged 0.3 to 0.5 mg/L at comparable potable reuse facilities.

While there are no health concerns with ammonia at these concentrations, ammonia will increase the chlorine demand, resulting in a higher chlorine dose to reach breakpoint chlorination. Since free chlorine disinfection is assumed for the DPR treatment train to provide an additional pathogen barrier (i.e., FAT plus free chlorine disinfection), the ammonia residual would be removed with the chlorine added to the purified recycled water before addition to the Central Pipeline.

Boron

Boron is not currently regulated for drinking water, but has a notification level of 1 mg/L. Boron is commonly considered in seawater desalination, since it is poorly rejected by RO membranes and occurs in high concentrations in seawater, however, the use of boron in laundry detergents and other household products can also cause elevated levels in treated wastewater flows. Boron concentrations above 0.5 mg/L have been found to have negative impacts on many irrigated plants, resulting in recent seawater desalination facilities using this threshold as a water quality target. Boron concentrations in the purified water are projected to be around 0.4 mg/L, based on concentrations at comparable facilities. While this is higher than the 0.1 to 0.2 mg/L present in the existing RWTP feed water, these levels are not expected to have a negative impact on either irrigation or public health.

Chlorine

Chlorine is present in the purified recycled water due to its use for biofouling control on the MF and RO membranes. The residual in the purified recycled water is typically 2 to 3 mg/L at comparable treatment facilities in Southern California. It should be noted that these residuals are entirely in the form of chloramines, without a free chlorine residual. However, for DPR free chlorine is being considered to increase the virus inactivation credits of the overall treatment process. Due to the low organic content in the purified recycled water, neither free chlorine nor chloramine residuals are expected to have significant impact on disinfection byproduct formation.

In the event that purified recycled water is introduced to the RWTP feed without first quenching the chlorine, there is a risk that some disinfection byproducts could be formed before the residual is fully quenched. This risk would be greater with higher purified water contributions, however, sodium bisulfite or thiosulfate could be utilized to quench any residual before blending if disinfection byproduct formation is a concern. Bench scale testing could be done to determine potential risk of disinfection byproduct formation from blending purified recycled water without first quenching the chlorine residual.

Additional Water Quality Parameters

Beyond the four parameters mentioned previously, blending purified water with imported water will positively impact the water quality for a large number of constituents. TDS and TOC would both be reduced, reducing the risk of the formation of disinfection byproducts. Hardness would also be reduced, which would be a benefit for numerous domestic water uses. In order to maximize these benefits, it has been assumed that the purified water would be stabilized for the transmission piping using only pH adjustment with caustic soda, rather than through the addition of calcium (using lime or calcium chloride). Using only pH adjustment to stabilize the water would result in a relatively high pH (approximately 9.0), however, as mentioned previously, the low buffering capacity of this water would result in the blended water seeing a minimal pH increase above current levels.

7.2.3 Concentrate Management

For the purpose of evaluating alternatives, a dedicated concentrate disposal outfall to Coyote Point is assumed for the long-term project costs, which represents the concentrate disposal method supported by the City since it does not increase TDS concentrations in the RWF final effluent. This disposal option includes the costs for a pump station and pipeline to Coyote Point.

As discussed in Section 7.1.8, RO concentrate produced at the Phase 1 Ford Pond IPR project would return to the SJ/SC RWF via the existing sewer system for treatment at the SJ/SC RWF and ultimate disposal at the existing outfall.

7.3 Conceptual Cost Estimates

Conceptual cost estimates were prepared for long-term Potable Reuse Alternatives 1, 2, and 3. Two variations of the present value costs for Alternative 3 are shown which demonstrate the cost impact to the potable reuse program if purified recycled water is not prioritized in the Central Pipeline. Alternative 3A assumes that all of the water can be added to the Central Pipeline whereas Alternative 3B assumes a long-term average of 15,000 AFY can be added to the Central Pipeline.

The cost estimates include capital costs, O&M costs, and present value unit costs. The capital and O&M costs for Alternatives 1, 2, and 3 are presented in Table 7-14; annualized costs for Alternatives 1, 2, 3A, and 3B are summarized in Table 7-15. The costs broken out for Phase 1, 2, and 3 respectively, as well as the overall Phase 1 through 3 combined. The costs are based on a dedicated concentrate disposal outfall to Coyote Point.

As shown in Table 7-15, the resulting costs per acre-foot have a similar order of magnitude for Alternatives 1, 2, and 3A. Alternative 2 and 3A have similar lower cost per acre-foot when compared to Alternative 1. Alternative 3B has the highest unit cost. The cost estimating assumptions are discussed in Section 0. The detailed cost estimates are presented in Appendix 7C.

Table 7-14: Conceptual Cost Estimates[1,2] for Long-Term Potable Reuse Alternatives

Alternative	Alternative 1 IPR	Alternative 2 IPR + DPR	Alternative 3 DPR
Phase 2[3]	**Los Gatos Ponds IPR**	**Los Gatos Ponds IPR**	**Central Pipeline DPR**
Capital Cost ($M)	$303	$295	$353
Treatment ($M)	$188	$188	$274
Conveyance ($M)	$115	$107	$77
Recharge ($M)	-	-	$2.6
Annual O&M Cost ($M)	$11.7	$12.2	$13.9
Phase 3[3]	**Westside Injection IPR**	**Central Pipeline DPR**	**Central Pipeline DPR**
Capital Cost ($M)	$203	$109	$1.0
Treatment ($M)	$78.4	$83.9	-[4]
Conveyance ($M)	$47.5	$22.7	$1.0
Recharge ($M)	$76.9	$2.6	-[4]
Annual O&M Cost ($M)	$8.8	$6.9	$4.7
Phase 1+2+3			
Capital Cost ($M)	$570	$469	$418
Treatment ($M)	$307	$312	$314
Conveyance ($M)	$171	$138	$86
Recharge ($M)	$92.6	$18.4	$18.4
Annual O&M Cost ($M)	$24.6	$23.2	$22.7

Notes:
1 – Considered an AACE International Class 5 estimate, which has an accuracy range of -20 to -50 percent on the low end and +30 to +100 on the high end.
2 – Cost estimates assume that RO concentrate is pumped through a new pipeline to the Coyote Point outfall.
3 – Capital and O&M costs for each respective phase only.
4 – The Alternative 3 Phase 3 AWPF capacity is assumed to be constructed in Phase 2 to allow flexibility in the AWPF operations prior to Phase 3.
5 – For the Los Gatos Ponds IPR project, the purified recycled water would be recharged using the existing ponds. As shown in Figure 7-7, the water would be distributed from the new Los Gatos pipeline to the ponds through existing infrastructure.

Table 7-15: Annualized Unit Costs[1,2] for Long-Term Potable Reuse Alternatives

Alternative	Alternative 1 IPR	Alternative 2 IPR + DPR	Alternative 3A[3] DPR	Alternative 3B[7] DPR
Phase 2				
Additional Yield (AFY)	20,200	20,200	20,800[4,5]	15,000[4,7]
Annualized Capital Costs ($M)[1]	$15.5	$15.1	$18.0	$18.0
Annual O&M Costs ($M)	$11.7	$12.2	$13.9	$13.9
Total Annualized Cost ($M)	$27.2	$27.3	$31.9	$31.9
Unit Cost ($/AF)	$1,350	$1,350	$1,500	$2,100
Phase 3				
Additional Yield (AFY)	10,600	10,600	10,000[4,6]	-[4,7]
Annualized Capital Costs ($M)[1]	$10.3	$5.6	$0.1	-
Annual O&M Costs ($M)	$8.8	$6.9	$4.7	-
Total Annualized Cost ($M)	$19.1	$12.5	$4.8	-
Unit Cost ($/AF)	$1,800	$1,200	$500	-
Phase 1+2+3				
Total Yield (AFY)	35,000	35,000	35,000	19,200
Annualized Capital Costs ($M)[1]	$29.1	$23.9	$21.3	$21.3
Annual O&M Costs ($M)	$24.6	$23.2	$22.7	$18.0
Total Annualized Cost ($M)	$53.7	$47.1	$44.0	$39.3
Unit Cost ($/AF)	$1,550	$1,350	$1,250	$2,050

Notes:
1 – Capital costs are annualized over 30 years assuming financing rate of 5.5%, inflation rate of 2.5% for a net interest rate of 3%.
2 – Cost estimates assume that RO concentrate is pumped through a new pipeline to the Coyote Point outfall.
3 – Alternative 3A assumes that the long-term contribution of purified recycled water to the Central Pipeline will ultimately be 100 percent of the AWPF capacity.
4– The Alternative 3 Phase 3 AWPF capacity is assumed to be constructed in Phase 2 to allow flexibility in the AWPF operations prior to Phase 3.
5 – Assumes that the long-term contribution of purified recycled water to the Central Pipeline is 68 percent of the AWPF capacity.
6 – Assumes that the long-term contribution of purified recycled water to the Central Pipeline is 100 percent of the AWPF capacity. Since it is assumed that the Phase 3 AWPF capacity is constructed in Phase 2 (see Note 4), the Phase 3 costs are the O&M costs to produce the additional 10,000 AFY of purified recycled water.
7 – Alternative 3B assumes that the long-term contribution of purified recycled water to Central Pipeline is capped at an average of 15,000 AFY for Phases 2 and 3 (49 percent of the AWPF capacity), which is the long-term average determined over an 82-year hydrology simulation for a 32-mgd AWPF (SCVWD, Central Pipeline Direct Reuse System Alternative Draft TM). Since it is assumed that the Phase 3 AWPF capacity is constructed in Phase 2 (see Note 4) and that the average annual production remains at 15,000 AFY, there is no additional yield or cost in Phase 3.

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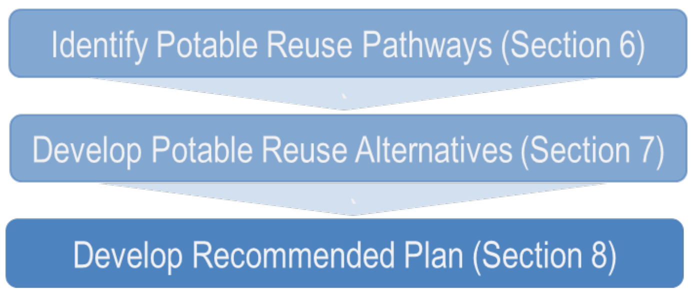
8. Potable Reuse Recommended Plan

Section 6 identified three potable reuse pathways while Section 7 developed both near-term and long-term potable reuse alternatives based on the pathways to meet SBWR Strategic Plan recycled water planning targets. Section 8 presents the evaluation of the near-term and long-term potable reuse alternatives and the recommended plan for the near-term and long-term potable reuse projects. The potable reuse implementation plan is presented in Section 10.



8.1 Evaluation and Ranking of Potable Reuse Alternatives

As part of an internal workshop held on February 25, 2014, SCVWD completed an evaluation of the near-term and long-term capital projects identified in Section 7 using 16 criteria. Each project was scored by the workshop participants on a scale of 5 (most desirable) to 1 (least desirable) for each of the 16 criteria and then an average score was calculated. Table 8-1 presents the evaluation criteria that were used in the evaluation.

Table 8-1: Phase 1 Capital Projects Evaluation Criteria

Evaluation Criteria		
1. Cost	6. Site issues	11. Groundwater basin capacity
2. Yield	7. Operational flexibility	12. Regulatory
3. Complexity to implement treatment	8. Year-round production	13. Expandability
4. Environmental	9. Ease of brine management	14. Ability to expedite
5. Ease of partnership/lack of opposition	10. Potential impacts to groundwater quality	15. Grant eligibility
		16. Overall evaluation

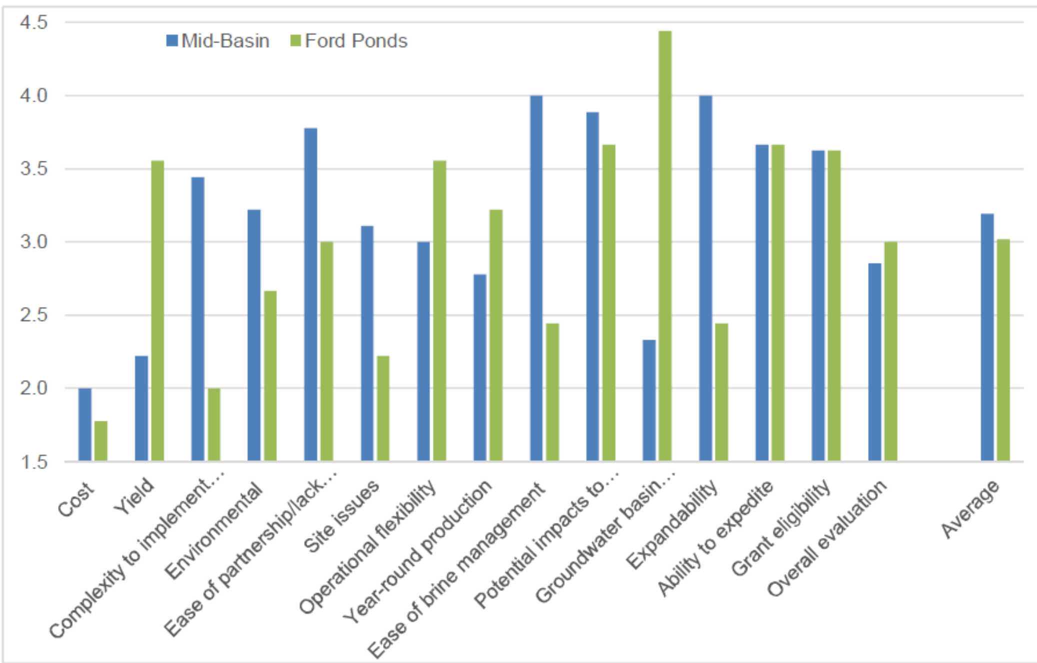
8.1.1 Near-Term Potable Reuse Evaluation

SCVWD and the consultant team evaluated the near-term (Phase 1) capital projects described in Section 7.1, which are:

- Near-term (Phase 1) Option A – Mid-Basin Injection IPR
- Near-term (Phase 1) Option B – Ford Ponds IPR

The results of SCVWD's evaluation for the Phase 1 Capital Projects are presented in Figure 8-1. After comparing the projects on the 16 evaluation criteria in Table 8-1, it was concluded that the projects were rated equal. Table 8-2 presents the advantages and disadvantages of the two short-listed Phase 1 Capital Project options.

Figure 8-1: Evaluation Results for the Near-Term (Phase 1) Capital Projects



Notes:
Mid-Basin = Phase 1 Option A
Ford Ponds = Phase 1 Option B

Table 8-2: Comparison of Short-Listed Phase 1 Capital Projects Advantages and Disadvantages

Parameter	Phase 1 Option A Mid-Basin Injection IPR	Phase 1 Option B Ford Pond IPR
Advantages	• Maximizes use of existing SVAWPC facilities because a new AWPF is not required in Phase 1. • Only one centralized AWPF is required for IPR (constructed in Phase 2 and expanded in Phase 3). A single facility could lower O&M costs by only having to operate one AWPF for IPR. • No property acquisition is required for the AWPF.	• Produces the most IPR water in Phase 1. • The SCVWD already has rights to 5 mgd of SBWR water as a source for the Ford AWPF . • AWPF at the Ford site reduces size of Centralized AWPF and associated conveyance size • Centralized AWPF and pipelines to Los Gatos ponds are smaller.
Disadvantages	• The injection wells need to be phased in to confirm that the approach works. • Injection wells only used seasonally when excess SVAWPC water is available in winter in Phase 1. • Property acquisition is required for injection wells. • The pipeline to the Santa Clara injection wells must be constructed to the ultimate diameter in Phase 1 even though the flows are small.	• AWPFs at two different sites are required (centralized and satellite at Ford), which could increase O&M costs over a single plant. • Additional operators could be required or the Ford plant would need to operate unattended. • The Ford site is remote from other SCVWD treatment facilities. • New spreading ponds at Ford are required. • New property acquisition required for the AWPF and ponds at the Ford site • For Ford satellite AWPF, the existing sewer system will be used to dispose of the concentrate, which will require an industrial discharge permit with the City of San José.

As discussed above, SCVWD's evaluation concluded that the two Phase 1 Capital Projects were rated equal. SCVWD selected the Ford Pond IPR as the assumed Phase 1 capital project (i.e., the near-term potable reuse project) and opted to include a modified concept for the Mid-Basin injection IPR part of the long-term potable reuse plan. The Ford Ponds IPR project will utilize the existing SBWR water allocation from the nearby Silver Creek Pipeline and maximize Phase 1 IPR recharge capacity while minimizing the size of centralized AWPF and associated conveyance. Additionally, the Ford Pond IPR project is independent of the long-term approach, which relies on centralized treatment and conveyance, whereas the Mid-Basin Injection IPR project would require a portion of the pipeline to the Los Gatos ponds be constructed to convey the water from the SVAWPC to the injection wells. The installation of this pipeline could potentially delay the Mid-Basin IPR project while the details of long-term approach is refined.

A modified concept for the Mid-Basin Injection IPR project could be implemented as part of the long-term alternative instead (see Section 8.2.2). The near-term project concept for the Mid-Basin Injection IPR project was based on utilizing SVAWPC product flow during winter months when the SBWR recycled water demands are lower. Since the water would only be available seasonally, a higher number of injection wells would be needed to recharge the water when it is available. The revised concept identifies the Mid-Basin Injection IPR project as a component of the long-term plan to meet the 2025 recycled water targets. The concept is modified assuming purified recycled water from the centralized AWPF could be supplied to the injection wells year-round, decreasing the number of injection wells needed as compared to the near-term concept.

Table 8-3 presents a summary of project elements for the Ford Pond IPR project. These Phase 1 elements will be included in the development of potable reuse alternatives to achieve the SBWR Strategic Plan 2025 and 2035 targets.

Table 8-3: Ford Pond IPR Project Elements

Project Elements	Description
Satellite AWPF with FAT	
Influent flow from SBWR	5.0 mgd
MF-RO recovery rate	80%
AWPF production capacity	4.0 mgd
AWPF online factor	94%
Annual recharge capacity	4,200 AFY
Pump station	
Product water pump station	75 hp
Pipelines	
Influent pipeline	0.7 miles of 14" pipeline
Product water pipeline	1.8 miles of 14" pipeline
Sewer discharge for MF backwash and RO concentrate	0.5 miles of 8" pipeline
Recharge Facilities	
Ford Percolation Ponds	
Existing pond capacity	1,100 AFY
Additional new pond capacity required	3,100 AFY

8.1.2 Long-Term Potable Reuse Evaluation

The long-term potable reuse alternatives described in Section 7.2 were evaluated by SCVWD and by the consultant team, including advantages and disadvantages. The three long-term alternatives are as follows:

- Alternative 1: Los Gatos Recharge Ponds (Phase 2) and Westside Injection Wells IPR (Phases 3)
- Alternative 2: Los Gatos Recharge Ponds IPR (Phase 2) and Central Pipeline DPR (Phase 3)
- Alternative 3: Central Pipeline DPR (Phases 2 & 3)

SCVWD's evaluation focused on three long-term projects:

- Los Gatos recharge ponds indirect potable reuse (included in Alternatives 1 and 2)
- Sunnyvale injection well indirect potable reuse
- Central Pipeline direct potable reuse (included in Alternatives 2 and 3)

Figure 8-2 presents the results of SCVWD evaluation for the three long-term projects based on the 16 evaluation criteria presented earlier. Table 8-4 presents the advantages and disadvantages of the three long-term project alternatives identified in Section 7.

Figure 8-2: Evaluation Results for Long-Term Capital Projects

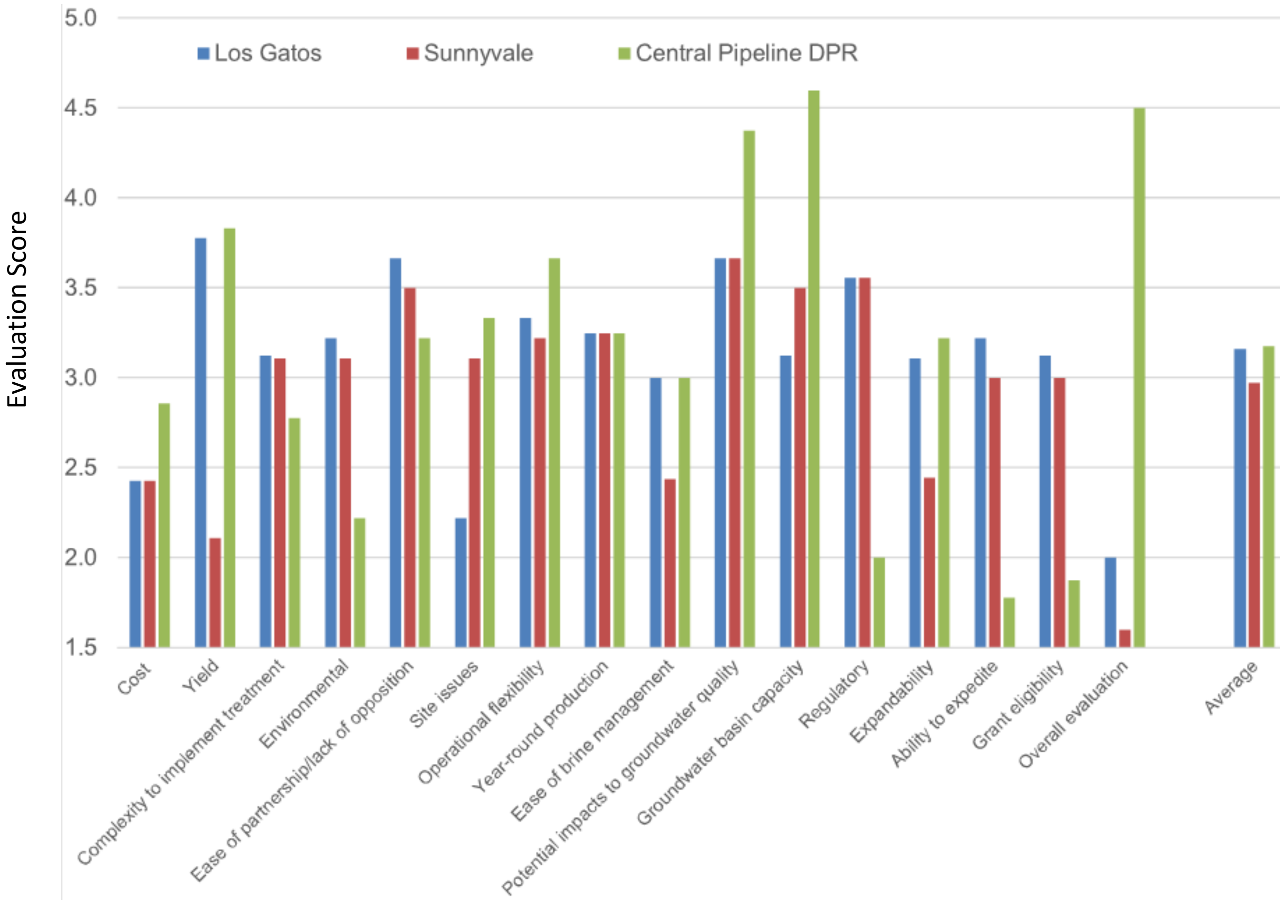


Table 8-4: Comparison of Long-Term Capital Projects Advantages and Disadvantages

Parameter	Alternative 1 IPR	Alternative 2 IPR and DPR	Alternative 3 DPR
Advantages	• IPR regulations well established • High utilization of existing recharge infrastructure (Los Gatos recharge ponds) • No property acquisition is required for the AWPF • The low TDS of the purified recycled water will benefit the groundwater basin • New purified recycled water pipeline to Los Gatos recharge ponds will provide additional flexibility/reliability in raw water system	• In Phase 3, water can be utilized in either the Central Pipeline and the Los Gatos recharge system, which provides more flexibility to utilize the water • DPR is implemented in Phase 3 which has an increased chance of the DPR regulations being approved by that timeframe • High utilization of existing recharge infrastructure (Los Gatos recharge ponds) • The low TDS of the purified recycled water will benefit the groundwater basin • New purified recycled water pipeline to Los Gatos recharge ponds will provide additional flexibility/reliability in raw water system	• No AWPF expansion required for Phase 3 (the full capacity is constructed in Phase 2) • Lower conveyance capital cost as compared to Alternatives 1 and 2 • PWPS to the Central Pipeline would be located at the centralized AWPF so property acquisition is not required

Parameter	Alternative 1 IPR	Alternative 2 IPR and DPR	Alternative 3 DPR
Disadvantages	• Highest conveyance cost to convey water to Los Gatos recharge ponds and Westside injection wells • Property acquisition is required for injection wells near Los Gatos recharge ponds	• High conveyance cost to convey water to Los Gatos recharge ponds • Streamflow augmentation via release from Central Pipeline could trigger NPDES permit consideration • Property acquisition is required for the PWPS to the Central Pipeline • In years with high State Project Water allocations, there may limited capacity in the Central Pipeline for purified recycled water for DPR	• DPR regulations do not currently exist. With this alternative DPR is implemented in Phase 2, which could be impacted by status of regulations. • Streamflow augmentation via release from Central Pipeline could trigger NPDES permit consideration • In years with high State Project Water allocations, there may limited capacity in the Central Pipeline for purified recycled water for DPR

SCVWD's evaluation concluded that indirect potable reuse at the Los Gatos recharge ponds and direct potable reuse in the Central Pipeline are the preferred approaches. Since DPR regulations do not currently exist, the feasibility of implementing Alternative 3 by 2025 is not certain; therefore, Alternative 1 and 2 are the preferred long-term potable reuse alternatives. By utilizing the existing Los Gatos recharge ponds for Phase 2 IPR, SCVWD would have the flexibility of implementing either direct injection (Alternative 1) or DPR at the Central Pipeline (Alternative 2) during Phase 3 in order to meet the SBWR Strategic and Master Planning 2025 and 2035 targets.

Additionally, as discussed under the near-term evaluation (Section 8.1.1), the long-term plan will also incorporate the Mid-Basin Injection IPR project based on the high ranking of the project in the near-term project evaluation. The project concept was re-worked to be served year-round by the centralized AWPF, as opposed supplied seasonally with excess water from the SVAWPC that may be available in winter and shoulder months, which decreases the number of injection wells. The concept would tie into the pipeline to Los Gatos: a pipeline would branch off of the pipeline to Los Gatos to serve the injection wells.

Implementing a mid-basin project would reduce the size of the Phase 4 projects included in the three long-term alternatives, which would make more capacity available in the Westside injection wells that could potentially be served by the Sunnyvale injection well IPR project.

The recommended long-term potable reuse plan is discussed further in Section 8.2.2.

8.2 Recommended Plan for Potable Reuse

This section presents the recommended plan for the near-term and long-term potable reuse projects. The recommended plan for potable reuse is summarized in Table 8-6. The plan includes the near-term project to establish 4,200 AFY of potable reuse within the next five years, as well as long-term projects to achieve the recycled water targets (see Table 1-1). The recommended plan includes both a satellite AWPF and a centralized AWPF to supply multiple projects within the SJ/SC RWF service area. The near-term project is discussed further in Section 8.2.1 and the long-term projects are discussed further in Section 8.2.2.

Table 8-5: Recommended Plan for Potable Reuse

Near-Term/ Long-Term	Phase	Description	Capacity by Phase (AFY)	Cumulative Capacity (AFY)
Near-Term	Phase 1	Ford Recharge Ponds IPR	4,200	4,200
Long-Term	Phase 2	Mid-Basin Injection Wells IPR	5,600	9,800
	Phase 3	Los Gatos Recharge Ponds IPR	20,200	30,000
	Phase 4	Westside Injection Wells IPR or Central Pipeline DPR[1]	5,000	35,000

Note: [1]The Phase 4 project will be decided at a later date depending on the establishment of DPR regulations in California.

8.2.1 Recommended Near-Term Potable Reuse Projects

Based on the evaluation of near-term options (see Section 8.1.1), the City and SCVWD have identified the Ford Pond IPR project as the preferred near-term potable reuse project. The Ford Pond IPR project includes additional treatment of 5 mgd of SBWR tertiary recycled water through a satellite AWPF located near the Ford Pond. At this time it is envisioned that the satellite AWPF would employ full advanced treatment (MF, RO, and AOP) to minimize diluent water requirements, which would produce an annual average 4,200 AFY. RO concentrate would be discharged through an industrial discharge permit to the SJ/SC RWF sewer system.

SCVWD is starting groundwater modeling for the Ford Pond project that would define the availability of native groundwater flowing through the zone of influence of recharged recycled water to consider for diluent water.

The AWPF would be located in the vicinity of the Ford Pond. SCVWD's preliminary evaluations identified a vacant parcel on Great Oaks Boulevard for the AWPF. The AWPF could potentially be located closer to the Ford Ponds. A more detailed siting study will be completed to identify the AWPF site location.

The Ford Pond is a single recharge pond that is estimated to have a capacity of about 1 mgd. The project would be phased to start with production of about 840 AFY (treating about 1 mgd of SBWR tertiary recycled water) to utilize the single existing pond. Improvements will be needed to the existing Ford Pond to eliminate the existing hydraulic connection between the pond and the adjacent stream, the Coyote Creek. Because the existing Ford Pond is connected to the creek, it is anticipated that resource agency permits will be required to remove the connection between the pond and Coyote Creek. There is also the potential that water recharged at the Ford recharge pond may daylight in Coyote Creek, which would also require additional study and permitting. Because of the additional permitting requirements associated with the Ford recharge pond, additional recharge sites will be evaluated further before the project is advanced. The project would then be expended to the goal of 4,200 AFY and either additional recharge ponds or injection wells will be constructed to recharge the additional water.

Three pipelines will be needed for the Ford Pond project, which include a tertiary recycled water pipeline to convey the water from the SBWR system to the satellite AWPF, a pipeline to convey the purified recycled water from the satellite AWPF to the recharge ponds, and a pipeline to convey brine from the satellite AWPF to the SJ/SC RWF sewer. The length of the pipelines will depend on the site selection for the AWPF.

The elements of the Ford Pond IPR project are shown in Figure 8-3. The conceptual cost estimate for the For Pond IPR project is presented in Table 8-6. The Ford Pond IPR project is described in more detail in Section 7. The implementation plan for this near-term project is presented in Section 11.

Figure 8-3: Ford Pond IPR Project Elements

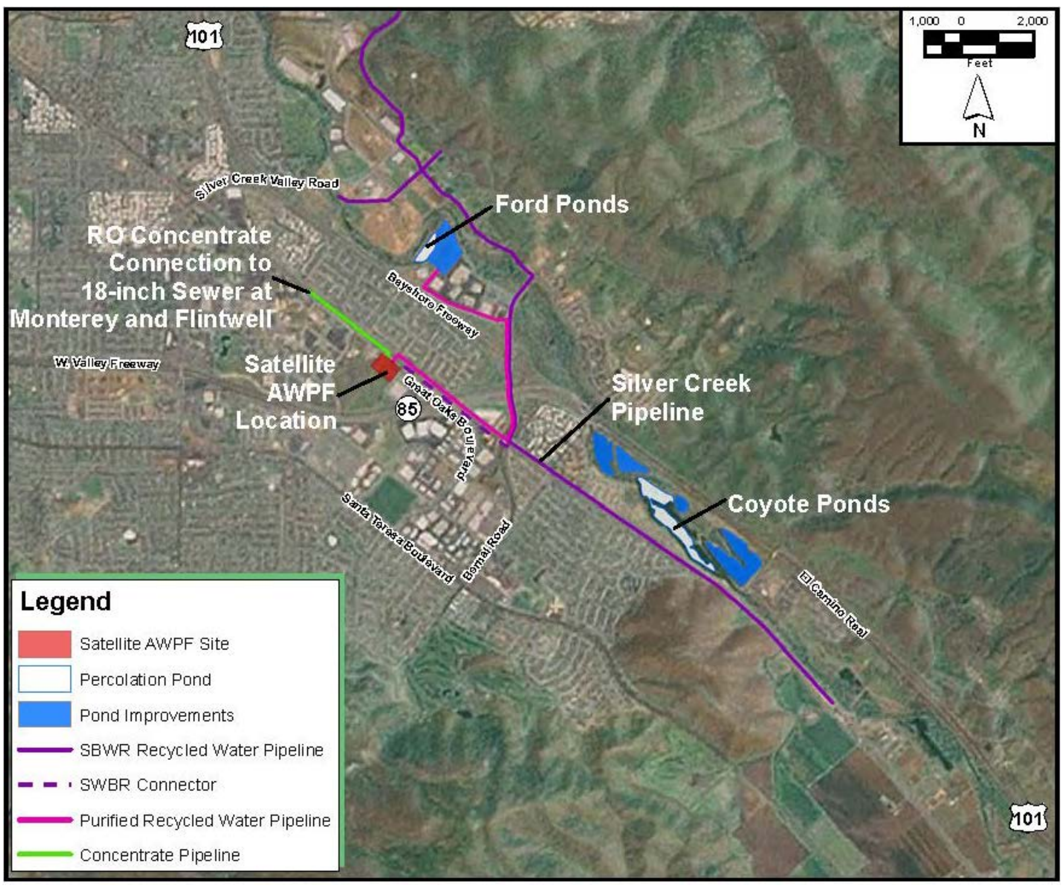


Table 8-6: Ford Pond IPR Project Conceptual Cost Estimate[1]

Parameter	Ford Pond IPR
Yield (AFY)	4,200
Capital Cost ($M)	$64.4
Treatment ($M)	$40.4
Conveyance ($M)	$8.2
Recharge ($M)	$15.8
Annualized Capital Costs ($M)[2]	$3.3
Annual O&M Costs ($M)[3]	$4.1
Total Annualized Cost ($M)	$7.4
Unit Cost ($/AF)	$1,750[4]

Notes:

1 – Considered an AACE International Class 5 estimate, which has an accuracy range of -20 to -50 percent on the low end and +30 to +100 on the high end.

2 – Capital costs are annualized over 30 years assuming financing rate of 5.5%, inflation rate of 2.5% for a net interest rate of 3%.

3 – Does not include SBWR recycled water rate, which needs to be determined. O&M costs do include a placeholder for the San José industrial sewer discharge fee, which was estimated using the Monitored Industrial Sewer Service and Use Charge unit rates from the City's website and estimated brine quality. The fees need to be coordinated and confirmed with the City during project implementation.

4 – Unit cost will increase once the O&M cost elements identified in Note 3 are included in the estimate.

Opportunities to implement non-potable and potable reuse in Coyote Valley were explored at a conceptual level as part of the Coyote Valley Concepts Study Technical Memorandum (TM). The driver for this study was two-fold: first, to identify non-potable opportunities to provide an alternative water source to the Cinnabar Hills Golf Club, which is currently using surface water supplied from the District from the San Felipe project, and second, to identify potential potable reuse opportunities in Coyote Valley involving the District surface water infrastructure. Conceptual project opportunities identified include serving the Cinnabar Hills Golf Club, and potentially the Coyote Creek Golf Club and other agricultural users, with a blend of purified recycled water from the Ford Pond satellite AWPF and SBWR recycled water. Future potable reuse concepts explored include direct potable reuse in the Cross Valley Pipeline and reservoir augmentation at the Calero Reservoir, which could potentially be served by an expanded Ford Pond satellite AWPF. These project concepts are possibilities that could potentially be melded into the long-term implementation plan. There are many facets of the projects that need to be developed further if these concepts are pursued, most especially the institutional coordination between the City and the District. The TM is included in Appendix 8A.

8.2.2 Recommended Long-Term Potable Reuse Projects

A series of long-term potable reuse projects have been identified to achieve the overall potable reuse goal of 35,000 AFY when combined with the near-term project. Purified recycled water would be supplied by a centralized AWPF and a pipeline that would be built in stages to deliver the water to the recharge areas. The long-term projects are shown in Figure 8-4 and summarized in Table 8-7. The implementation plan for the long-term projects is discussed in Section 11.

Figure 8-4: Long-Term Potable Reuse Project Elements

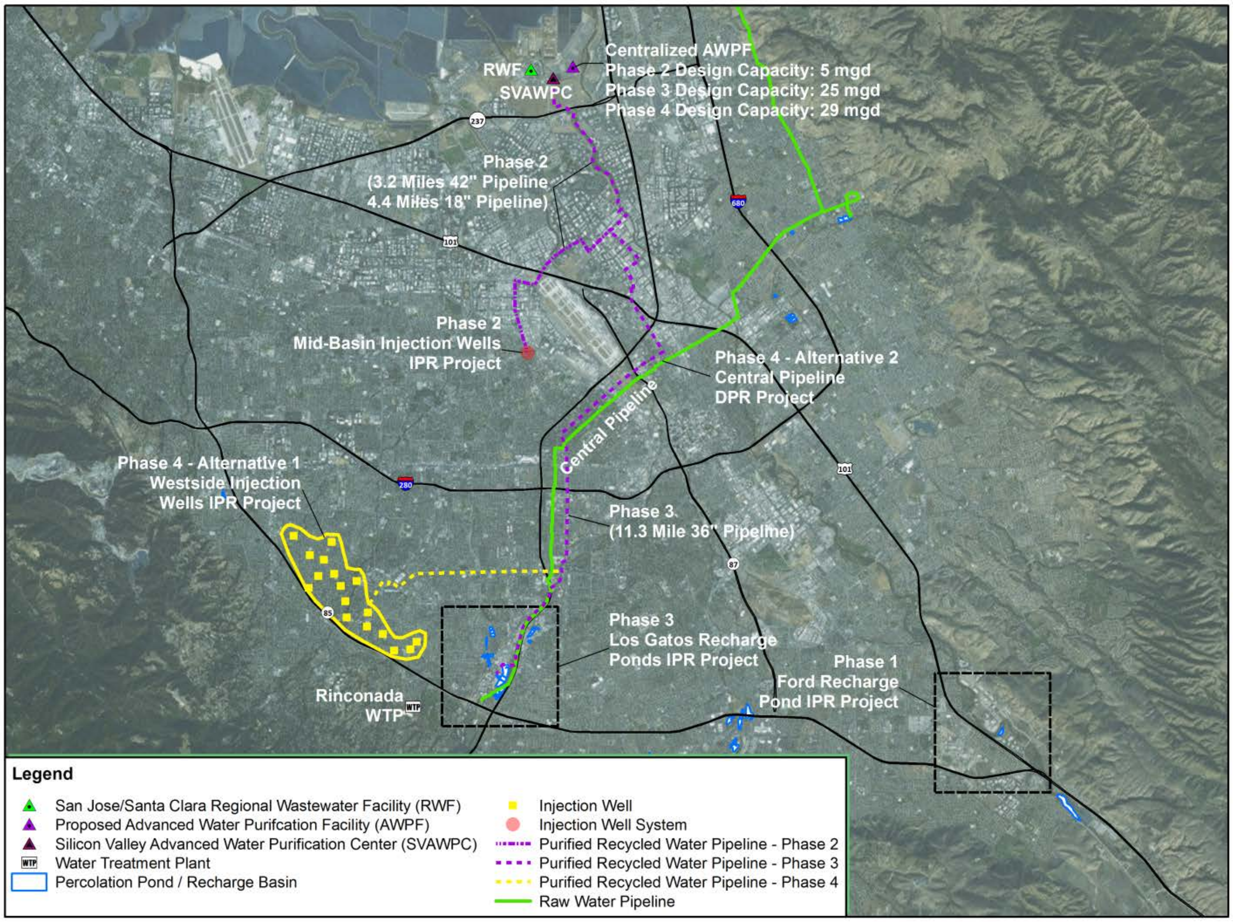


Table 8-7: Long-Term Potable Reuse Implementation Plan

Phase	Description	Capacity by Phase (AFY)	Cumulative Capacity (AFY)[2]	Centralized AWPF Production Capacity by Phase (mgd)	Centralized AWPF Cumulative Production Capacity (mgd)
Phase 2	Mid-Basin Injection Wells IPR	5,600	5,600	5.3	5.3
Phase 3	Los Gatos Recharge Ponds IPR	20,200	25,800	19.2	24.5
Phase 4[1]	Westside Injection Wells IPR (Alternative 1) or Central Pipeline DPR (Alternative 2)	5,000	30,800	5.7	29.2

Note:

1 – The Phase 4 project will be decided in the future depending on the establishment of DPR regulations in California.

2 – When combined with the Phase 1 (near-term) capacity, the total cumulative capacity for the potable reuse recommended plan is 35,000 AFY.

The long-term program has flexibility with implementation. The Los Gatos Recharge Ponds IPR project is the anchor project for the long-term plan with the additional with the smaller projects identified to supplement the Los Gatos project and meet the recycled water goals. The phasing shown in Table 8-7 was established based on geography and regulatory considerations, including the following:

- The Central Pipeline DPR project was identified to be in the final phase (Phase 4) because regulations do not currently exist for DPR. As the regulations are formulated and issued by DDW, this option may become more attractive and could be implemented sooner.
- The Mid-Basin Injection IPR project is the closest IPR project to the centralized AWPF and would require the least amount of pipeline from the centralized AWPF. Therefore, this project was identified as the Phase 2 project with the assumption that it could be brought into service before the Los Gatos project if the District opted to build the pipeline in segments. This project could be delayed to 2035 as the Los Gatos project, combined with the near-term Ford Pond project, would meet the 2025 recycled water target.
- The Los Gatos project is identified as the Phase 3 project as it is further away from the centralized AWPF than the Mid-Basin injection project and the Westside injection project would be served from the pipeline at the Los Gatos Ponds (i.e., the Los Gatos pipeline needs to be installed to the Los Gatos recharge ponds to supply the Westside injection wells).
- The Westside injection wells project, if selected, is identified as Phase 4 because the Los Gatos pipeline needs to be installed to the Los Gatos recharge ponds to supply the Westside injection wells.

As the long-term program is advanced, the order of these projects may be adjusted based on the detailed reoperations evaluation for the recommended plan, the development of regulations, the availability of local and imported water supplies, and other factors,

This section describes the elements of the recommended plan for long-term potable reuse.

Centralized AWPF and Concentrate Management

The centralized AWPF would be located near the SVAWPC. Since the implementation plan includes both injection wells and DPR, the centralized AWPF would employ full advanced treatment (MF, RO, and AOP).

Concentrate management/disposal will be required to manage the concentrate produced from RO. Concentrate management/disposal options are discussed in Section 6. A series of options have been identified that will require further study, as well as discussions with other municipal and regulatory agencies, to refine feasibility and costs. For this report, a concentrate-only outfall to Coyote Point is assumed for the long-term project costs which represent a mid-range cost for concentrate management. Costs for other concentrate management options were also evaluated, including combining the brine with the SJ/SC RWF outfall and pumping the concentrate north to discharge to the EBDA outfall.

Mid-Basin Injection IPR Project (Phase 2)

The first phase of the long-term plan (Phase 2 of the recommended plan) will be to use injection wells to recharge water in Santa Clara. At this time it is estimated that a mid-basin injection well IPR project would be about 5,600 AFY, which will be confirmed with groundwater modeling. The first phase of the centralized AWPF would be designed to produce 5.3 mgd of purified recycled water. The first phase of the pipeline would be constructed from the centralized AWPF to the mid-basin injection wells located west of the Norman Y. Mineta San José International Airport. The pipeline would be sized to accommodate the future flows for Phases 3 and 4 of the potable reuse recommended plan. The water would be injected through a series of nine new injection wells located appropriately to achieve the travel time requirements for the Title 22 GWR regulations.

Note that if the groundwater modeling does not support implementation of an IPR project using injection wells in Santa Clara, then the long-term plan could increase the size of the Phase 4 project and still meet the overall goals.

As part of an additional study, a concept was developed for a smaller-scale temporary injection well project to demonstrate the feasibility of IPR using injection wells in the mid-basin area and support the development of the long-term potable reuse program. The concept explored includes a short-term IPR project that would include a temporary 1-mgd satellite AWPF to produce purified recycled water that would be recharged to the groundwater basin through an injection well. This project would be developed as a temporary project since it would eventually be replaced by the larger, permanent mid-basin injection IPR project. Based on the concept-level engineering analysis the approach is feasible, but needs to be developed further if it will be pursued. Some of the critical elements that need to be developed include institutional agreements between the City, the District, and Santa Clara; groundwater modeling; and the regulatory approach. The temporary 1-mgd project concept is described in the Mid-Basin Injection Indirect Potable Reuse Study TM, which is included in Appendix 8B.

Los Gatos Recharge Ponds IPR Project (Phase 3)

The second phase of the long-term plan (Phase 3 of the recommended plan) is to recharge recycled water at the Los Gatos recharge ponds. The off-stream recharge ponds would be used for GWR, which have a capacity of 20,200 AFY (see Table 6-16). The centralized AWPF would be expanded for an overall production capacity of 24.5 mgd and the pipeline would be expanded to the area of the Los Gatos Ponds. The decision for the Phase 4 project would impact the capacity of the pipeline: if the Westside injection wells are pursued, then the pipeline from mid-basin injection wells to the Los Gatos recharge ponds would need to be sized to accommodate those flows. If direct potable reuse is selected for Phase 4, then the portion of the pipeline from the connection to the Central Pipeline to the Los Gatos recharge ponds would only need to be sized for the capacity of the Los Gatos recharge pond project.

In addition to the long-term Los Gatos recharge ponds IPR project, a project concept was developed to implement a “quick implementation” project to assist in maintaining water levels in the main groundwater basin until the permanent Los Gatos IPR project can be brought on-line. The concept includes a fast-track IPR project with a temporary pipeline to transport up to 9 mgd of purified recycled water produced at the SVAWPC to recharge the groundwater basin through the Los Gatos ponds. This project would provide an emergency drought proof water supply, and would demonstrate the feasibility of IPR using the Los Gatos ponds for potable reuse in support the development of the long-term potable reuse program. This project would be developed as a temporary project since it would eventually be replaced by the larger, permanent potable reuse project at the Los Gatos ponds. The concept is described in the Fast-Track Pipeline Indirect Potable Reuse Study TM, which is included in Appendix 8C. The TM includes discussion of necessary SVAWPC improvements, permitting and regulatory considerations, and pipeline materials and alignments. If this project was pursued further, then the concept would need to be developed in more detail, including institutional, engineering, and regulatory elements.

Westside Injection Wells IPR Project (Alternative 1) or Central Pipeline DPR Project (Alternative 2) (Phase 4)

The third phase of the long-term plan (Phase 4 of the recommended plan) will be to either expand the IPR program to the Westside injection wells (Alternative 1) or connect to the Central Pipeline for DPR (Alternative 2). The decision between the two projects will be based on advances in DPR projects in California, SCVWD's ability to consistently use the water in the Central Pipeline to maximize the value of the AWPF, and consistency with SCVWD's water supply planning. Additionally, Sunnyvale is considering pursuing an indirect potable reuse project with the Westside injection wells, which may limit the availability of this option for the City and District. If the DPR option is selected, then this would provide SCVWD with more flexibility to determine the optimum split between the indirect and direct potable reuse projects (i.e., more direct potable reuse may be desired during drought years when less imported water is available and more indirect potable reuse during wet years when more imported water is available). The capacity of this final phase is 5,000 AFY, which will require that the centralized AWPF to be expanded to 29.2 mgd.

If the Westside injection wells are pursued, then a pipeline would be extended from the Los Gatos recharge ponds to the Westside injection wells. The Westside injection wells would be implemented in the area shown in Figure 8-4. For the direct potable reuse option, the water would be added to the Central Pipeline (see Figure 8-4). At this time the regulatory requirements for treatment for DPR have not been defined; for this study it is assumed that additional disinfection would be required before adding the water to the pipeline. The disinfection process, a pump station to raise the HGL of the water to add it to the Central Pipeline, and a connection to the Central Pipeline would be needed.

Long-Term Plan Costs

The conceptual cost estimates for the long-term potable reuse projects are presented in Table 8-8. Alternative 1 represents the long-term potable reuse costs assuming Phase 4 is the Westside injection wells indirect potable reuse and Alternative 2 represents the costs assuming Phase 4 is direct potable reuse. The overall unit cost for Alternative 1 is slightly higher than Alternative 2 because the conceptual unit cost for the Westside injection wells indirect potable reuse project is higher than for the Central Pipeline direct potable reuse project. The detailed cost estimates are presented in Appendix 8D.

Table 8-8: Long-Term Potable Reuse Conceptual Cost Estimates[1]

Alternative Concentrate Disposal Option [2]	Alternative 1 IPR Coyote Point Outfall	Alternative 2 IPR + DPR Coyote Point Outfall
Phase 2 (5,600 AFY)	**Mid Basin Injection IPR**	**Mid Basin Injection IPR**
Capital Cost ($M)	$140	$140
Treatment ($M)	$49.6	$49.6
Conveyance ($M)	$55.4	$55.4
Recharge ($M)	$35.4	$35.4
Annualized Capital Costs ($M)[3]	$7.2	$7.2
Annual O&M Cost ($M)	$3.4	$3.4
Total Annualized Cost ($M)	$10.6	$10.6
Unit Cost ($/AF)	$1,900	$1,900
Phase 3 (20,200 AFY)	**Los Gatos Ponds IPR**	**Los Gatos Ponds IPR**
Capital Cost ($M)	$261	$252
Treatment ($M)	$181.5	$181.5
Conveyance ($M)	$79.1	$70.9
Recharge ($M)	-	-
Annualized Capital Costs ($M)[3]	$13.3	$12.9
Annual O&M Cost ($M)	$9.7	$10.2
Total Annualized Cost ($M)	$23.0	$23.1
Unit Cost ($/AF)	$1,150	$1,150
Phase 4 (5,000 AFY)	**Westside Injection IPR**	**Central Pipeline DPR**
Capital Cost ($M)	$121	$63.8
Treatment ($M)	$40.8	$43.4
Conveyance ($M)	$35.8	$17.8
Recharge ($M)	$44.4	$2.6
Annualized Capital Costs ($M)[3]	$6.2	$3.3
Annual O&M Cost ($M)	$4.1	$4.5
Total Annualized Cost ($M)	$10.3	$7.8
Unit Cost ($/AF)	$2,050	$1,550
Phase 2+3+4 (30,800 AFY)		
Capital Cost ($M)	$522	$456
Treatment ($M)	$271.8	$274.5
Conveyance ($M)	$170.2	$144.0
Recharge ($M)	$79.8	$38.0
Annualized Capital Costs ($M)[3]	$26.6	$23.3
Annual O&M Cost ($M)	$17.3	$18.1
Total Annualized Cost ($M)	$43.9	$41.4
Unit Cost ($/AF)	$1,400	$1,350

Notes:
1 – Considered an AACE International Class 5 estimate, which has an accuracy range of -20 to -50 percent on the low end and +30 to +100 on the high end. Cost estimates assume that treatment, conveyance, and recharge facilities will be operated at full capacity year round. Note that unit costs will be higher if assumed recharge capacity is not available at all times.
2 – Capital and O&M costs related to the Coyote Point outfall disposal option for each phase is included in Appendix 8D.
3 – Capital costs are annualized over 30 years assuming financing rate of 5.5%, inflation rate of 2.5% for a net interest rate of 3%.

9. Regional Opportunities

In addition to SBWR and future opportunities involving the RWF, potential synergies and partnership opportunities may exist among the three north county water recycling programs. The Sunnyvale Water Pollution Control Plant (WPCP) and the Palo Alto Regional Water Quality Control Plant (RWQCP) support water recycling initiatives involving local retail water suppliers. This section describes these additional north county water recycling programs and identifies north county partnership opportunities in both non-potable reuse and potable reuse. Potential District roles in facilitating and supporting these partnerships are also identified. South county partnerships are not discussed due to greater concerns regarding rate structures and the Regulation Board.

The regional opportunities investigation is organized into the following main sections:

- Regional Recycled Water Setting (Section 9.1) – This section describes the existing potable water supplies and highlights the existing wastewater treatment and recycled water facilities.
- Regional Recycled Water Opportunities (Section 9.2) – Centered on the potential recycled water opportunities in the north county, this section discusses the regional opportunities for implementing non-potable and potable reuse projects.
- Regional Partnership Opportunities (Section 9.3) – This section provides an overview of regional strategies and the partnerships that could lead to new non-potable and potable recycled water projects in the region.

The majority of the information included in this section was gained from meetings with the individual agencies, previous reports, and discussions with the District. Appendices 9A, 9B, and 9C contain summaries of the meetings with the Palo Alto RWQCP staff, Palo Alto Utilities Department staff, and City of Mountain View staff, respectively.

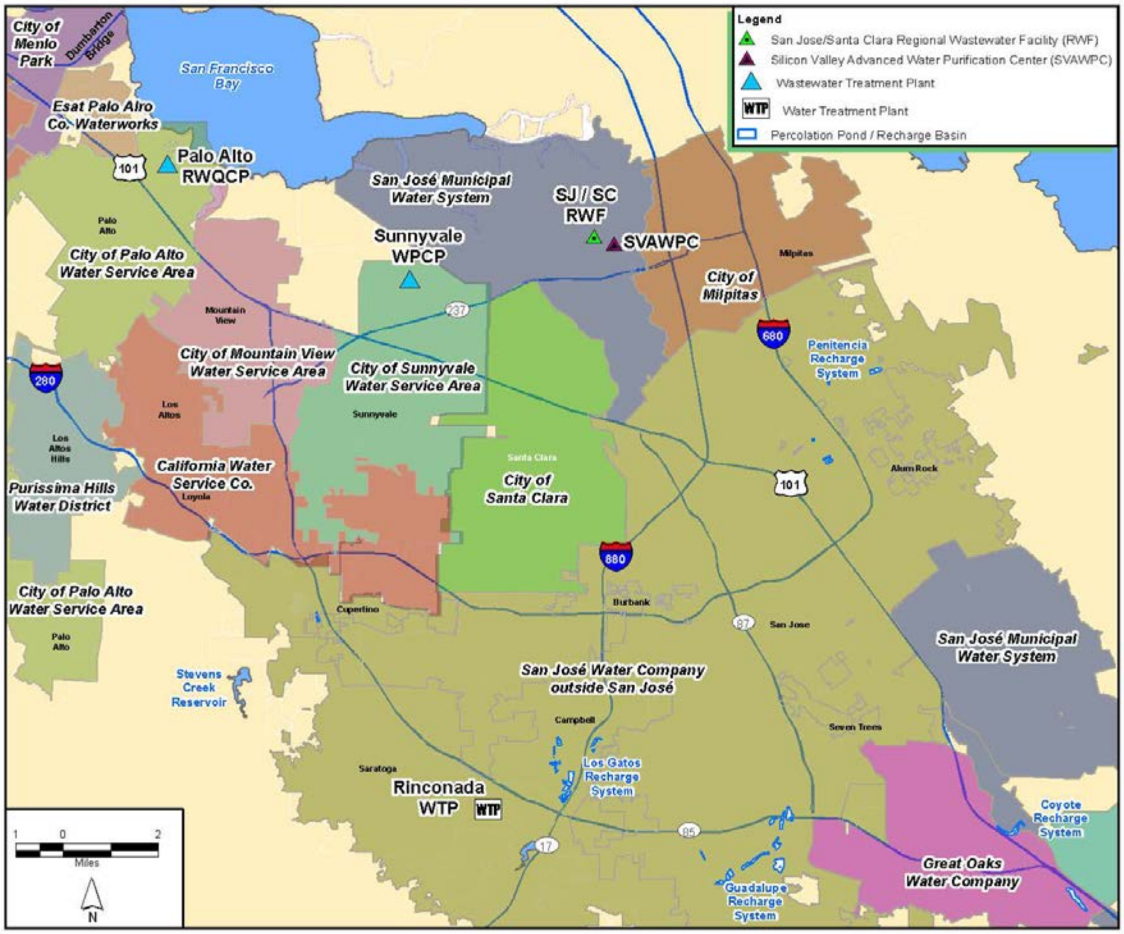
9.1 Regional Recycled Water Setting

This section details the water supply setting for northern Santa Clara County, and wastewater treatment and recycled water production capabilities for the Palo Alto and Sunnyvale areas. The RWF setting was described in Section 2.

9.1.1 Existing Potable Water Supply

This section supplements the Section 2 discussion to address the retail water setting and considerations regarding expanded recycled water use in north County. Figure 9-1 provides an overview of the region's water agencies.

Figure 9-1: North County Water Retailers



City of Palo Alto

Palo Alto's Utilities Department is the water retailer for the City of Palo Alto. Palo Alto receives water from the San Francisco Regional Water System (SF RWS) operated by the San Francisco Public Utilities Commission (SFPUC). The SFPUC wholesale customers signed a 25-year Water Supply Agreement (WSA) with SFPUC in 2009 that sets the total wholesale customer supply (Supply Assurance) at 184 mgd (subject to drought cutbacks). Each wholesale customer has an Individual Supply Guarantee (ISG) in their contract with SFPUC. The wholesale customers have agreed how to allocate draught cutbacks between themselves, through Bay Area Water Supply and Conservation Agency (BAWSCA). Although the WSA expires in 2034, the Supply Assurance and ISGs continue in perpetuity. Palo Alto's ISG is 17.07 mgd (City of Palo Alto 2011a). Groundwater extraction wells serve as a back-up water supply (estimated to be 10 percent or less) during periods of drought when the SFPUC supply may be limited (City of Palo Alto 2011a).

In FY 2010, the City supplied approximately 13,065 AF of water, of which approximately 94 percent (12,263 AF) was obtained from the SFPUC. The remaining 6 percent (802 AF) supplied by the City was recycled water (City of Palo Alto 2011a).

Palo Alto has considered adopting a resolution in support of sustainable groundwater management in the San Francisquito Creek area. The resolution acknowledges that groundwater plays a critical water supply role during droughts and consensus was reached that, as demand for groundwater increases, a coordinated approach to groundwater management would benefit the local cities and agencies. Maintaining the quality and availability of the groundwater was important as Palo Alto has recently refurbished its five existing wells and constructed three new wells as an emergency water supply source (City of Palo Alto 2014).

City of Mountain View

Mountain View receives about 84 percent of its water supply from the SF RWS. Mountain View's SFPUC ISG is 13.46 mgd. Mountain View has a minimum required purchase of 8.93 mgd. In 2010, about nine percent of the City's supply came from District treated water, four percent through Mountain View's seven active groundwater wells, and three percent from recycled water, with the remainder supplied from SFPUC. In 2010, Mountain View's groundwater production was 476 AF (City of Mountain View 2011).

City of Sunnyvale

Sunnyvale's Field Services Division of the Department of Public Works is responsible for purchasing and distributing potable and non-potable water within Sunnyvale. Sunnyvale has three sources of potable water supply: surface water from the SF RWS; treated surface water from the District; and groundwater from seven wells owned and operated by Sunnyvale. Seven percent of Sunnyvale's CY 2010 water demands were served with recycled water from the Sunnyvale WPCP (HydroScience 2011b). Sunnyvale's ISG for SFPUC water is 12.58 mgd, and their contract requires a minimum purchase of 8.93 mgd.

San José/Santa Clara Metro Area

As noted in Section 2, there are six water retailers in the San José/Santa Clara metro area, including San José Muni, the City of Santa Clara, the City of Milpitas, Great Oaks Water Company (Great Oaks), SJWC, and Cal Water.

San José Muni and Santa Clara, under their agreement with the SFPUC, are temporary and interruptible customers until 2018. The maximum amount that San José Muni and Santa Clara can purchase from SFPUC combined is 9 mgd. These retailers can purchase excess SFPUC water if available due to other customers not using their ISGs. Direct SFPUC supplies to San José Muni and Santa Clara are interruptible if total usage by all wholesale customers exceeds the Supply Assurance of 184 mgd in 2018. The SFPUC will make decisions about future water availability by December 2018 after the cost analyses and environmental documentation are complete (HydroScience 2011a).

The City of Santa Clara utilizes groundwater for the majority (60 percent) of its water supply. The City of Santa Clara expects to continue taking their portion of SFPUC supply through 2018, until SFPUC reevaluates water demands on the SF RWS. If Santa Clara has to reduce its usage of SFPUC water, they would turn to increased groundwater use and/or increased supply from the District (City of Santa Clara 2011). The City of Santa Clara also receives recycled water (10 percent of its supply) from SBWR.

The City of Milpitas receives approximately 71 percent of its potable water supply from SFPUC and 24 percent from Santa Clara Valley Water District (SCVWD), and utilizes groundwater as back-up water supply. The City of Milpitas's ISG for SFPUC water is 9.23 mgd. They have a required minimum purchase of 5.341 mgd (City of Milpitas 2011). The City of Milpitas also receives recycled water (5 percent of its supply) from SBWR.

Great Oaks provides public water utility service to the Blossom Valley, Santa Teresa, Edenvale, Coyote Valley, and Almaden Valley areas of San José. They have over 20,000 customers. Great Oaks has 19 groundwater wells, which supply all of their potable water demands, and does not use any recycled water at this time. In CY 2010, the Great Oaks supplied 10,536 AF of water to its customers. Projected future deliveries for 2025 and beyond are expected to remain stable. Great Oaks maintains an intertie with SJWC, but has not used this potential source of potable water (Great Oaks 2010).

SJWC's service area encompasses approximately 139 square miles, including most of San José, most of Cupertino, the entire cities of Campbell, Monte Sereno, and Saratoga, the Town of Los Gatos, and parts of unincorporated Santa Clara County. SJWC has multiple potable water sources: treated water from the District, groundwater, local surface water, and recycled water. SJWC is under contract with SCVWD to purchase about 50 percent of its water supply in the form of treated water. Groundwater comprises just over a third of SJWC's water supply through their more than 100 groundwater wells. Surface water is sourced from the local watersheds in the Santa Cruz Mountains. Recycled water purchased from the SBWR system totaled approximately 1,200 AFY for landscape irrigation in CY 2010. In CY 2009, SJWC supplied 122,834 AF of water to its customers. Projected future deliveries are expected to be relatively stable with slight increase in demand through at least 2035 for normal and single dry years (SJWC 2011).

Cal Water

Cal Water's Los Altos Suburban District serves Los Altos and parts of Los Altos Hills, Cupertino, Mountain View, and Sunnyvale. Cal Water uses a combination of local groundwater and imported water. Cal Water has 29 wells of which 20 are currently active. The active wells have a combined design capacity of 21.2 mgd. Maximum day demands are supplied by the imported water deliveries from SCVWD. Groundwater provides approximately 34 percent of Cal Water's demands. Approximately 11,600 AF of water was supplied in CY 2010 (Cal Water 2011).

Summary of Potable Water Supply Sources

As noted above, there are typically four water sources for the area, including SFPUC, SCVWD treated surface water, groundwater from the basins managed by SCVWD, and recycled water. The approximate percentages of water supply for each of the water retailers are show in Table 9-1. The use of recycled water is covered in more detail in Section 9.1.2.

Table 9-1: Existing Potable Water Supply for Water Retailers in Northern Santa Clara County

Water Retailer	SFPUC (%)	SCVWD Treated Surface Water (%)	SCVWD Groundwater (%)	Recycled Water (%)	Local Water (%)
City of Palo Alto[1]	94	0	BACK-UP	6	0
City of Mountain View[2]	84	9	4	3	0
City of Sunnyvale[3]	42	43	8	7	0
San José Muni[4,5]	21	61	3	15	0
City of Santa Clara[6]	11	19	60	10	0
City of Milpitas[7]	71	24	BACK-UP	5	0
Great Oaks[8]	0	0	100	0	0
SJWC[9]	0	49	38	1	12
Cal Water[10]	0	66	34	0	0

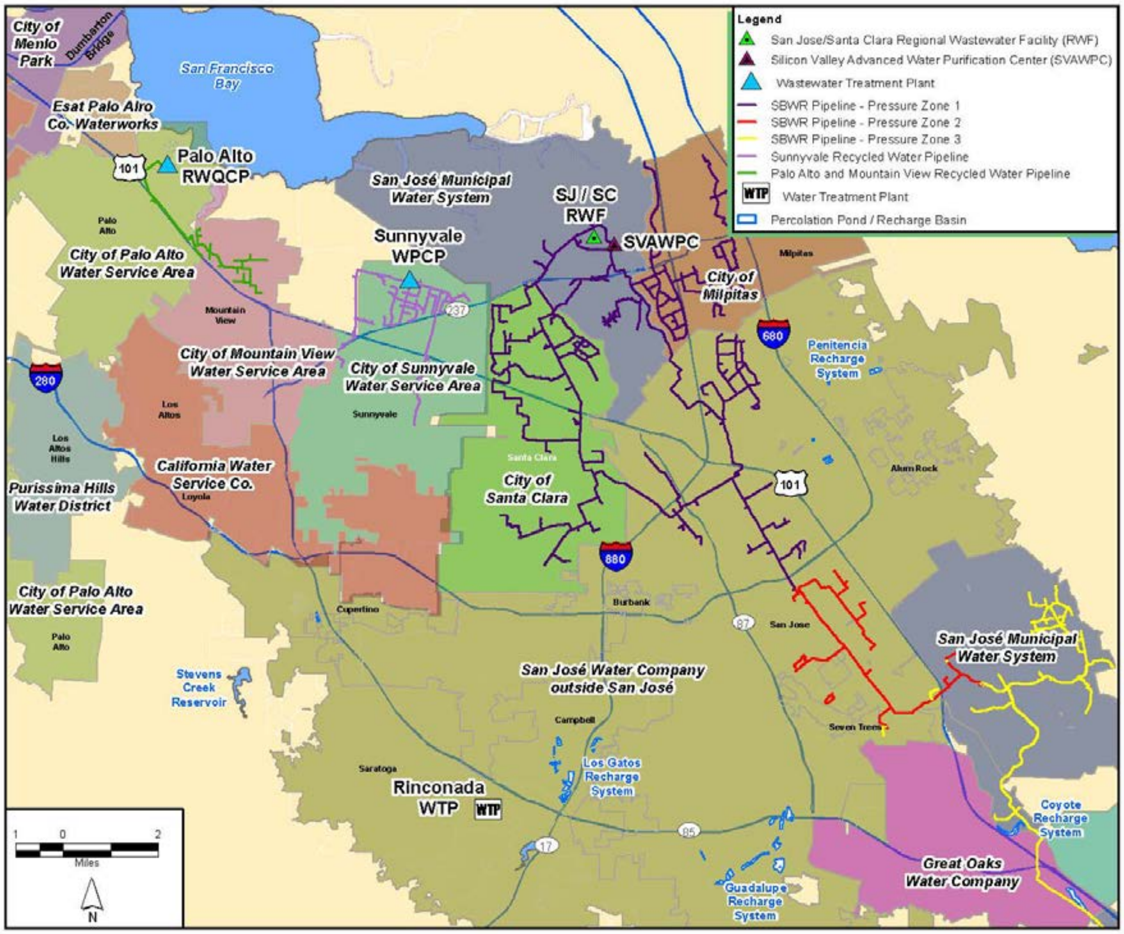
Notes:

1. *City of Palo Alto 2011a*
2. *City of Mountain View 2011*
3. *HydroScience 2011b*
4. *HydroScience 2011a*
5. *San José Muni plans to increase groundwater pumping to minimize operating costs.*
6. *City of Santa Clara 2011*
7. *City of Milpitas 2011*
8. *Great Oaks 2010*
9. *SJWC 2011Cal Water 2011*

9.1.2 Existing Wastewater Treatment and Recycled Water Facilities

The wastewater service in northern Santa Clara County is provided by three facilities: the Palo Alto RWQCP, the Sunnyvale WPCP, and the San José/Santa Clara RWF. The locations of these three wastewater treatment facilities, operated by the City of Palo Alto, the City of Sunnyvale, and the City of San José, respectively, are depicted in Figure 9-2. The existing wastewater treatment facilities and the existing recycled water facilities for the Palo Alto RWQCP and Sunnyvale WPCP are described in this section.

Figure 9-2: South Bay Wastewater Treatment Plants and Recycled Water Pipelines



Palo Alto RWQCP

Wastewater Facilities

The Palo Alto RWQCP is owned and operated by the City of Palo Alto and treats wastewater collected from Palo Alto, Mountain View, Los Altos, Los Altos Hills, East Palo Alto Sanitary District, and Stanford University. The RWQCP Water Reuse Program is operated by the Department of Public Works. The Palo Alto RWQCP has an existing non-potable recycled water program, with additional expansion anticipated. The Palo Alto RWQCP's average dry weather flow capacity is 39 mgd and it has an average treated water discharge of 22 mgd. The peak capacity is approximately 80 mgd.

The RWQCP's recycled water had an historical average total dissolved solids (TDS) level of 950 milligrams per liter (mg/L), with a peak of over 1,000 mg/L. Salinity reduction projects in the collection system reduced the average TDS level to 780 mg/L by August 2013. Additional collection system lining projects are planned in Palo Alto and Mountain View, with a goal of achieving an average TDS of 600 mg/L. The City of Palo Alto has established a policy of not further expanding the recycled water system until salinity of recycled water is reduced to below 600 mg/L TDS.

Existing Recycled Water Facilities

All of the water at the RWQCP may be available for recycling (City of Palo Alto 2011a). Currently the Palo Alto RWQCP reclamation facility can produce 4.5 mgd of tertiary treated water for Title 22 "unrestricted" use. The remaining water, approximately 18 mgd, meets the "restricted use" standard and could be available for non-potable or potable reuse with additional treatment.

The Palo Alto Utilities Department has implemented the first two phases of the recycled water program developed in the 1992 Water Reclamation Master Plan (Brown and Caldwell 1992). In CY 2010, about 560 AFY of recycled water was used at the RWQCP, replacing potable water. The existing off-site non-potable recycled system consists of facilities that serve the Palo Alto Golf Course (109 AFY), Greer Park (87 AFY), Palo Alto Duck Pond (36 AFY), and trucked uses for dust control and/or landscape irrigation. The total use of "unrestricted use" recycled water in CY 2010 was 803 AFY (City of Palo Alto 2011a). The Emily Renzel Marsh (1,344 AFY) received "restricted use" recycled water, while another 1,120 AFY of "restricted use" recycled water was used for industrial purposes, as stack scrubber water at the RWQCP. The total use of "restricted use" recycled water in CY 2010 was 1,120 AFY (City of Palo Alto 2011a). The total recycled water use in CY 2010 was 3,267 AFY (City of Palo Alto 2011a).

In 2012, the RWQCP supplied 849 AF of Title 22 "unrestricted" recycled water, of which 550 AF was served to Mountain View (Appendix 9A). The City of Mountain View provides recycled water produced from the Palo Alto RWQCP to the Shoreline Park and Golf Course and other landscaping users in the North Bayshore Area. Figure 9-3 shows Mountain View's existing recycled water distribution system. Mountain View has an agreement with the Palo Alto RWQCP for recycled water through 2035 and is seeking to extend this agreement to support additional investment in their system.

Average recycled water use in Mountain View is currently about 0.4 mgd (Appendix 9C), or approximately 450 to 500 AFY. The salinity of the Palo Alto RWQCP's recycled water has affected how much recycled water Mountain View has used over the past few years. Mountain View has been working with the Palo Alto RWQCP on a salinity reduction program, including lining several sewer pipelines. Additional lining projects are planned to extend the life of the sewers and further reduce salinity in the wastewater that enters the Palo Alto RWQCP. These projects will be required by the Palo Alto RWQCP as a prerequisite to extending the term of the recycled water agreement. Palo Alto has estimated that these additional source reduction projects in Mountain View could lower the TDS levels in the Palo Alto RWQCP's recycled water by 100 mg/L.

Figure 9-3 presents the current distribution system, shown as "Palo Alto Recycled Water System" and "Mountain View Recycled Water System." Figure 9-3 also shows the proposed Palo Alto System extension. Additional information on the City of Palo Alto recycled water system is provided in Appendix 9A.

Table 9-2 provides a summary of Palo Alto's existing recycled water system.

Figure 9-3: Palo Alto Regional Recycled Water Use

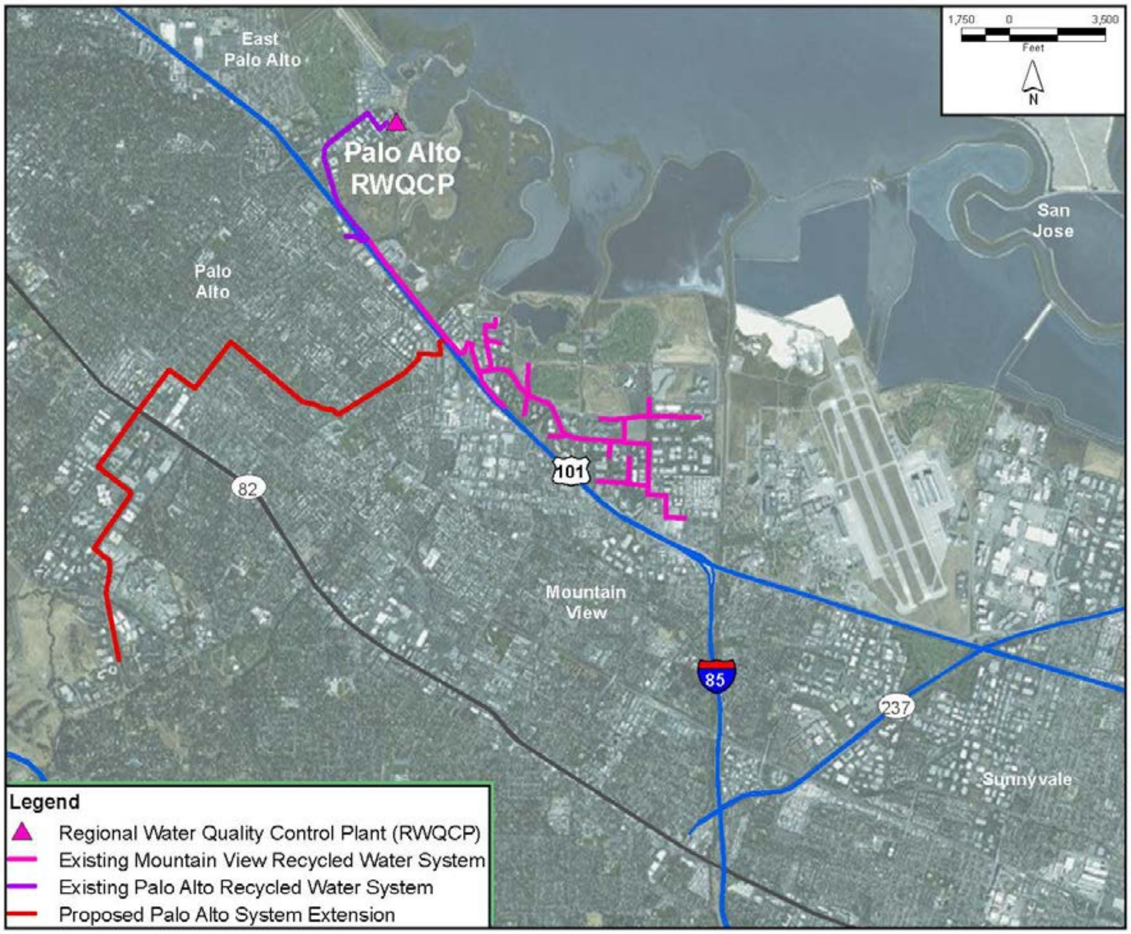


Table 9-2: Palo Alto Regional Recycled Water System

Parameter	Description
Planning Period	Existing
Amount Reused	890 AFY (2012)[1]
Category	Non-potable reuse
Recycled Water Use	Irrigation and Industrial
Recycled Water Treatment/Capacity	Title 22 effluent from the Palo Alto RWQCP (4.5 mgd)
Recycled Water Storage and Pumping	Five pumps and three storage tanks at the Palo Alto RWQCP
Distribution System Infrastructure	Pipeline from Palo Alto RWQCP to Mountain View distribution system

Notes

1. *Includes amount delivered to Mountain View.*

City of Sunnyvale

Wastewater Facilities

The Donald M. Somers WPCP (also referred to as the Sunnyvale WPCP) treats wastewater collected from the City of Sunnyvale. The WPCP's average dry weather flow capacity is 29.5 mgd but current influent flow to the plant averages approximately 15 mgd. The peak wet weather capacity is approximately 40 mgd (HydroScience 2013b).

Existing Recycled Water

The WPCP and the recycled water system are operated by the Environmental Services Department. The Sunnyvale WPCP has an existing non-potable recycled water use program with plans for expansion. Sunnyvale's recycled water program was developed in 1991 and is framed around two goals (HydroScience 2013b):

- Short-term goal of recycling 20 to 30 percent of effluent from the WPCP; and
- Long-term goal of reusing 100 percent of all wastewater effluent (15 mgd) generated from the WPCP to reduce or eliminate discharges to the South San Francisco Bay (Bay).

Sunnyvale plans to meet these goals through expanded non-potable and potable reuse.

The source of recycled water is Title 22 effluent from the Sunnyvale WPCP, which provides tertiary-level treatment, including oxidation ponds, nitrification for ammonia removal, dual media filtration and disinfection. Recycled water has been produced at the WPCP since 1998. Due to operational issues, the WPCP runs in two alternating modes described below.

- Mode 1 – Secondary Effluent Discharge: The entire advanced secondary treated municipal effluent is discharged to the Bay and no recycled water is produced. The secondary capacity of the WPCP is approximately 16 mgd. Due to less stringent regulatory limits for turbidity compared to recycled water use, less polymer and chlorine are required during the treatment process when effluent is discharged to the Bay. As a result, the WPCP realizes lower operating costs. However, the recycled water system is reliant upon stored recycled water and the system frequently is supplied with potable water when recycled water is not available.
- Mode 2 – Recycled Water Batch Production: The entire WPCP flow is treated to meet Title 22 of the California Code of Regulations for disinfected tertiary recycled water, which is a higher level of treatment than under Mode 1. The produced recycled water is stored for subsequent distribution to Sunnyvale customers primarily for irrigation use. Approximately 1,000 AFY of recycled water is produced under this mode.

As part of an on-going master planning project, Sunnyvale has been incorporating flow-based treatment improvements and is evaluating future process and improvement options for the WPCP that will increase its recycled water production. The master planning is expected to be complete in early 2015. Sunnyvale is considering implementation of a membrane bioreactor (MBR) for secondary and tertiary treatment, or activated sludge for secondary treatment. If an MBR is used, then the MF permeate from the MBR could possibly be used as the feedwater to a future RO system for potable reuse. The treatment improvements would be designed to eliminate the current need for batch production of recycled water and allow for continuous production of recycled water, resulting in increased recycled water production capacity.

Sunnyvale currently uses recycled water for non-potable reuse demands and has identified additional non-potable demands. Sunnyvale is also exploring the potential for implementing additional treatment to produce purified recycled water for IPR.

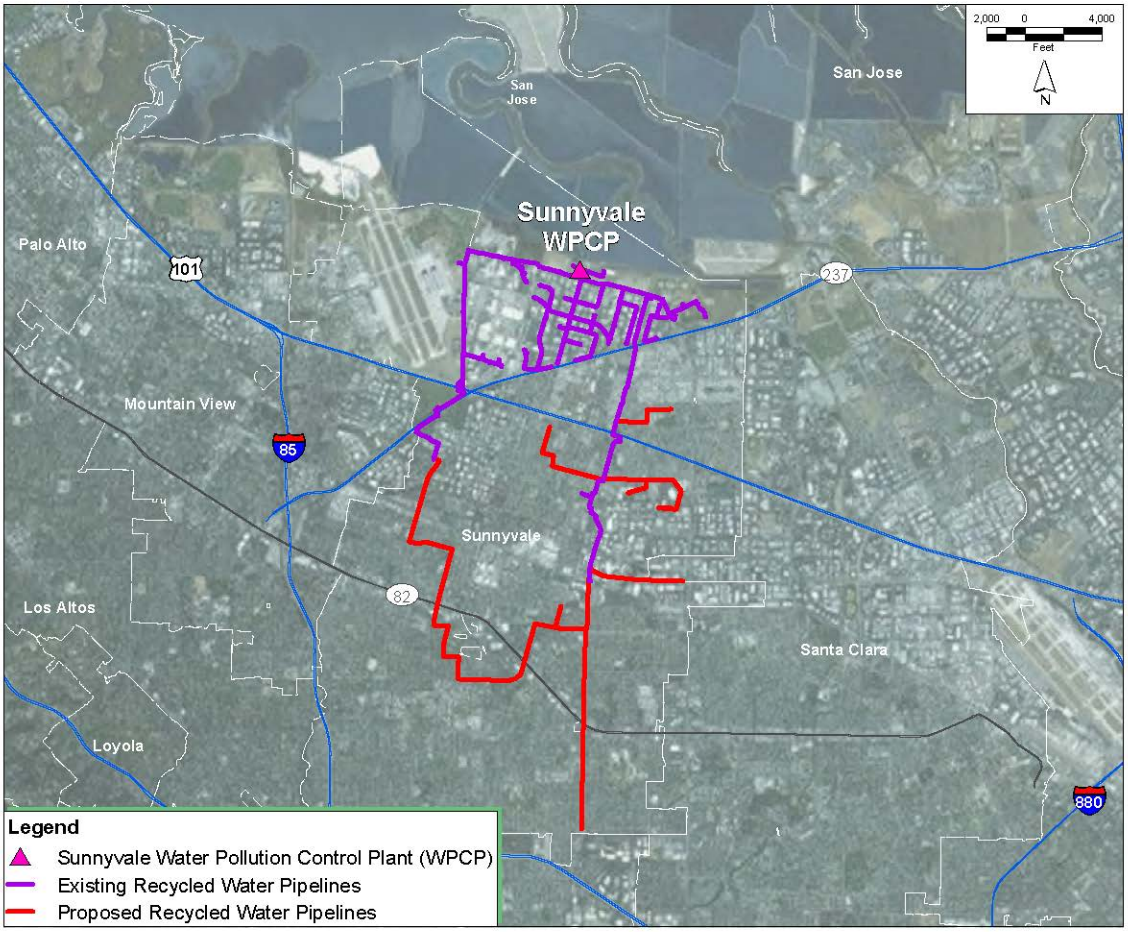
Sunnyvale's current recycled water use is approximately 1,060 AFY, which accounts for approximately 7 percent of its total water supply. Sunnyvale supplies recycled water for irrigation purposes to approximately 120 customers in the northern portion of Sunnyvale. These customers consist of parks, golf courses, business and industrial parks, and play fields (HydroScience 2013b).

To achieve the short-term recycled water goal of reusing 20 to 30 percent of wastewater effluent generated from Sunnyvale WPCP, Sunnyvale has constructed the Sunnyvale WPCP pump station, the San Lucar Tank and pump station, the Sunnyvale Golf Course Pump Station, and approximately 18 miles of recycled water distribution infrastructure. Sunnyvale's existing system is summarized in Table 9-3 and the recycled water facilities are shown in Figure 9-4.

Table 9-3: Sunnyvale Existing Recycled Water System

Parameter	Description
Planning Period	Existing
Amount Reused	1,062 AFY (2012)
Category	Non-potable reuse
Recycled Water Use	Irrigation and Industrial
Recycled Water Treatment/Capacity	Two operating modes: 1) no recycled water produced; 2) all WPCP flow treated to Title 22 standards
Recycled Water Storage and Pumping	Three pump stations and one reservoir tanks
Distribution System Infrastructure	Approximately 18 miles of recycled water pipelines ranging from 6- to 36-inches

Figure 9-4: City of Sunnyvale Existing and Planned Non-Potable Recycled Water Use



9.1.3 Summary of Water Supply and Wastewater and Recycled Water Facilities

Table 9-4 provides a summary of the potable water sources, wastewater treatment plant flows, and non-potable recycled water use estimates by each water retailers. Section 3 provides additional information and details for the San José/Santa Clara metro area non-potable recycled water facilities. For SBWR Strategic Plan purposes, the baseline use is defined as those uses already in place plus the recycled water uses that are expected to be in service circa 2015.

Table 9-4: Total Estimated Baseline Recycled Water Demands

Water Retailer	Potable Water Primary Water Supply[1]	WWTP Facility	WWTP Average Flows (mgd)	Recycled Water Total Estimated Baseline (AFY)
City of Palo Alto	SFPUC	Palo Alto RWQCP	4.5	890
City of Mountain View	SFPUC			-[2]
City of Sunnyvale	SFPUC/SCVWD	Sunnyvale WPCP	15	1,062
City of Milpitas[3]	SFPUC	SJ/SC RWF	110	1,100
City of Santa Clara[3]	Groundwater			4,300
San José Muni[3]	SCVWD			6,200
SJWC[3]	SCVWD			3,300
Great Oaks	Groundwater			0
Cal Water	SCVWD			0
			Total	**16,900[4] (rounded)**

Note:

1. *Certain agencies rely substantially on multiple sources.*
2. *Included in Palo Alto demands.*
3. *See Tables in Section 3.*
4. *Does not include 5,600 AFY commitment to SCVWD, which is currently envisioned to be used for potable reuse, but is treated as a non-potable demand since the water would be conveyed through the SBWR distribution system prior to any advanced treatment for IPR.*

9.2 Regional Recycled Water Opportunities

Potential planned recycled water projects in Palo Alto/Mountain View and Sunnyvale that could augment non-potable reuse or potable reuse in North County are highlighted in this section. Detailed information regarding the expansion of the existing programs can be found in each of the cities' UWMPs or specific plans developed to address potential recycled water projects. Additional information for the potential SBWR non-potable and potable projects is included in Section 3 (Non-potable Reuse Opportunities) and Section 7 (Potable Reuse Opportunities).

9.2.1 Non-Potable Recycled Water Opportunities

A summary of existing non-potable reuse projects is highlighted in Section 9.1.2. This section describes potential non-potable reuse projects that could be implemented to expand the existing recycled water systems.

City of Palo Alto

The City of Palo Alto is currently preparing environmental documentation for the Palo Alto Recycled Water Project, the third phase of their original 1992 recycled water program. This project would involve construction of pipelines, booster pump stations, and laterals (City of Palo Alto 2011b). The project would initially serve about 900 AFY of recycled water to the Stanford Research Park, primarily for landscaping uses. The proposed pipelines are shown in Figure 9-3 above as "Proposed Palo Alto System

Extension." This project would not be implemented until the RWQCP's recycled water approaches the 600 mg/L TDS target established by the City Council.

Future extensions from this project could serve Stanford University (which was the fourth phase of the RWQCP program identified in the original 1992 Water Reclamation Master Plan) and the Los Altos Hills area, along with potentially looping to the RWQCP's recycled water pipeline to Mountain View (City of Palo Alto 2011b). Any further expansion would require specific authorization by the City Council.

The additional demand for Stanford University and the connection to the Mountain View pipeline, identified as the intermediate-term demand, was estimated to require approximately 1,900 AFY of recycled water (Carollo 2012). Recycled water service to Stanford would improve the Palo Alto Recycled Water Project's unit costs and Stanford's utility department has expressed interested in recycled water. However, Stanford's land management group has hesitated on committing to recycled water due to water quality concerns (their current irrigation water has a TDS level of 550 mg/L) and potential implications on San Francisquito Creek surface water rights.

The RWQCP's Long Range Facilities Plan indicated that some of the recycled water facilities (filters, chlorine contact basins, and recycled water storage tanks) are aging and will need to be replaced in the next 10 to 20 years. The plan also identifies increased storage and pumping facilities that would be required to serve the peak month flow of 9.8 mgd, representing the demand of existing uses, the Stanford Research Park project, and the intermediate-term demands (Carollo 2012).

Full build-out of the Palo Alto system was identified in the 1992 Water Reclamation Master Plan. The estimated total potential non-potable reuse demand for this system was determined to be 5,980 AFY, with a peak month flow rate of 12.39 mgd (Brown and Caldwell 1992). Recycled water service to all of the users identified in the Master Plan may not be feasible due to their remote locations and/or limited demand.

City of Mountain View

Mountain View completed its Recycled Water Feasibility Study in March 2014, which identified a total potential recycled water demand for existing and potential customers of about 2,130 AFY (Carollo 2014). This estimate includes additional irrigation, indoor use, and industrial use identified within the city limits and in adjacent develop areas.

Mountain View staff has recommended pursuing Alternative 1 from the Feasibility Study, based on the estimated cost, the amount of estimated demand, and the potential for a significant portion of the infrastructure to be constructed with, and potentially cost shared with, the Bay View development at the National Aeronautics and Space Administration (NASA) site. Alternative 1 would serve 24 new customers in the North Bayshore Area and seven new customers on the NASA site. The additional demand served by Alternative 1 is estimated to be 0.52 mgd, about 429 AFY. Mountain View continues to work with the Bay View development staff to develop the pipeline alignments necessary within their project site, and will continue to develop Alternative 1 before finalizing the project's necessary infrastructure and costs (City of Mountain View 2014).

Mountain View's proposed projects are included with the City of Palo Alto's above since they both would be served from the same Palo Alto RWQCP facility.

Table 9-5 highlights the potential Palo Alto/Mountain View reuse system expansion facilities.

Table 9-5: Palo Alto/Mountain View Planned Non-Potable Reused System Expansion

Parameter	Description
Planning Period	Near-term
Amount Targeted	Existing 890 AFY[1] Additional Near-Term Capacity of 900 AFY[2] Additional Intermediate Capacity of 1,900 AFY (for a total sum of additional capacity of 2,800 AFY) [3] Build-Out Capacity of 5,980 AFY[4]
Category	Non-potable reuse
Recycled Water Use	Irrigation and industrial
Recycled Water Treatment Improvements	Addition of greater filtration capacity at the Palo Alto RWQCP
Recycled Water Storage and Pumping Improvements[2]	Addition of a booster pump station at the Mayfield Soccer Fields and a pump station at the RWQCP
Distribution System Infrastructure Improvements[2]	Addition of approximately 5 miles of 12 to 18-inch recycled water Pipelines and approximately 5 miles of lateral pipelines to over 50 use sites

Note:

1. *Includes delivery to Mountain View.*
2. *Phase 3 of 1992 Master Plan (City of Palo Alto 2011b)*
3. *Carollo 2012*
4. *Brown and Caldwell 1992*

City of Sunnyvale

To achieve Sunnyvale's long-term recycled water goal of reusing 100 percent of all wastewater generated from Sunnyvale WPCP, Sunnyvale plans to expand its current non-potable reuse system as well as pursuing indirect potable reuse projects within and outside of the Sunnyvale city limits. Sunnyvale's plans to expand the non-potable recycled water system are discussed below. Note that based on discussions in the Indirect Potable Reuse Planning, TM #2 – Purified Water Alternatives Evaluation (Kennedy/Jenks 2013), if Sunnyvale pursues potable reuse, then it is likely that the non-potable reuse expansions would be limited unless an intertie is secured with another recycled water supply.

The proposed expansion of the non-potable recycled water system would include improvements to treatment processes at Sunnyvale WPCP as well as expansion of the recycled water pumping, storage facilities, and recycled water distribution system to meet the additional demand of 2,061 AFY (build-out demand of 3,123 AFY). Sunnyvale is currently in the master planning process for treatment plant improvements. The non-potable treatment process improvements will be implemented per the Proposition 84 Integrated Regional Water Management (IRWM) grant. The proposed improvements include the addition of an MBR system, or activated sludge, with effluent disinfection to facilitate a side-stream flow to be treated to Title 22 standards for recycled water reuse. The remainder of the flows would be treated to NPDES permit standards for discharge to the Bay. This improvement would eliminate the current need for batch production of recycled water and allow for continuous production of recycled water for reuse.

The expansion of the recycled water system would require additional storage facilities and pumping capacity. Based on the estimated recycled water build-out demand of 3,123 AFY, the average day demand is 2.8 mgd and the peak day demand for the recycled water system will be approximately 6.5 mgd. New and additional storage would provide the equivalent of one peak day of recycled water storage, creating the operational flexibility to seasonally shut-down parts of the system for maintenance and repair, as well as reducing the need for emergency potable water back.

In October 2014, Sunnyvale, the District, Cal Water, and Apple finalized agreements to move forward with the planning, design, and construction of the Wolfe Road Facilities to serve non-potable recycled water to the new Apple campus in Cupertino and other recycled water customers along the pipeline alignment.

Sunnyvale's planned recycled water system for non-potable reuse is summarized in Table 9-6. As noted previously, if Sunnyvale pursues potable reuse as discussed below, then the expansion of the non-potable reuse system may be more limited.

Table 9-6: Sunnyvale Planned Non-Potable Reuse System Expansion

Parameter	Description
Planning Period	Near-term
Amount Targeted	Existing 1,062 AFY Additional Capacity of 2,061 AFY Build-Out Capacity of 3,123 AFY
Category	Non-potable reuse
Recycled Water Use	Irrigation
Recycled Water Treatment Improvements	Addition of MBR System or activated sludge and Disinfection at Sunnyvale WPCP to provide continuous recycled water production. Note: Existing recycled water treatment utilizes batch production. Improvements will be made.
Recycled Water Storage and Pumping Improvements	Addition of storage capacity of 5.0 MG is required to provide equivalent of one peak day of recycled water storage of 6.5 MG when combined with existing 1.5 MG storage at San Lucar Tank. Potential sites for addition of recycled water storage are Wolfe-Evelyn Plant Site and Central Avenue Water Plant Site.
Distribution System Infrastructure Improvements	Addition of approximately 18.5 miles of 6-inch to 24-inch recycled water pipelines is required. Base alignments of Wolfe Road Main and Main Loop, as well as extensions from existing pipeline systems are included. In October 2014, Sunnyvale, the District, and Cal Water signed agreements to move forward with the planning, design, and construction of the Wolfe Road Facilities.

Source: HydroScience 2013b

San José/Santa Clara Metro Area

As discussed previously, there are six water retailers in the San José/Santa Clara metro area, including the City of Milpitas, the City of Santa Clara, San José Muni, SJWC, Cal Water, and Great Oaks. Of these six retailers, four – the City of Milpitas, the City of Santa Clara, San José Muni, and SJWC – currently use and have plans to expand recycled water use.

The non-potable reuse market assessment summarized in Section 3 also identified the potential long-term non-potable reuse demands that had been recognized by the SBWR retailers. Planning studies completed by Milpitas, Santa Clara, San José Muni, and SJWC also identified a potential additional long-term demand of 10,000 AFY bringing the total potential non-potable demand to 25,000 AFY as detailed in Section 3. Section 5 describes the potential long-term non-potable project alternatives.

Summary

Table 9-7 provides a summary of the current baseline non-potable demands as well as the potential long-term demands as identified in the individual city or agency plans. The San José/Santa Clara Metro Area non-potable demands are summarized in Section 3 of this Report.

Table 9-7: Potential Long-Term Non-Potable Demands

Retailer	Baseline (AFY)	Potential Long-Term Demands (AFY)	Total Potential Non-Potable Market (AFY)
City of Palo Alto	890	2,800	3,690
City of Mountain View	-[2]	-[2]	-[2]
City of Sunnyvale	1,062	2,061	3,123
City of Milpitas[3]	1,100	1,100	2,200
City of Santa Clara[3]	4,300	900	5,200
San José Muni[3]	6,200	1,150	7,400
SJWC[3]	3,300	6,820	10,100
Great Oaks	0	0	0
Cal Water	0	0	0
Total	**16,900**	**14,800**	**31,700[4]**

Note:

4. *Does not include baseline demands.*
5. *Included in Palo Alto demands.*
6. *See Tables in Section 3.*
7. *Does not include 5,600 AFY commitment to SCVWD, which is currently envisioned to be used for potable reuse, but is treated as a non-potable demand since the water would be conveyed through the SBWR distribution system prior to any advanced treatment for IPR.*

9.2.2 Regional Potable Reuse Opportunities

City of Palo Alto

Palo Alto is not currently planning a potable reuse project, but could consider a potable reuse project to increase the quantity and quality of the local groundwater. Currently, Palo Alto does not plan to pursue a significant potable reuse project unless there are:

- Changes to the RWQCP's discharge requirements;
- Increased mass loadings to the plant;
- Requests from partner agencies or other local agencies;
- Available State or Federal funding; or
- Other water supply issues which may lead to an increased value of the recycled water, such as shortages/legislation/potable reuse opportunities.

If Palo Alto did want to consider a potable reuse project, then the most likely project would be an IPR project via injection into the local groundwater basin. Purified recycled water would supplement the local groundwater supply, providing a sustainable source for Palo Alto's existing groundwater extraction wells.

Palo Alto's existing groundwater extraction wells are currently reserved for short-term use during emergency or drought conditions. Historically higher pumping in the area resulted in saline intrusion from the Bay and land subsidence. A groundwater replenishment project could replenish the water in an area that would allow the City's existing wells to be used as a baseload supply, providing an element of reliability as an alternate to SF RWS. There is a growing interest in groundwater, especially strategies to protect against land subsidence, saltwater intrusion, negative impacts to surface water, and high groundwater levels. The addition of purified recycled water could be a component of a sustainable groundwater management plan.

Potable reuse could be a support initiative to the Utilities Department's Emergency Water Supply and Storage project, completed in 2013, which consisted of refurbishing five wells, and constructing three wells, a new storage reservoir, and a pump station. These wells could provide up to 11,000 gallons per minute of reliable well capacity and could supply up to 1,500 AFY during a drought (City of Palo Alto 2011). A purified water source could aid the city in addressing water quality issues related to these wells (under current conditions, treatment or blending with potable water would be needed to meet water quality limits for iron, manganese, and TDS). A potable reuse project would likely require injection wells since there is not a lot of space for spreading ponds in Palo Alto. Injection wells would require treatment of the recycled water currently produced at the Palo Alto RWQCP with advanced treatment. Full advanced treatment, including MF, RO and advanced oxidation process (AOP), would be required for potable reuse projects groundwater augmentation if injection wells are involved. Additionally, RO would probably be required for any project that required TDS reduction.

Based on Palo Alto's testing records, the TDS levels in the groundwater range from 440 to 710 mg/L (City of Palo Alto 2013). Recharging potable reuse water into the aquifer with AWPF produced water (TDS < 100 mg/L) will improve the quality of the groundwater over time, which may reduce or eliminate the need for blending or partial treatment of the extracted groundwater. Depending on the size of the potable reuse project and the characteristics of the groundwater basin, additional extraction wells may also be needed. The feasibility of potable reuse recharge will depend largely on location and volume of recharge and pumping.

The RWQCP's Long Range Facilities Plan identified the option of adding an RO system to reduce salinity in the non-potable recycled water if source control methods did not prove successful enough. If this RO system is constructed, then RO could potentially be integrated into a future AWPF or a portion of the RO permeate from the AWPF could be blended with the Title 22 recycled water to reduce the TDS to acceptable levels at the SVAWPC for the SBWR non-potable system.

RO concentrate disposal methods for the AWPF would need to be investigated. The RO concentrate disposal would be the responsibility of Palo Alto, as the producer of the recycled water. Since the Palo Alto RWQCP discharges into the Bay, the plant has similar discharge limits as the Sunnyvale WPCP and the SJ/SC RWF. Based on the bench-scale toxicity tests completed at the SJ/SC RWF, it is anticipated that the RO concentrate from the AWPF could create issues with toxicity compliance if the RO concentrate is discharged into the Bay. Palo Alto could consider partnering with Sunnyvale and SCVWD to participate in a regional solution for RO concentrate disposal. Additional discussion of the regional concentrate disposal options is provided in this section and in Appendix 6D, Concentrate Management Options.

To determine the feasibility of a potable reuse project, the following issues would need to be investigated further by Palo Alto and others considering reuse projects, including potential regional solutions:

- Groundwater basin characteristics, including potential groundwater contamination, arsenic leaching or degradation due to potential geochemical interactions between recycled water and ambient groundwater, location of extraction wells or spreading basins, potential location for injection wells, long-term water levels, and groundwater modeling to determine residence time;
- Land availability for injection wells;
- Recycled water supply analysis;
- Advanced treatment analysis and siting study;
- RO concentrate disposal evaluation; and
- Cost feasibility evaluation considering future projected costs and benefits of purchasing water from SFPUC.

City of Mountain View

Mountain View has not considered potable reuse to date. Mountain View staff indicated groundwater wells in the city have artesian conditions, where well water rises to the surface under pressure. This may make groundwater injection potable reuse options less feasible in Mountain View without a corresponding increase in groundwater extraction to create additional storage volume in the aquifer. These artesian conditions are also found in other portions of the Santa Clara subbasin.

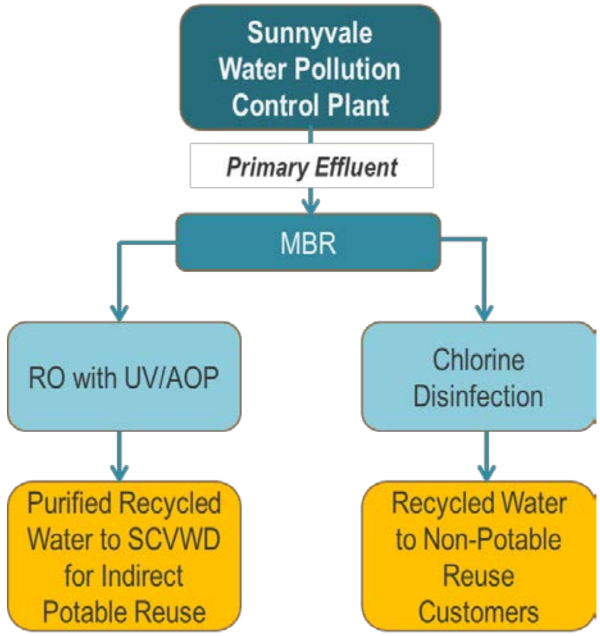
City of Sunnyvale

Due to limited non-potable reuse demands within Sunnyvale to meet their goal of 100 percent recycled water, Sunnyvale is exploring indirect potable reuse projects within and outside the Sunnyvale city limits. Sunnyvale has previously explored potential purified water alternatives that included various treatment locations, treatment technologies, and source water. After discussions with Sunnyvale and SCVWD, alternatives requiring satellite sites or concentrate pipelines or SBWR effluent as sources were eliminated.

The recommended treatment alternative for Sunnyvale's long-term potable reuse, based on planning to date completed by the District and Sunnyvale (Kennedy/Jenks 2013), is the centralized treatment of effluent from the Sunnyvale WPCP using an MBR, followed by advanced water treatment with RO and UV disinfection and advanced oxidation process (AOP).

The recommended advanced treatment alternative is shown in Figure 9-5. It should be noted that this treatment train is not a typical AWPF since there are currently no indirect potable reuse projects using an MBR in California. A small demonstration project would likely be required to show how this treatment train would work for the larger scale project.

Figure 9-5: Sunnyvale Potable and Non-Potable Reuse Alternatives



The potential mid-term potable reuse production would be approximately 11,750 AFY (or about 10 mgd). The evaluation assumed that the purified water would be delivered to either injection wells within Sunnyvale, the Westside injection well field located south of Sunnyvale and east of the Los Gatos recharge ponds, or the Los Gatos recharge ponds.

Sunnyvale also investigated an option to use the Stevens Creek Pipeline to convey the purified recycled water. The Stevens Creek Pipeline is a raw water pipeline used by the District to convey raw water to the McClellan Ponds. This pipeline originates from the Riconada Force Main near the Riconada Water Treatment Plant (WTP) on Wedgewood Avenue and roughly parallels Highway 85 and an existing railroad, before extending west and north to Stevens Creek. There are multiple existing turnouts to release raw water from this pipeline. The Stevens Creek Pipeline provides water to the McClellan Recharge Ponds. Raw water is currently delivered to the McClellan Ponds on a year-round basis. The diversion of raw water to most of the local creeks is seasonal, occurring when creeks dry after the rainy season, and therefore the operational strategy will require further evaluation. The connection of purified water to Stevens Creek Pipeline would be to repurpose the pipeline segment between Stevens Creek and Saratoga Creek for purified water conveyance. As noted in other section of this Strategic Plan, the release of purified recycled water into a stream system would require additional regulatory permitting, including an NPDES permit and potentially USACE and CDFW permits. The streamflow augmentation is discussed in Appendix 6B.

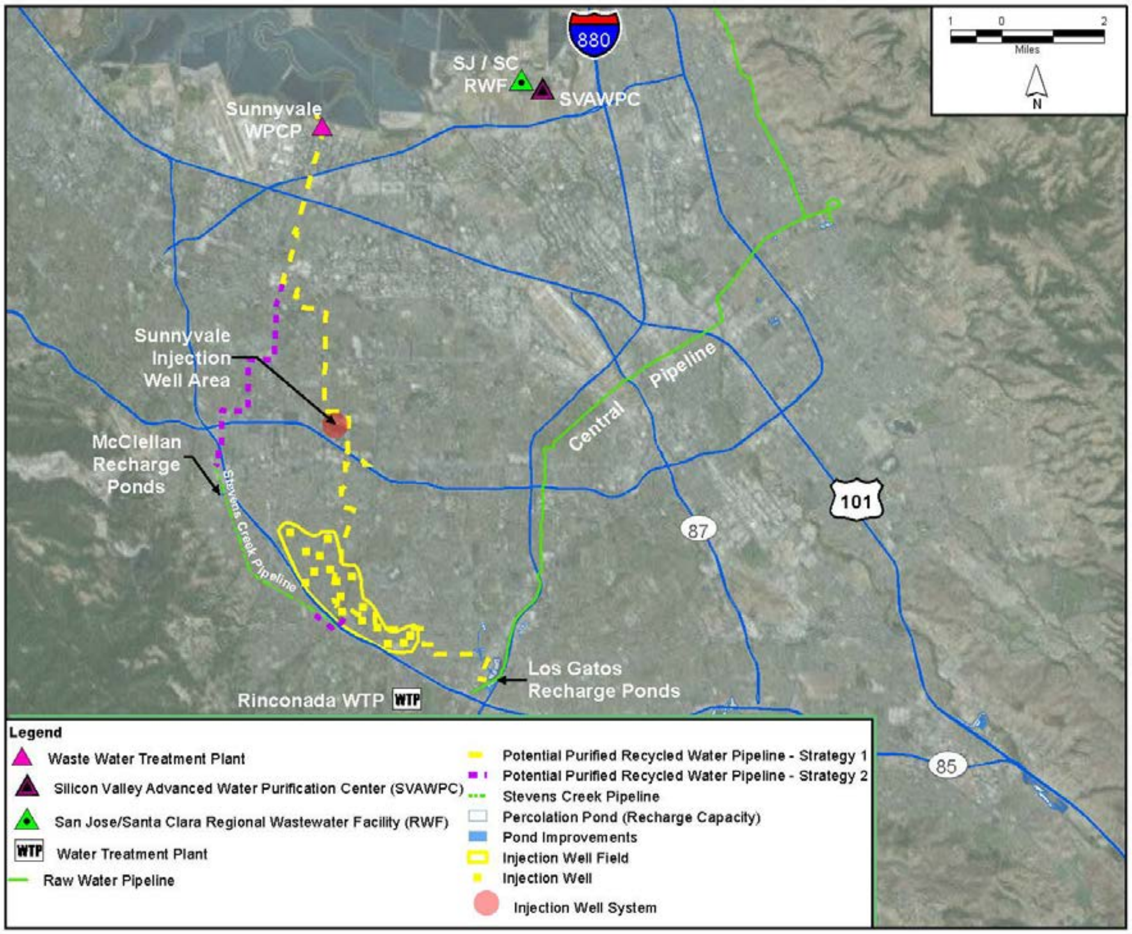
The required improvements for planned potable reuse is summarized in Table 9-8 and shown in Figure 9-6.

Table 9-8: Sunnyvale Planned Potable Reuse Demand

Parameter	Description
Planning Period	Mid- to Long-Term
Capacity	Existing: None Additional Capacity of 11,747 AFY or 10 mgd Build-Out Capacity of 11,747 AFY or 10 mgd
Category	Potable reuse
Recycled Water Use (in partnership with SCVWD)	Los Gatos System Percolation Ponds (5,667 AFY) Stevens Raw Water Pipeline (5,480 AFY)
Source Water	Sunnyvale WPCP
Recycled Water Treatment Improvements	Addition of MBR System and Advanced Water Treatment at Sunnyvale WPCP
Recycled Water Storage and Pumping Improvements	Addition of a new pump station at Sunnyvale WPCP and a new booster pump station in central Sunnyvale
Distribution System Infrastructure Improvements	Addition of approximately 77,700 ft of 6-inch and larger recycled water pipelines is required
Injection Wells	Addition of 17 injection wells

Source: HydroScience Engineers, Inc. 2013a

Figure 9-6: Potential Sunnyvale Potable Reuse Opportunities



San José/Santa Clara Metro Area

Section 8.2 presents the recommended plan for the near-term and long-term potable reuse projects. The recommended plan for potable reuse is summarized in Table 9-9 and shown in Figure 9-7. The plan includes the near-term project to establish 4,200 AFY of potable reuse within the next five years, as well as long-term projects to achieve up to 35,000 AFY of potable reuse. The recommended plan includes both a satellite AWPF and a centralized AWPF to supply multiple projects within the SJ/SC RWF service area.

The City and SCVWD have identified the Ford Pond IPR project as the preferred near-term potable reuse project. The Ford Pond IPR project includes additional treatment of 5 mgd of SBWR tertiary recycled water through a satellite AWPF located near the Ford Pond. At this time it is envisioned that the satellite AWPF would employ full advanced treatment (MF, RO, and AOP) to minimize diluent water requirements, which would produce an annual average 4,200 AFY. RO concentrate would be discharged through an industrial discharge permit to the SJ/SC RWF sewer system. The near-term project is discussed further in Sections 8 and 10 of this report.

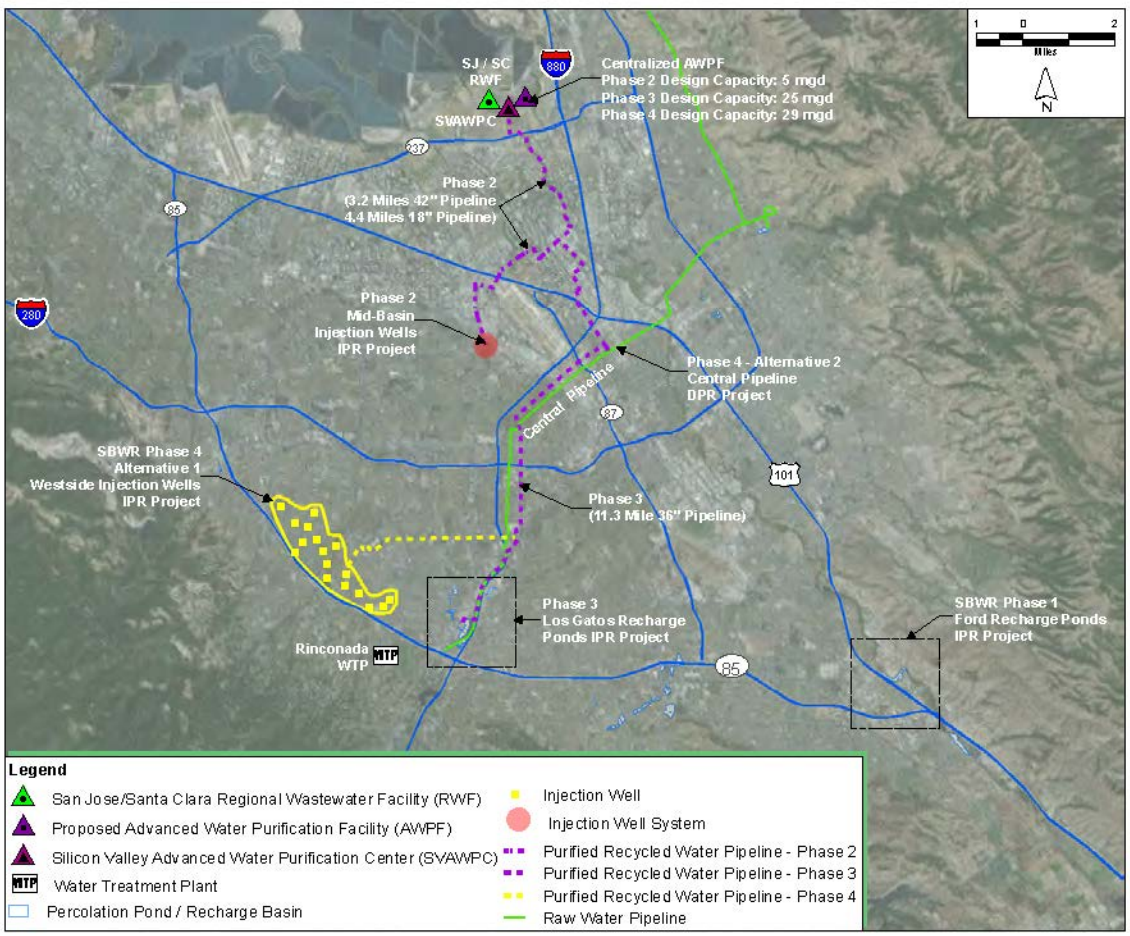
Future phases of potable reuse would be supplied by a centralized AWPF and a pipeline that would be built in stages to deliver the water to the recharge areas. As shown in Table 9-9, the final phase of the project would be to expand to the Westside injection wells or to pursue direct potable reuse in the Central Pipeline. The long-term project is discussed further in Section 8. Potential operational impacts of potable reuse opportunities are described in Section 6.

Table 9-9: Recommended Plan for Potable Reuse at the RWF

Near-Term/ Long-Term	Phase	Description	Capacity by Phase (AFY)	Cumulative Capacity (AFY)
Near-Term	Phase 1	Ford Recharge Ponds IPR	4,200	4,200
Long-Term	Phase 2	Mid-Basin Injection Wells IPR	5,600	9,800
	Phase 3	Los Gatos Recharge Ponds IPR	20,200	30,000
	Phase 4	Westside Injection Wells IPR or Central Pipeline DPR[1]	5,000	35,000

Note: [1]The Phase 4 project will be decided at a later date depending on the establishment of DPR regulations in California.

Figure 9-7: SBWR Potable Reuse Recommended Plan



9.2.3 Summary of Opportunities

The recycled water availability and non-potable reuse and potable reuse opportunities identified for the Palo Alto RWQCP, the Sunnyvale WPCP, and the SJ/SC RWF are summarized in Table 9-10. Concentrate disposal from a regional opportunity would need to be solved on a regional basis with the agencies producing the brine responsible for coordinating a solution.

Table 9-10: Summary of Regional Recycled Water Opportunities

Recycled Water Source	Recycled Water Availability	Recycled Water Options (AFY)	
		Non-Potable Reuse	Potable Reuse
Palo Alto RWQCP	• 22 mgd of treated water discharge • Can currently produce 4.5 mgd of tertiary treated water[1]	City of Palo Alto[2]: • 900 AFY to Stanford Research Park, currently under environmental review. • Intermediate term - 1,900 AFY to Stanford University and connection to Mountain View pipeline • Long-term – 5,980 AFY for build out City of Mountain View: • Recommended alternative from 2014 Feasibility Study: 429 AFY[3] • Full build-out from 2014 Feasibility Study: 2,130 AFY[4]	City of Palo Alto: • Palo Alto is not currently planning a potable reuse project, but could consider a potable reuse project to increase the quantity and quality of the groundwater City of Mountain View: • Direct injection does not appear feasible at this time due to artesian groundwater conditions, but may be considered in the future
Sunnyvale WPCP	• 13.5 mgd of tertiary effluent[5]	• Current demand: 1,062 AFY (0.95 mgd)[6] • Build-out demand: 3,123 AFY[5], which will likely not be pursued if potable reuse is implemented	• Long-term: 11,200 AFY (10 mgd)[7]
SJ/SC RWF and SBWR	• 100 mgd of secondary or tertiary effluent	• Baseline demand (existing, 2015 planned, and committed capacity): 15,000 AFY without SCVWD and 20,000 AFY with SCVWD[7] • Long-term potential: 30,000 AFY with SCVWD[7]	• Near-term Phase 1: 4,200 AFY[8] • Near--term Phase 2: 5,600 AFY[8] • Long-term Phase 3: 20,200 AFY[8] • Long-term Phase 4: 5,000 AFY[8] • Total : 35,000 AFY[8]

Notes:

1. *Recycled water system will not be expanded until salinity of recycled water is reduced to below 600 mg/L TDS (achieved through collection system lining projects)*
2. *City of Palo Alto 2011b; Carollo 2012; Brown and Caldwell 1992*
3. *City of Mountain View 2014*
4. *Carollo 2014*
5. *Kennedy/Jenks 2013*
6. *HydroScience 2013b*
7. *See Tables in Section 3*
8. *See Section 8*

9.3 Regional Partnership Opportunities

Based on the existing and planned activities by the three north County water recycling agencies, potential interties and partnerships have been identified. This section describes these potential opportunities and considerations as these three systems expand and move into potable reuse.

9.3.1 Non-Potable Systems

SBWR-Sunnyvale Intertie (Northern Regional Connector Intertie)

SBWR submitted a grant application for Bureau of Reclamation WaterSMART funding in 2012 for the proposed SBWR Northern Regional Connector. The project was envisioned to expand the SBWR service area to include the Sunnyvale and the Cupertino, and potentially Palo Alto and Mountain View. While Sunnyvale produces recycled water, the supply is intermittent and the water quality is less reliable compared to SBWR product water. However, this will change with the implementation of the recently funded IRWM project. The Northern Regional Connector was proposed to connect the SBWR and Sunnyvale recycled water systems through the construction of approximately 27,780 linear feet of pipeline to deliver approximately 900 AFY of recycled water to Sunnyvale's existing non-potable recycled water customers. Additionally, the extension along Wolfe Road was included to deliver an additional 420 AFY to the City of Cupertino. Once constructed, the Sunnyvale WPCP was expected to produce recycled water only during emergency conditions, and Sunnyvale would have relied on SBWR recycled water as their primary recycled water supply to cease using potable water to back-up their existing recycled water supply.

Although the project was selected for grant funding, broader cost implications prompted this intertie concept to be put on hold. In October 2014, Sunnyvale, the District, Cal Water, and Apple finalized agreements to move forward with the planning, design, and construction of the Wolfe Road Facilities to serve non-potable recycled water to the new Apple campus in Cupertino and other recycled water customers along the pipeline alignment.

Sunnyvale-Mountain View Intertie

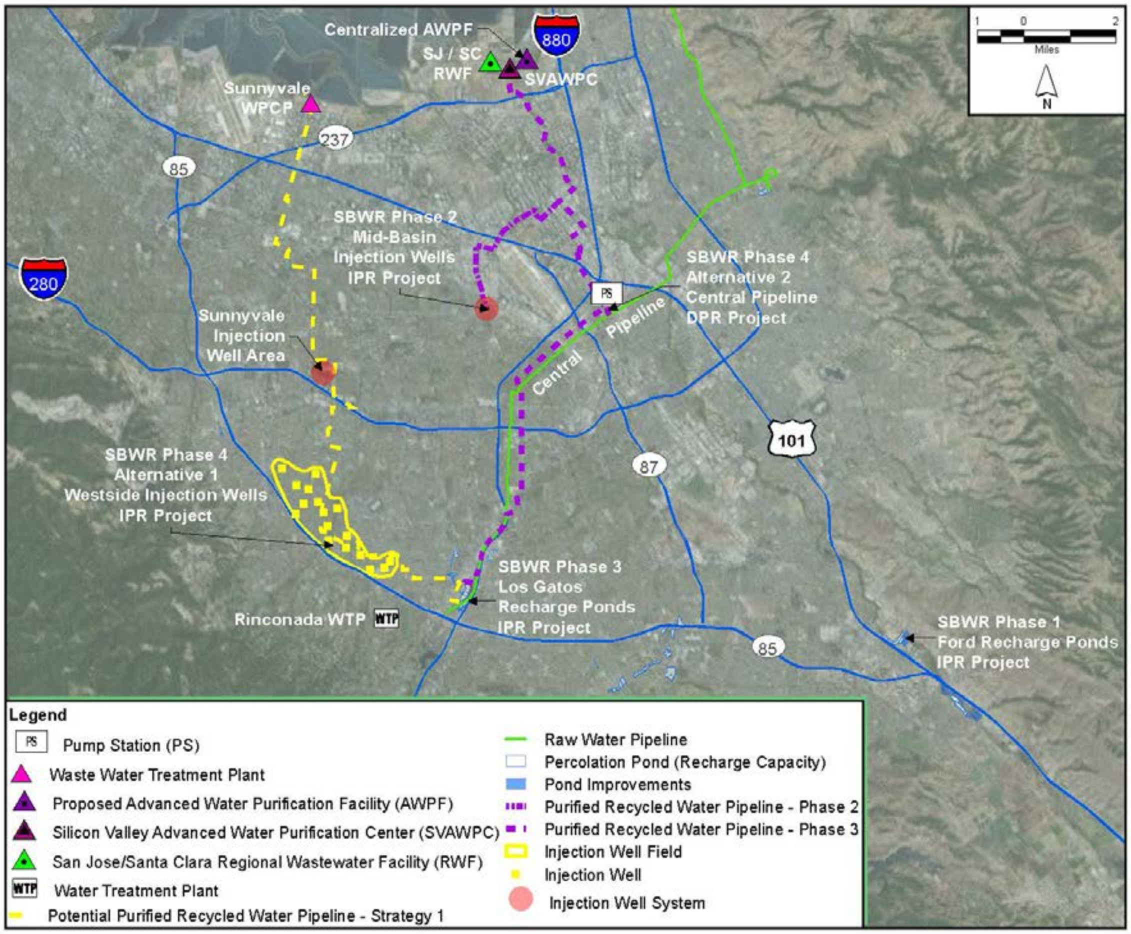
There has been consideration of an intertie between the Sunnyvale and Mountain View recycled water systems to serve recycled water demands in the eastern portion of Mountain View. There may be the potential to combine this project with a future PG&E tunnel that may be installed from northern Sunnyvale to Mountain View and Palo Alto. As Sunnyvale's non-potable reuse initiative expands, an intertie between the two systems would become a logical consideration. This type of intertie could serve as a reliability feature, at a minimum, and could evolve to a support mechanism should either Palo Alto/Mountain View or Sunnyvale desire to expand recycled water service, including potable reuse, beyond their production capability.

9.3.2 Potable Reuse Systems

SBWR-Sunnyvale Potable Reuse Integration Opportunities

Both the SBWR and Sunnyvale concepts have identified the Los Gatos recharge ponds and the Westside injection wells as potential recharge areas. Each concept has separate conveyance pipelines to these two recharge areas: the conveyance concept for SBWR runs south from the SJ/SC RWF and then west to the Los Gatos recharge ponds and the Westside injection wells (see Figure 9-7) while the conveyance for Sunnyvale runs south from the Sunnyvale WPCP to the Westside injection wells and then Los Gatos recharge ponds (see Figure 9-6). Additionally, the SBWR concept includes serving an injection well area in the City of Santa Clara and the Sunnyvale concept includes a near-term project that would serve an injection well in Sunnyvale. The SBWR and Sunnyvale concepts are shown in Figure 9-8.

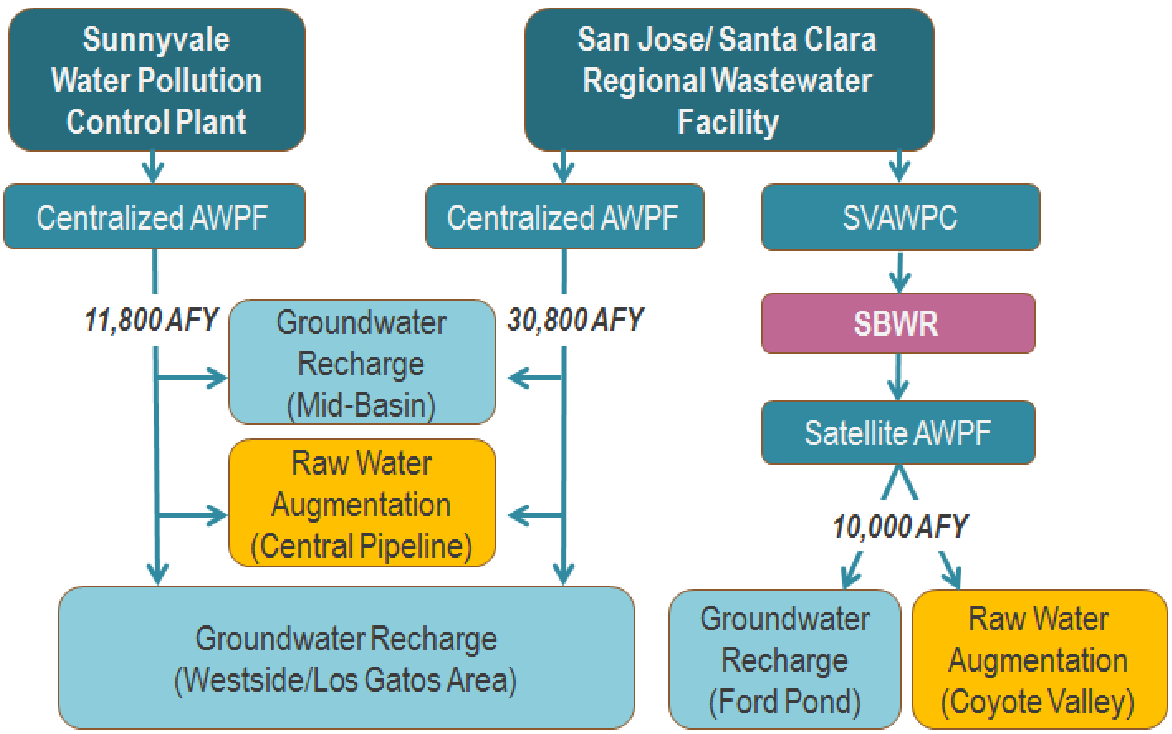
Figure 9-8: SBWR and Sunnyvale Potable Reuse Opportunities



Since both the SBWR and Sunnyvale concepts terminate at the Los Gatos recharge ponds/Westside injection wells, there may be synergies to combining these two concepts and using a single pipeline to convey the purified recycled water from the AWPFs in the north to the recharge areas in the south. The two potable reuse programs could be integrated into a single system (see Figure 9-9) and deliver purified recycled water to the following recharge areas:

- Los Gatos recharge ponds (IPR)
- Westside injection wells (IPR)
- Injection wells in Santa Clara (IPR)
- Injection wells in Sunnyvale (IPR)
- Connection to the Central Pipeline (DPR)

Figure 9-9: Integrated SBWR-Sunnyvale Potable Reuse Opportunity



As part of the SBWR Strategic and Master Planning and noted above, the SBWR potable reuse concepts are based on achieving 35,000 AFY by 2035, of which 30,600 AFY could be recharged at the Los Gatos recharge ponds, Westside injection wells, and/or injection wells in Santa Clara, as well as added to the Central Pipeline for DPR. The Sunnyvale concept is based on achieving 11,200 AFY (10 mgd), which could be recharged at the Westside injection wells and injection wells in Sunnyvale. Combined, these two projects could achieve 41,800 AFY of potable reuse. Table 9-11 summarizes the recharge areas and which potable reuse project could serve each recharge area.

Table 9-11: Integrated SBWR and Sunnyvale Potable Reuse Concept

Recharge Area	Recharge Capacity (AFY)	Potential Recharge Capacity that could be Served by AWPFs	
		SBWR	Sunnyvale
Los Gatos recharge ponds (IPR)	20,200	√	--
Westside injection wells (IPR)	10,600[1]	--	√
Injection wells in Santa Clara (IPR)	5,600[2]	√	--
Injection wells in Sunnyvale (IPR)	1,120[3]	--	√
Connection to the Central Pipeline (DPR)	15,000[4]	√	--
Total	52,500		

Notes:

1. *Assuming 17 injection wells.*
2. *Assumed. Will be confirmed as part of current analysis.*
3. *Based on Sunnyvale's draft concept for a near-term potable reuse project.*
4. *Long-term average. Annual contribution of purified recycled water to the Central Pipeline is estimated to range from 1,000 to 32,000 AFY depending on SWP allocations. (SCVWD, Central Pipeline Direct Reuse System Alternative Draft TM)*

Integrating these two potable reuse projects into a single conveyance project has two primary advantages: reduced overall project costs and improved operational flexibility. Integrating the two projects would reduce costs with construction of a single pipeline instead of two separate pipelines. Combining the projects into a single system will allow water to be recharged at more locations allowing for backup when there is insufficient capacity in the Central Pipeline to accept purified recycled water. The main disadvantage of combining the two systems is that the permitting would be more complex for combining recycled water from two separate systems.

One mid-term potable reuse strategy for SBWR is mid-basin injection within the City of Santa Clara to primarily support that retail agency's long term plans for groundwater pumping. Should the City of Sunnyvale and other local water retailers wish to expand their groundwater pumping, this mid-basin injection concept could be expanded and perhaps include a mid-term strategy supported by the Sunnyvale WPCP. As part of a future District's effort, the District's groundwater model will need to be updated to support the injection of purified recycled water into the main basin.

9.3.3 Navigating Regional Issues

As the region's local agencies work to increase water recycling in their service area, several issues will need to be addressed. These include but are not limited to the following:

- Incorporation of recycled water into regional water supply;
- Water supply contract limitations; and
- RO concentrate management.

Incorporation of Recycled Water into the Regional Water Supply

The District, as regional water supply wholesaler and groundwater basin manager, is in a unique position to optimize the role of water recycling in both supplementing the local water supply and managing the groundwater basin through a combination of direct replenishment (via percolation ponds or injection) and pumping reduction (in lieu recharge) via both DPR to supplement a water treatment plant and non-potable reuse.

As the some agencies in the region move forward to achieve its recycled water goal of 50,000 AFY, coordination of these pathways with imported and local supply management and groundwater pumping/production by the retailers will be required. The District's surface water (Water Evaluation and Planning [WEAP]) and groundwater models are tools that could be used to navigate this coordination.

An example of this coordination is potable reuse via groundwater recharge. As the region's agencies look to develop this potable reuse option, retailers may need to evolve their water supply strategy to include or increase local groundwater pumping. This realignment of water supply service would need to be considered by the District and local agencies in their water supply planning, including identifying potential surface water facilities reallocation or reoperation. Pumping and recharge must be balanced to ensure groundwater sustainability, and there are many factors influencing this including recharge location.

RO Concentrate Management

At this time, potable reuse projects that involve groundwater injection or direct potable via raw water augmentation require full RO treatment in addition to advanced oxidation. This poses an RO concentrate management challenge, as noted in Appendix 6D.

Table 9-12 presents the concentrate disposal options evaluated in Appendix 6D that are considered potentially feasible as a regional concentrate disposal option. The numbering for the disposal options is from Appendix 6D.

Table 9-12: Regional Concentrate Disposal Options

Disposal Option	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 AWPFs 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 concentrate 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, 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.

As described in this section, potable reuse projects are being conceptually evaluated for SBWR and Sunnyvale, and could be pursued in Palo Alto. Partnering on a regional concentrate management/disposal method is a potential benefit for all three projects, especially for cost sharing and permitting. A disadvantage of a regional concentrate solution is the need for pipelines to convey the concentrate to the selected location.

The District is partnering with the three regional recycled water initiatives to begin a regional conversation on RO concentrate management. A workshop on the topic is being scheduled for early 2015. The goal of the workshop is to provide the participants with a collective understanding of the issues related to the management of RO By-Product. Information shared will assist with prioritizing the most feasible alternatives and associated action items necessary for their successful implementation. Ideally, the focus will be on cost-effective, regional win-win solutions.

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10. Implementation Plan

This section summarizes the recommended near and long term recycled water alternatives and presents implementation plans for those projects.

10.1 Comparison of Alternatives

As discussed in Sections 4 and 8, the near-term projects were developed in coordination with SBWR and SCVWD staff. Cumulatively, the recommended near-term projects will provide 20,000 AFY of recycled water and include the following two sets of projects:

- SBWR reliability projects to meet 15,000 AFY of near-term NPR demands, and
- Phase 1 IPR project which will provide 5,000 AFY of groundwater recharge at the Ford Pond recharge ponds

For the near-term, the assumption is that implementation of the NPR and IPR pathways will proceed concurrently using the same SBWR distribution system.

For the long-term, implementing the NPR and IPR pathways will require construction of separate distribution and treatment infrastructure and the two pathways diverge in terms of costs and their ability to meet the long-term recycled water goals.

Figure 10-1 shows the recycled water supplies for long-term NPR and potable pathways versus the targets established for the Strategic Plan. Both pathways assume a baseline of 15,000 AFY of near-term NPR. For the NPR pathway, the additional long-term NPR supply is estimated at 10,000 AFY, bringing the total potential NPR pathway to 25,000 AFY, excluding SCVWD's Phase 1 IPR project at Ford Pond. The NPR pathway alone will not be adequate to meet either the 2025 target of 40,000 AFY or the 2035 target of 50,000 AFY. For the potable pathway, the near-term IPR project will provide 5,000 AFY with an additional long-term supply of 30,800 AFY, bringing the total potential potable pathway to 50,800 AFY, including the baseline flows.

At the long-term target of 50,000 AFY, approximately 75 mgd of RWF effluent could be distributed as recycled water on a daily basis during the dry weather peak demand period. By 2035 the estimates of RWF dry weather influent flow vary from 110 to 130 mgd depending on population projection methodology and assumed level of water conservation. Even after reaching the recycled water targets, there will still be RWF discharge to the Bay during all conditions.

Figure 10-1: Long-Term Pathways versus Recycled Water Targets

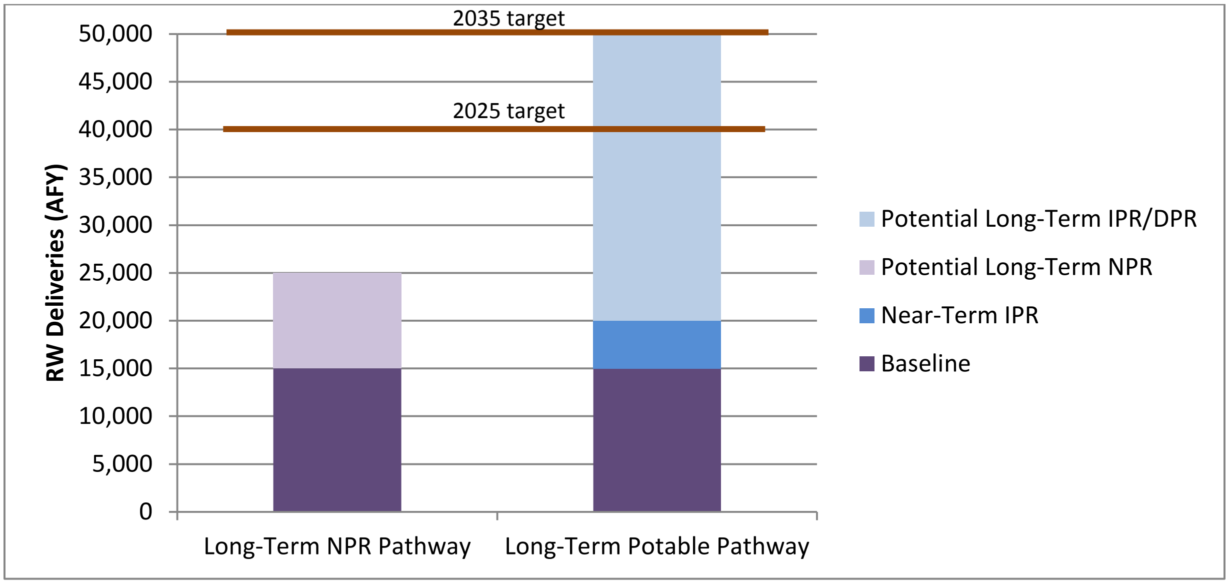


Table 10-1 compares the incremental estimated costs of water for the long-term NPR and potable pathways. Note that these costs do not include the near-term NPR or potable reuse projects, and consequently do not represent the total cost of recycled water. The incremental costs of the two long-term pathways are shown here for comparison purposes to each other.

Table 10-1: Comparative Costs of Long-Term Pathways

	Long-Term NPR [1]	Long-Term Potable
Total Capital Cost	$243,200,000	$527,000,000
Annual O&M Cost	$12,400,000	$17,300,000
Total Annualized Cost [2]	$16,900,000	$44,200,000
Incremental RW Deliveries, AFY	10,000	30,800
Unit Cost of Long-Term Projects, $/AF	**$1,690**	**$1,350**

Notes:

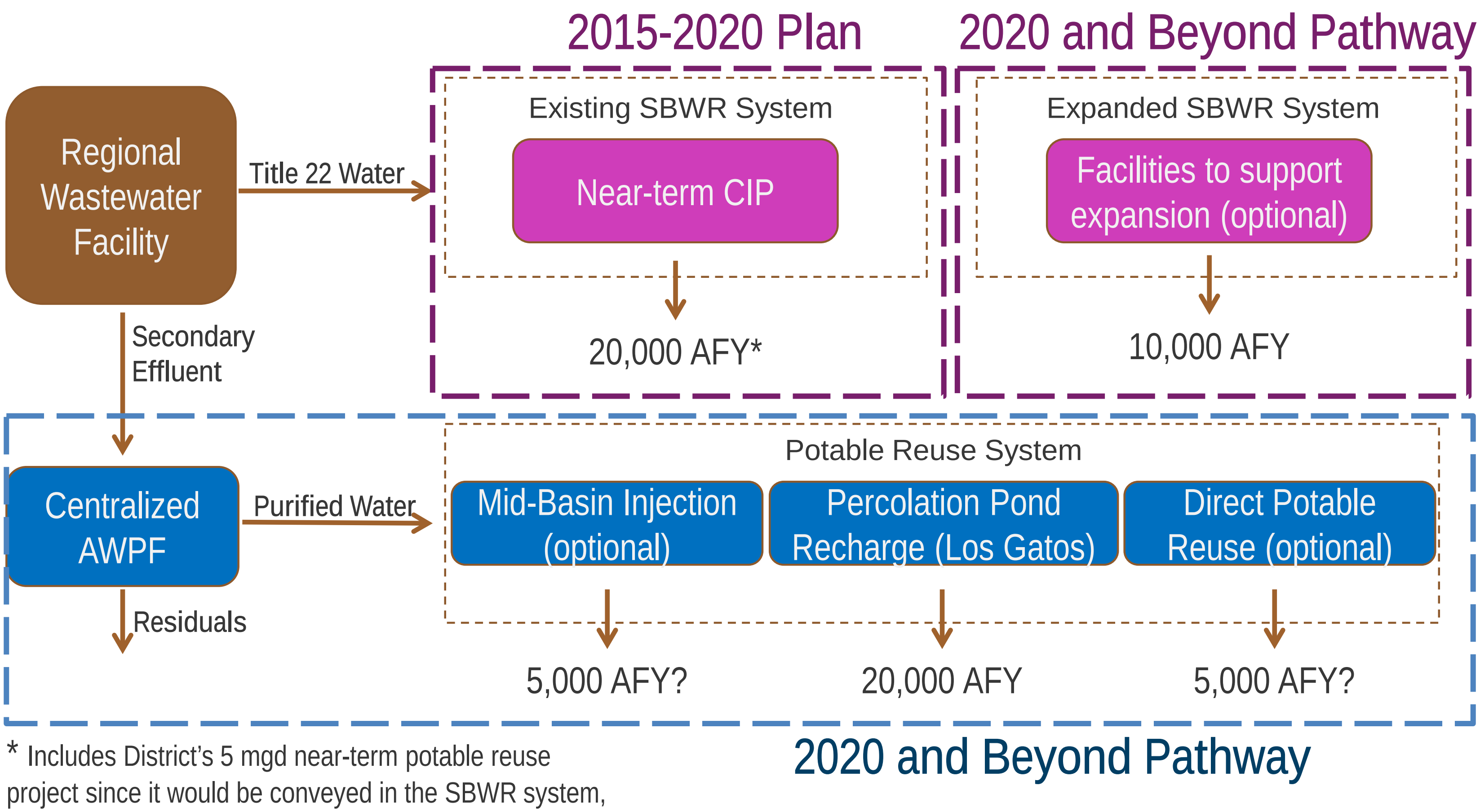
[1] *Costs shown do not include on-site retrofits or a rehabilitation and replacement fund.*

[2] *Capital costs are annualized over 30 years assuming financing rate of 5.5%, inflation rate of 2.5% for a net interest rate of 3%.*

Meeting the recycled water targets established in the Strategic Plan will require implementation of potable reuse in addition to NPR. It is likely that expansion of NPR would proceed as a retailer-driven program based on retailer preferences and their ability to recover the costs of implementing an expanded non-potable program. It is likely that development of IPR/DPR would proceed as a wholesaler-driven program with a regional focus on potable reuse to achieve the county-wide 2025 and 2035 water supply targets.

Figure 10-2 summarizes the overall framework plan for recycling effluent from the RWF.

Figure 10-2: Framework Plan for Recycling RWF Effluent



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10.2 Non-Potable Implementation Plan

10.2.1 Near-Term

The near-term NPR reliability improvements include several discrete projects that vary by costs and complexity. Rehabilitation and renewal projects such as the valve exercising program or replacement of the VFD's in PS 5 are generally straightforward and can be implemented by staff or through relatively short duration design and construction efforts. Major upgrades and large capital projects require additional study, finance planning, partnering, property acquisition, and other longer duration implementation steps. The table below describes the implementation steps for the near-term projects, with the exception of adding Zone 1 storage, which is the most complex and expensive of the near-term NPR projects and is described separately in Section 10.2.1.1

Table 10-2: Near-term NPR Reliability Project Implementation Elements

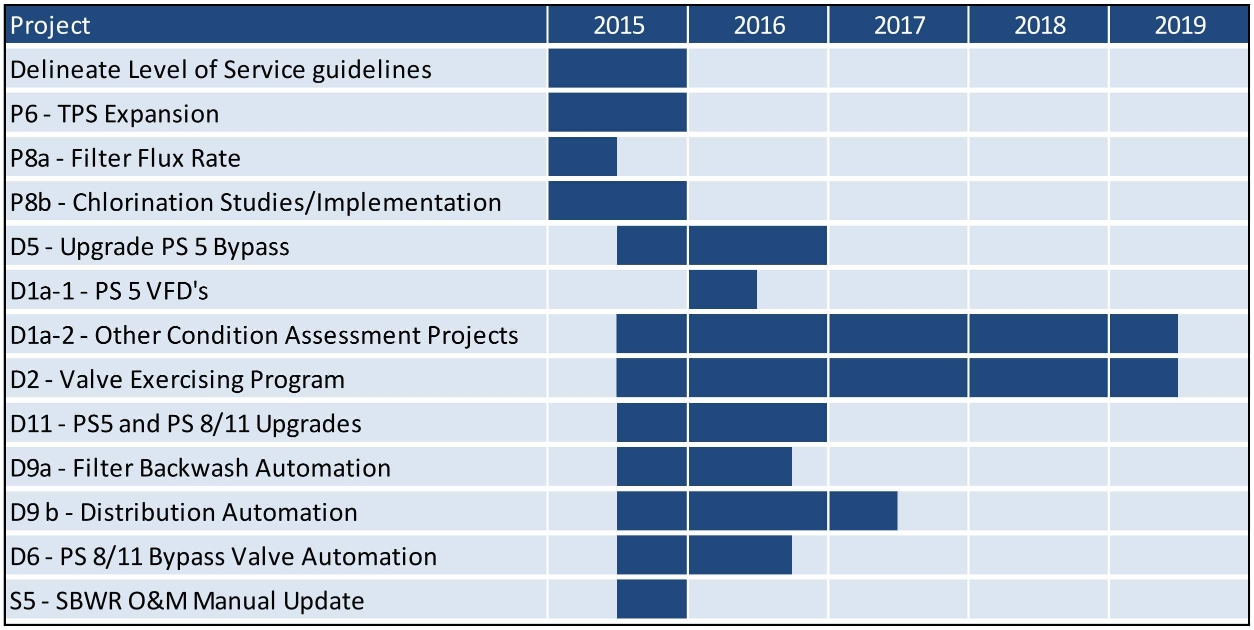
Near-Term Reliability Project [1]	Implementation Elements
Level of Service Delineation	• Develop formal LOS plan to set customer expectations and to serve as a guide in development and implementation of major SBWR system improvements.
TPS Upgrade	• Evaluate system hydraulics and define pump criteria • Evaluate building space availability for pump electrical equipment • Assess adequacy of existing power feed • Assess condition of existing pump station and determine if other minor work should be undertaken to rehabilitate the pump station. • Design • Bid and Award • Construction
Filter Flux Rate Study	• Develop Title 22 Engineer Report documenting the pilot study and validation work which have already been completed. • Submit for California Department of Public Health (CDPH) review, address comments, and obtain final CDPH approval for the rerating.
Free Chlorine Disinfection Studies/Implementation	• Complete Demonstration and Study Report • Prepare CDPH Review Report and obtain CDPH Approval • Implement Free Chlorine disinfection including chloramination modifications recommended by Study
Upgrade Pump Station 5 Bypass	• Identify the extent of operational scenarios that the bypass should support. • Determine if flow monitoring is needed. • Identify hydraulic considerations, constraints, and performance requirements for the bypass. • Assess condition of existing isolation valves near pump station 5 to facilitate project implementation. Determine if other rehabilitation work is needed to support the project. • Define if remote operation of the bypass is needed • Design • Bid and Award • Construction
PS 5 VFD Replacement	• Identify a replacement VFD and determine if other minor electrical work should be undertaken to rehabilitate the electrical system.

	• Purchase required replacement equipment and materials • RWF electricians complete the VFD replacement.
Other Condition Assessment Projects	• Implement annual program to address condition assessment projects using asset management techniques to further understand, define and prioritize SBWR asset replacement needs. • Conduct coordination/collaboration workshops should be held annually with operation staff, maintenance staff, and management to review capital priorities and any condition issues • Implement projects by scoping work, procuring consultant or assigning to RWF staff, design, bid and award, and construction
Valve Exercising Program	• Program would be implemented by RWF staff to preserve the operability and functionality of valves. • The valve exercise program would be an ongoing activity that should be carried out on a regular scheduled basis (i.e. every 6 months).
PS 5 and PS8/11 Electrical Room HVAC replacement	• Conduct HVAC system study should be undertaken to identify cooling requirements, assess alternatives, and identify recommended upgrades • Implement project by procuring consultant, design, bid and award, and construction
Filter Backwash Automation	• Conduct study to identify automation goals and objectives, define the existing system, and identify needed improvements for system automation. • If only minor conduit and wiring is needed to tie the filter controls to the existing control system, a Contractor could perform the work with RWF Control System staff providing the programming. For a more complex project, a conventional design/bid/build approach would be recommended
Distribution System Automation	• Conduct automation master plan to define automation goals and objectives, identify infrastructure upgrades like network communication, develop control strategies, evaluate costs, identify a preferred alternative and develop a detailed implementation plan. • Implement through conventional design/bid/build approach
Automate Zone Bypass Valve at Pump Station 8/11	• Implement through conventional design/bid/build approach
Update SBWR Systems Operations Manual	• Update manual to reflect current existing infrastructure, regulations, demand conditions, and operations strategies. • Update existing infrastructure, design criteria, etc. • Describe seasonal variations in operation or variations associated with various flow thresholds • Describe coordination procedure and requirements with SCVWD Silicon Valley Advanced Water Purification Center (SVAWPC) • Update Zone 3 Reservoir Operation • Incorporate Hydraulic Model results into Operations Manual • Describe approaches for pump station energy efficiency • Describe mitigation approaches for temporary shutdown or failure of various systems o Pump Stations o Storage Reservoirs o Major Trunk Lines

[1] Zone 1 Storage Project is described separately following Figure 10-3.

The preliminary implementation schedule for these near-term NPR reliability projects is shown in Figure 10-3.

Figure 10-3: Near-Term NPR Reliability Projects Preliminary Implementation Schedule



The near-term Zone 1 Storage Project is described separately in Section 10.2.1.1.

10.2.1.1 Zone 1 Storage (Yerba Buena Alternative) Implementation

The Zone 1 Storage project is the most complex and highest cost project recommended as part of the near-term NPR System CIP. Significant collaboration and numerous decisions must be made to further develop and implement the project, particularly in regard to financing, phasing, and final details of the project.

Storage Siting Study

As described in Section 4, a Storage Siting Study was completed and identified the Yerba Buena Alternative as the recommended near-term project based on the numerous benefits provided.

Predesign

The next step in the technical development of the Zone 1 Storage project is to complete predesign. This will entail developing a predesign report (3% to 5% design) for the recommended alternative including development of more detailed design criteria, refinement of hydraulic modeling/analysis, development of general arrangement drawings for the storage tank and Pump Station 11 upgrades, site and yard piping drawings, and infrastructure plans for Yerba Buena Road and Senter Road.

A key question to be answered on the pipeline alignment is how and where to cross Coyote Creek. The Coyote Creek crossing is expected to be tunneled and will have environmental permitting requirements due to waterway crossing and habitat. Tunneling operations require adequate construction stage area (may require easements) and clearance from other utilities.

The Predesign should also evaluate the feasibility of providing onsite irrigation pump stations that can take water directly from Zone 1 in lieu of installing new Zone 2 pipelines. I.e. small package onsite pump stations at the cemetery and other customers may have significant cost savings benefit compared to constructing new Zone 2 pipelines.

Outreach with existing Zone 2 users should be completed to define flow and pressure requirements for the existing irrigation systems as Zone 2 capacity will be reduced to more modest levels with the retirement of PS 5. Existing Zone 2 customers that would be converted to Zone 1 should also be contacted to verify that irrigation systems will not be negatively impacted.

The predesign report will provide the project definition needed to initiate environmental review and proceed with detailed design.

Financing Plan

Development of a financial plan and strategy will be a key task that dictates the schedule for the project. Typically, recycled water projects are financed through a combination of grants, partnerships relative to project benefits, and the State Water Resource Control Board State Revolving Fund (SRF).

The SRF program is typically used to cover financing and cost not covered by grants and partnerships. The SRF program offers 30 year financing at an interest rate of ½ the most recent General Obligation (GO) Bond Rate at time of funding approval. The interest rate has ranged from 1.7 percent to 3.0 percent over the last 10 years. Currently, the SRF program has 1% financing available through December 2015 as part of the state drought response program.

However, initial discussions with City staff have indicated that project financing may not be a viable option due to planned borrowing for the RWF upgrades. If this is the case, the project would be on a "pay as you go" approach which would require developing a capital reserve fund that could be used to pay for the project.

A "pay as you go" approach would push the project schedule out as capital funds would need to be collected and saved over several years to pay for construction. The project infrastructure could also be constructed in phases which would spread capacity expenditures. For example, the project pipeline infrastructure could be constructed first with the 4 MG storage tank and new PS 11 occurring at a later date to spread out capital expenditures.

Grant funding may be available through the following programs:

- Reclamation WaterSMART program which provides up to 25% reimbursement of project cost
- PG&E energy conservation programs
- Proposition 84 funding
- Proposition 1 Recycled Water funding

SCVWD may also participate in the project as the overall capacity of the system will be increased providing a water supply benefit for the region. The new PS11 is also a project needed to support delivery of additional 5 mgd of recycled water to Zone 3 where SCVWD has plans for an Indirect Potable Reuse project.

Environmental Review and Compliance

CEQA review and compliance is a major task and milestone for the Zone 1 storage project. The environment review process should begin following the predesign task or as soon as the recommended project elements are defined. The CEQA process is expected to take up to 12 months. If SRF financing will be used for the project, CEQA Plus requirements will need to be met.

A property/easement acquisition assessment should begin during predesign although final property/easement acquisition is dependent upon CEQA Plus compliance and would typically be completed in conjunction with the end of the CEQA process.

Design and Construction

The design phase of the project could be conducted concurrently with the CEQA Plus compliance process; this will reduce the implementation schedule although this approach may lead to some re-design to address CEQA concerns. Necessary permits should be obtained concurrently with design phase efforts. These permits may include, but are not limited to, Regional Water Quality Control Board permits, encroachment permits, and Department of Health Services permits.

A preliminary implementation schedule for the Zone 1 storage project is shown in Figure 10-4 assuming the ability to finance the improvements with SRF funds and construction of the project as one package. In a "pay as you go" approach, the schedule would be delayed until adequate capital funds were saved to support the project and a phase implementation approach would be developed. Figure 10-5 shows an example phased implementation schedule to spread-out capital expenditures. The actual implementation schedule will depend on financial capabilities, recycled water rate policies, grant availability and partnering opportunities.

Figure 10-4: Zone 1 Storage Preliminary Implementation Schedule (Assumed Financing)

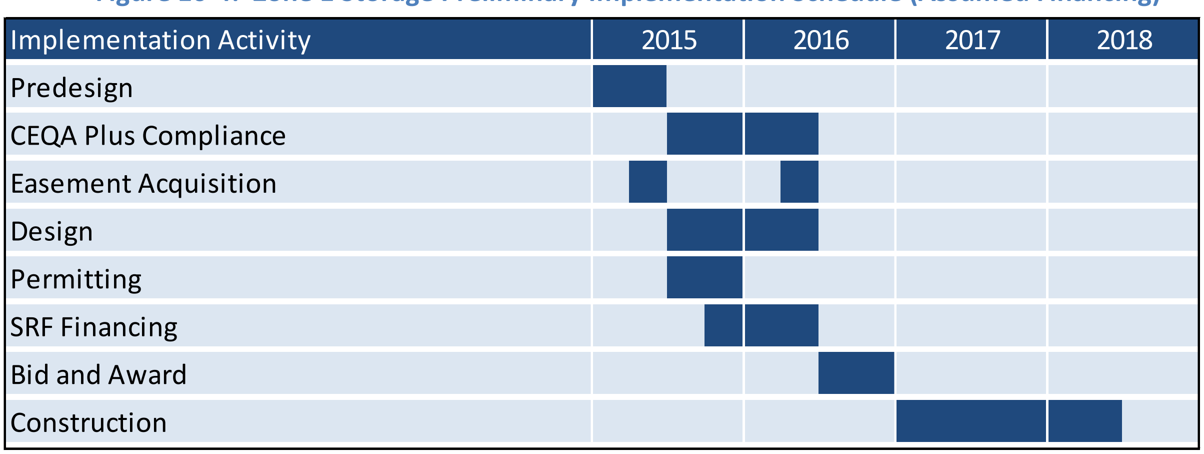
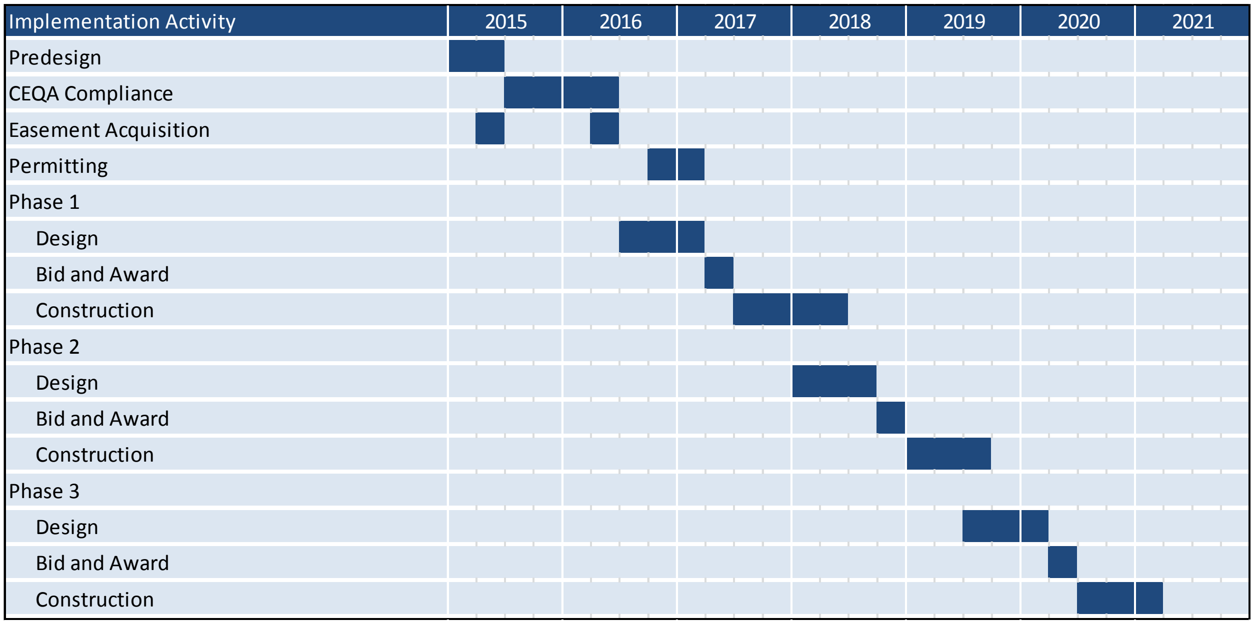


Figure 10-5: Zone 1 Storage Phased Implementation Schedule (Pay as you go Financing)

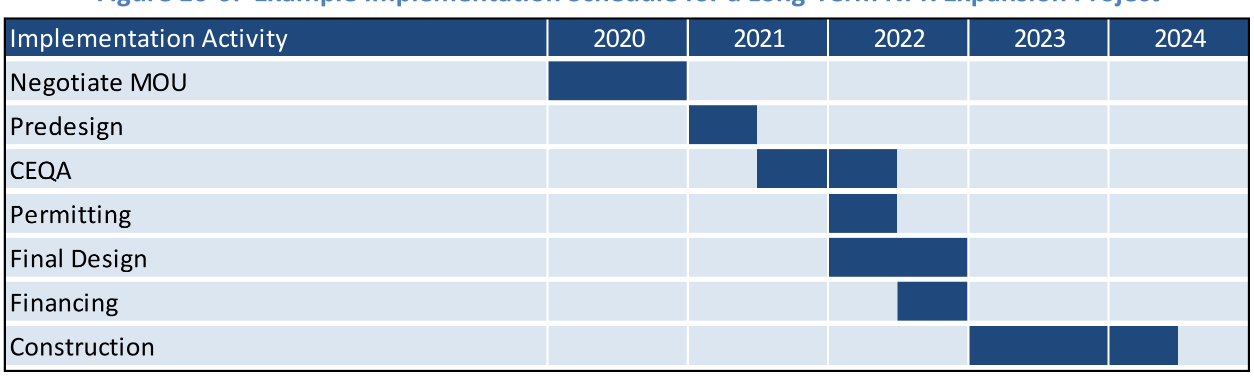


10.2.2 Long-Term

If expansion of the SBWR system occurs to serve the identified long-term NPR demands, it would likely proceed as a retailer-driven program based on retailer preferences and their ability to recover the costs of implementing an expanded program. As such, the first phase of implementation of SBWR expansion would involve development of Agreements or MOU's to define facility ownership, responsibilities with regards to funding, operations and maintenance, rehabilitation and renewal, emergency response, and regulatory compliance. The implementation of the specific project could then proceed with the normal activities of environmental documentation, permitting, design, and construction.

A long-term NPR project could take up to 5 years for implementation with the timing dependent on a specific water retailer having enough new demand to warrant expansion of the system. An example implementation schedule for a long-term SBWR expansion project is shown below in Figure 10-6

Figure 10-6: Example Implementation Schedule for a Long-Term NPR Expansion Project



10.3 Potable Reuse Implementation Plan

This section describes the implementation plans for the near-term and long-term potable reuse projects including the additional studies, engineering analyses, environmental, and permitting that are needed to progress the projects. Schedules for each project are identified.

10.3.1 Near-Term

The Ford Pond IPR project will be the first potable reuse project implemented within SCVWD. The primary next step for the project will be to initiate several additional studies in 2015 to further define the project. For example, a siting analysis will need to be completed to identify the preferred location for the AWPF. The regulatory and permitting approach will need to be developed, including a more detailed assessment of the permits required to modify and use the existing Ford recharge pond. If the permitting requirements are too extensive, then a siting analysis will need to be completed to identify the preferred location for new ponds in the vicinity of the current Ford Pond site. As soon as possible, the land will need to be procured for the AWPF and recharge ponds. The preliminary design can be completed in conjunction with the initial studies.

As part of the initial studies, a reoperations evaluation will be required for the near-term and long-term potable reuse program to assess the overall impacts to the District’s existing local and imported supplies. The District completed initial reoperations evaluations for the potable reuse concepts identified in the District’s initial potable reuse studies, which will need to be updated for the complete potable reuse program. The reoperations evaluation, supported by WEAP modeling (“Water Evaluation and Planning” system modeling), will identify additional projects and water supply management approaches to determine how to best use all sources of water and minimize carryover water. As the District expands recycled water use, including implementing potable reuse projects, a policy discussion and decision will be needed regarding recycled water and how it will be utilized in the District’s water supply plan, i.e., will recycled water be base loaded or only used as supplemental water during dry years. The economics of all sources of supply and operations need to be considered together. Recycled water by itself might be more favorable is it used as a base water supply rather than as a supplemental water supply, but the economic decisions need to account for the investments the District has already made in the existing system and/or the economics associated with use of existing surface water supplies. The reoperations study and policy decision will help guide the implementation of potable reuse projects.

Concurrent with the initial studies, the public outreach and funding/financing plan will need to be developed to allow the project to proceed on schedule. In addition, early in the project, the City and SCVWD will need to finalize agreements for SBWR agreement for recycled water and the City of San José industrial discharge permit to discharge the RO concentrate into the SJ/SC RWF sewer.

Following the completion of the initial studies and preliminary design, the project would move into final design concurrent with environmental documentation and permitting. Once the environmental documentation is complete and the permits finalized, then construction will commence.

The implementation elements for the Ford Pond IPR project that are presented in two of the activities, public outreach and funding/financing, would be implemented in conjunction with the programmatic implementation for the long-term portable reuse program. At this time it is envisioned that the environmental documentation and permitting for the Ford Pond indirect potable reuse project would be completed separately than the long-term potable reuse program, but this should be evaluated further as part of the regulatory and permitting approach developed for the Ford Pond indirect potable reuse project and the long-term program. Additionally, the conceptual-level evaluation of opportunities to implement non-potable and potable reuse in Coyote Valley could be further investigated, developed, and evaluated as the Ford Pond IPR project is developed. As noted in Section 8, there are many facets of the projects that need to be developed further if these concepts are pursued, most especially the institutional coordination between the City and the District. Two of the activities, public outreach and funding/financing, would be implemented in conjunction with the programmatic implementation for the long-term portable reuse program.

Table 10-3 is organized by seven main categories of activities. Two of the activities, public outreach and funding/financing, would be implemented in conjunction with the programmatic implementation for the long-term portable reuse program. At this time it is envisioned that the environmental documentation and permitting for the Ford Pond indirect potable reuse project would be completed separately than the long-term potable reuse program, but this should be evaluated further as part of the regulatory and permitting approach developed for the Ford Pond indirect potable reuse project and the long-term program.

Table 10-3: Ford Pond IPR Project Implementation Elements

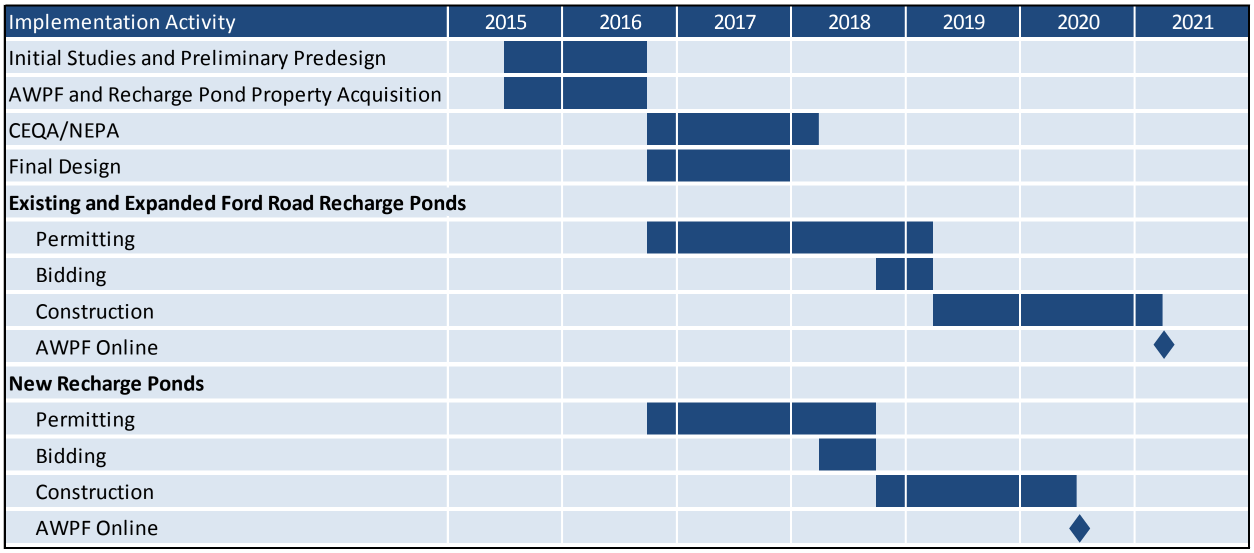
Categories	Implementation Items
Additional Studies	• Reoperations evaluation (in conjunction with long term) • Policy discussion/decision for recycled water supply (in conjunction with long term) • Siting analyses – AWPF and new recharge ponds • AWPF expansion approach • Conveyance pipeline alignment analyses (SBWR connector, purified recycled water, residuals) • Groundwater modeling/analysis • Evaluations of the potential for water recharged at the Ford recharge pond to daylight in Coyote Creek • Regulatory and permitting approach • Additional development of the Coyote Valley non-potable and potable reuse concepts
Environmental Documentation	• CEQA/NEPA

Permitting	• Potable reuse permit
	• If water daylights into Coyote Creek:
	  o NPDES permit
	  o Need to consider any impacts to the Three Creeks HCP
	• Potential permits that may be needed for the modifications to the existing Ford Road recharge pond:
	  o USCOE permit
	  o California Department of Fish and Wildlife Streambed Alteration Agreement
	• Building permits
	• Easements/ROW permits

Institutional	• Land procurement (AWPF and recharge ponds) • SBWR agreement for recycled water • City of San José industrial discharge permit
Preliminary Design Report and Final Design	*Initial 1-mgd Project* • AWPF • Pipelines • Improvements to existing recharge pond *Future 5-mgd Project* • AWPF expansion • New recharge ponds
Elements to be Combined with the Programmatic Implementation for the Long-Term Potable Reuse Program (Section 10.3.2)	
Public Outreach	• Public outreach plan and implementation
Funding/Financing	• Funding/financing plan and implementation

The Ford Pond IPR project preliminary implementation schedule is shown in Figure 10-7. The implementation schedule presents two scenarios: the first scenario assumes that the existing Ford recharge pond would be used with additional ponds located on the adjacent property and the second scenario assumes that new ponds would be developed with a separation from Coyote Creek. Assuming that the initial studies are started in 2015, the project should be complete in 2020 to 2021 depending on the location of the recharge ponds.

Figure 10-7: Ford Pond IPR Project Preliminary Implementation Schedule



10.3.2 Long-Term

The long-term potable reuse program includes implementation of three projects:

- Phase 2 – Mid-basin injection wells indirect potable reuse
- Phase 3 – Los Gatos recharge ponds indirect potable reuse
- Phase 4 – Westside injection wells indirect potable reuse or Central Pipeline direct potable reuse

This section addresses implementation items for both the programmatic elements and individual projects included in the long-term potable reuse pogrom. Programmatic elements are the items that need are common to the long-term program, such as environmental documentation, that will be implemented for the program and not separately for the individual projects.

As discussed in Section 8, the long-term program has flexibility with implementation. The Los Gatos Recharge Ponds IPR project is the anchor project for the long-term plan with the additional, smaller projects identified to supplement the Los Gatos project and meet the recycled water goals. The project phasing was based on geography and regulatory considerations. As the long-term program is advanced, the order of these projects may be adjusted based on the detailed reoperations evaluation for the recommended plan, the development of regulations, the availability of local and imported water supplies, and other factors.

Programmatic Implementation Items

The programmatic implementation items for the long-term potable reuse program are summarized in Table 10-4. Programmatic elements encompass all three projects, including additional studies, environmental documentation, permitting, public outreach, funding/financing, and institutional agreements with other agencies. The public outreach and funding/financing will be completed in conjunction with the near-term potable reuse project implementation, as will the reoperations evaluation and policy discussion/decision for recycled water supply (see discussion in Section 10.3.1). Since regulations for direct potable reuse do not currently exist, the environmental documentation and permitting would be completed for the indirect potable reuse program (i.e., Phase 4 would assume the Westside injection wells). If direct potable reuse is selected, then environmental documentation and permitting for the project would be needed at that time. Throughout the implementation of Phases 2 and 3, the development of direct potable reuse regulations and advancement of direct potable reuse projects need to be monitored to support the decision of the Phase 4 project.

Table 10-4: Long-Term Potable Reuse Projects Programmatic Implementation Items

Categories	Implementation Items
Additional Studies	• Conveyance pipeline alignment analyses • Groundwater modeling/analyses – mid-basin injection wells, Los Gatos recharge ponds, Westside injection wells • Siting analyses – mid-basin injection wells, Westside injection wells • AWPF siting and expansion approach • Regulatory and permitting approach • Additional brine management studies (Coyote Point outfall, SJ/SC RWF outfall and SVAWPC brine toxicity studies, EBDA outfall) • Monitor development of DPR regulations and advancement of DPR projects • Conceptual design report • Additional studies for the conceptual studies (small-scale temporary Mid-Basin Injection IPR project and the fast-track Los Gatos IPR project) • Flow diversion impacts to RWF • Impact of increased flow diversion on RWF operations
Environmental Documentation	• CEQA/NEPA for baseline IPR projects (mid-basin injection, Los Gatos, Westside injection); acknowledge that DPR may be a future option
Permitting	• Potable reuse permit for baseline IPR projects (mid-basin injection, Los Gatos, Westside injection); Phase 4 DPR (if selected) would require a separate permit
Institutional	• SJ/SC RWF agreement (source water for Centralized AWPF) • City of Santa Clara agreement (mid-basin injection) • Brine discharge agreements (e.g., SJ/SC RWF outfall, EBDA, etc.) • AWPF ground lease agreement • Power purchase agreement • Future AWTF siting
Elements to be Combined with the Near-Term Potable Reuse Project Implementation	
Additional Studies	• Reoperations evaluation • Policy discussion/decision for recycled water supply
Public Outreach	• Public outreach plan and implementation
Funding/Financing	• Funding/financing plan and implementation

Also identified in Table 10-4 are additional studies related to two of the conceptual studies completed as part of this Strategic Plan, which include the smaller-scale temporary injection well project (to precede the Mid-Basin Injection IPR project) and the fast-track IPR project with temporary pipeline to convey SVAWPC purified recycled water to the Los Gatos recharge ponds. As noted in Section 8, there are several elements that need to be developed in more detail. For the small-scale temporary Mid-Basin Injection IPR project, the next steps include institutional agreements between the City, the District, and Santa Clara; groundwater modeling; and the regulatory approach. For the fast-track Los Gatos IPR project, next step includes developing the concept in more detail, including institutional, engineering, and regulatory elements.

Implementation Items for Long-Term Potable Projects

The implementation items for each of the three long-term projects are presented in Table 10-5 for the mid-basin injection project, Table 10-6 for the Los Gatos recharge pond project, Table 10-7 for Westside injection project, and Table 10-8 for the Central Pipeline DPR project. Each individual project will have implementation for the following elements:

- Preliminary Design Report and Final Design for the individual project elements, such as treatment, pipelines, and recharge facilities
- Permitting specific to the project facilities, such as building permits and easements/right-of-way permits for the pipelines
- Institutional agreements for land procurement

The implementation for Phase 4 will require additional study and a decision to proceed with continued expansion of the indirect potable reuse program by adding the Westside injection wells or to proceed with direct potable reuse in the Central Pipeline. Also, since the Phase 4 project will be implemented after the near-term and the Phases 2 and 3 projects will have been in operation for several years, Phase 4 will include an update to the initial studies that will be completed as part of the programmatic implementation plan. The updates would include operating experience from Phases 2 and 3 and for current conditions. If direct potable reuse is selected for Phase 4, then the environmental documentation and permitting specific for direct potable reuse would need to be completed. Additional studies would also be required to confirm the specific treatment approach for direct potable reuse and to update the demand evaluation for purified recycled water in Central Pipeline.

Table 10-5: Mid-Basin Injection IPR Project (Phase 2) Implementation Items

Categories	Implementation Items
Preliminary Design Report and Final Design	• 5-mgd Centralized AWPF • Pipelines • Injection wells
Permitting	• Building permits • Easements/Right-of-way permits
Institutional	• Land procurement for injection wells

Table 10-6: Los Gatos Recharge Pond IPR Project (Phase 3) Implementation Items

Categories	Implementation Items
Preliminary Design Report and Final Design	• 25-mgd Centralized AWPF (20-mgd expansion) • Pipelines • Recharge basin improvements/modifications
Permitting	• Building permits • Easements/Right-of-way permits

Table 10-7: Westside Injection Wells IPR Project (Phase 4) Implementation Items

Categories	Implementation Items
Decision - Expand IPR or DPR	• Before starting Phase 4, determine if Phase 4 will expand IPR with the Westside Injection Wells IPR or implement the Central Pipeline DPR
Additional Studies	• Update initial studies based on Phases 2 & 3 operating experience and current conditions
Preliminary Design Report and Final Design	• 29-mgd Centralized AWPF (4-mgd expansion) • Pipelines • Injection wells
Permitting	• Building permits • Easements/Right-of-way permits
Institutional	• Land procurement for injection wells

Table 10-8: Central Pipeline DPR Project (Phase 4) Implementation Items

Categories	Implementation Items
Decision - Expand IPR or DPR	• Before starting Phase 4, determine if Phase 4 will expand IPR with the Westside Injection Wells IPR or implement the Central Pipeline DPR
Additional Studies	• DPR feasibility study based on advancements in regulatory setting and technology • Evaluate demand for purified recycled water in Central Pipeline • Update initial studies based on Phases 2 & 3 operating experience and current conditions
Preliminary Design Report and Final Design	• 29-mgd Centralized AWPF (4-mgd expansion) • Booster pump station and chlorination system • Pipeline and structure to connect to Central Pipeline
Environmental Documentation	• CEQA/NEPA for Central Pipeline DPR
Permitting	• Potable reuse permit for DPR • Building permits • Easements/ROW permits
Institutional	• Land procurement for pump station and chlorination system

The implementation schedule for the long-term potable reuse program is summarized in Table 10-9 and shown in more detail in Appendix 11A. The implementation schedule is based on the target on-line dates of 2025 for Phases 2 and 3 and 2035 for Phase 4, which coincides with the recycled water targets. It is assumed that Phases 2 and 3 would be implemented using the same schedule, but implementing these two projects together would exceed the 2025 recycled water target by 5,000 AFY. The capacity of the Los Gatos recharge project could be decreased by 5,000 AFY for 2025 and expanded by 5,000 AFY in 2035 to meet the 2035 target.

Table 10-9: Implementation Schedule for the Long-Term Potable Reuse Program

Phase	Start Date	Target On-line Date
Programmatic Activities		
Additional Studies	2015	-
Environmental Documentation	2016[1]	-
Potable Reuse Permitting	2017	-
Institutional Agreements	2015	-
Public Outreach	2015	-
Funding/Financing	2015	-
Phases 2 and 3	2018	2025
Decision - Expand IPR or DPR for Phase 4	2027	-
Phase 4		
Westside Injection Wells IPR	2029	2035
or Central Pipeline DPR	2027	2035

Note:
[1] *While the implementation schedule is based on meeting the 2025 and 2035 recycled water targets, the District is considering an accelerated time schedule for the potable reuse projects to provide recycled water supply before the target dates. The recommended plan and the implementation plan are flexible and projects can be implemented in a different order, or be implemented faster to achieve an earlier on-line date.*

While the implementation schedule is based on meeting the 2025 and 2035 recycled water targets, the District is considering an accelerated time schedule for the potable reuse projects to provide recycled water supply before the target dates. The recommended plan and the implementation plan are flexible and projects can be implemented in a different order, or be implemented faster to achieve an earlier on-line date. For example, the long-term implementation schedule assumes that the design phase for Phases 2 and 3 would start once environmental documentation is complete and permitting is mostly complete. The design phase could be completed concurrently with environmental documentation and permitting, to shorten the implementation schedule, although this approach is more risky and creates the potential for re-design if the environmental restrictions and permitting conditions are different than anticipated. Several of the programmatic activities, such as the additional studies, institutional agreements, public outreach, and funding/financing should start as early as possible in 2015. The environmental documentation would start in 2016 when the initial studies are completed, and the potable reuse permitting would start in 2017 when environmental documentation is at the mid-point of completion. The preliminary design reports for Phases 2 and 3 would commence in 2018, when environmental documentation is complete, to allow those projects to meet the 2025 recycled water target.

As shown in Table 10-9, a decision about the Phase 4 project (i.e., Westside injection indirect potable reuse or Central Pipeline direct potable reuse) is needed in 2027 to allow the 2035 recycled water target to be met. If the decision is to proceed with direct potable reuse, then the project implementation would begin immediately; if the decision is to proceed with indirect potable reuse through Westside injection, then the project would need to start by 2029 to achieve the desired online date of 2035. The direct potable reuse will have longer implementation schedule than the Westside injection wells because the environmental documentation and permitting for direct potable reuse need to be completed. If the District wants to accelerate the implementation of the Phase 4 project, then the Westside injection wells IPR project could completed in parallel with the Phases 2 and 3 projects. The start date for the DPR project would be limited by the development of DPR regulations, or advancements in the regulatory approval of similar projects prior to issuance of regulations.

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11. Governance and Finance

11.1 Background

As part of the visioning step in this Strategic Planning initiative, both the wastewater management and water supply perspectives on maintaining and expanding SBWR were identified. It was noted that the historic driver for SBWR, as prescribed in the South Bay Action Plan to reduce RWF effluent flows to protect the salt marsh habitats of the South San Francisco Bay, has diminished. Effluent flow projections from the RWF to the salt marsh habitat are comfortably below the flow management triggers established in the RWF's NPDES permit. Meanwhile, increased water recycling and in particular potable reuse has become a key part of the District's future water supply, as evidenced by the District's county-wide recycled water target of 50,000 AFY by 2035.

The Strategic Plan has verified the interest and opportunity of expanding the use of RWF effluent as a regional water supply. Technical water recycling pathways (NPR and potable) and cost implications have been identified, and the SBWR Technical Advisory Steering Committee (TASC) recognizes that as SBWR evolves, its governance structure and financing plan may need to evolve. This shift is necessary to maintain alignment with both the projected benefits and beneficiaries of water recycling and the breadth of issues and decisions associated with the evolution of RWF effluent reuse.

Although a rigorous assessment of future governance and financing strategies was not conducted as part of Strategic and Master Planning, two tasks were completed to support the TASC in future discussions and decisions regarding governance. First, a review of California settings where regional water recycling initiatives, including both NPR and potable reuse, was conducted to illustrate examples of governance structures that have successfully implemented these programs. Second, a wholesale rate model tool was developed to support decision-makers in evaluating various financing scenarios. This section presents the outcomes of these tasks and summarizes previous collaboration and governance discussions regarding SBWR.

11.1.1 History of Collaboration

The RWF and the District have a history of recycled water collaboration and partnering on funding pursuits and financing of SBWR. Collaborative efforts date back to the early 1990s, when the RWF and District worked together on the following recycled water initiatives.

- Reclamation Reuse for Groundwater Recharge study – This study was jointly funded by the RWF and District.
- Title XVI funding - In 1992, the RWF and District secured federal authorization through the US Bureau of Reclamation Title XVI program.

The SBWR Collaborative, which was initiated in 2002, led to the long-term agreements currently guiding RWF and District collaboration. The SBWR Collaborative established objectives that it considered relevant to the ownership of the SBWR system and concluded that:

- It is advantageous for the RWF and District to work together to maximize recycled water beneficial uses.
- Enhancing the quality of recycled water is key to increasing beneficial uses.
- The status quo was not working and a long-term agreement between the RWF and District was needed.

The SBWR Collaborative was the prompt for the formation of the Recycled Water Liaison Committee, which was comprised of RWF and District elected officials who were tasked with negotiating the terms of a long-term agreement. In 2010, the RWF and District executed the Integration Agreement and Ground Lease and Property Use Agreement.

- Integration Agreement - Key terms are the formation of a Recycled Water Policy Committee (RWPAC) that meets in April of each year to discuss budget and operations, cost sharing, grant opportunities, expansion opportunities for NPR and advanced treatment facilities, and changes to wholesale and retail sales of recycled water; the formation of Technical Working Groups comprised of staff from the Cities of San José and Santa Clara and District as needed to advise the RWPAC; and the RWF's contribution to advanced water purification (AWP) and District's contributions to SBWR operations.
- Ground Lease and Property Use Agreement - Key terms are the reservation of land at the San José/Santa Clara Regional Wastewater Facility (RWF) for AWP, the sizing of the AWP at 10 mgd of microfiltration and 8 mgd of reverse osmosis, water quality provision of 500 mg/L TDS, and a 40 year term of agreement. The AWP facility is now known as the Silicon Valley Advanced Water Purification Center (SVAWPC).

A more thorough discussion of the history of collaboration between the City and District is presented in Appendix 1A - Visioning Report.

11.1.2 Existing SBWR Governance

The RWF's governing structure, the Treatment Plant Advisory Committee (TPAC) and the City of San José (City) Council, make policy and budget decisions related to SBWR to prioritize the interests and needs of the RWF and sanitary sewer rate payers of San José, Santa Clara, and the Tributary Agencies. This governing structure served SBWR well when the primary driver for the system was linked to the NPDES permit condition regarding minimizing effluent flows during critical months to maintain salt marsh habitat. However, as water supply needs in the region are driving expanded use of recycled water from SBWR beyond what is needed for NPDES compliance, it has been recognized that this governing structure may need to be reviewed and potentially reconfigured.

Recognizing this, and as noted in the discussion on previous collaboration, the City (on behalf of the RWF) and the District commenced in February 2002 on a ten-month collaborative stakeholder process—

the South Bay Water Recycling Collaborative—to develop recommendations for an institutional framework for long-term ownership, operation, maintenance and future expansion of SBWR, including review and suggestions on water quality and cost issues. The goal of the Collaborative effort was to recommend an institutional framework that would most effectively meet the long-term water supply and wastewater discharge needs of the community now and in the future. The key conclusion was that two options for institutional arrangement beyond the status quo met the goals of the Collaborative with sufficient likelihood of success to be explored in further depth:

a) Development of a new Joint Powers Authority (JPA) responsible for the recycled water system; and

b) Development of a long-term comprehensive agreement between the RWF and the District for managing and enhancing the SBWR system.

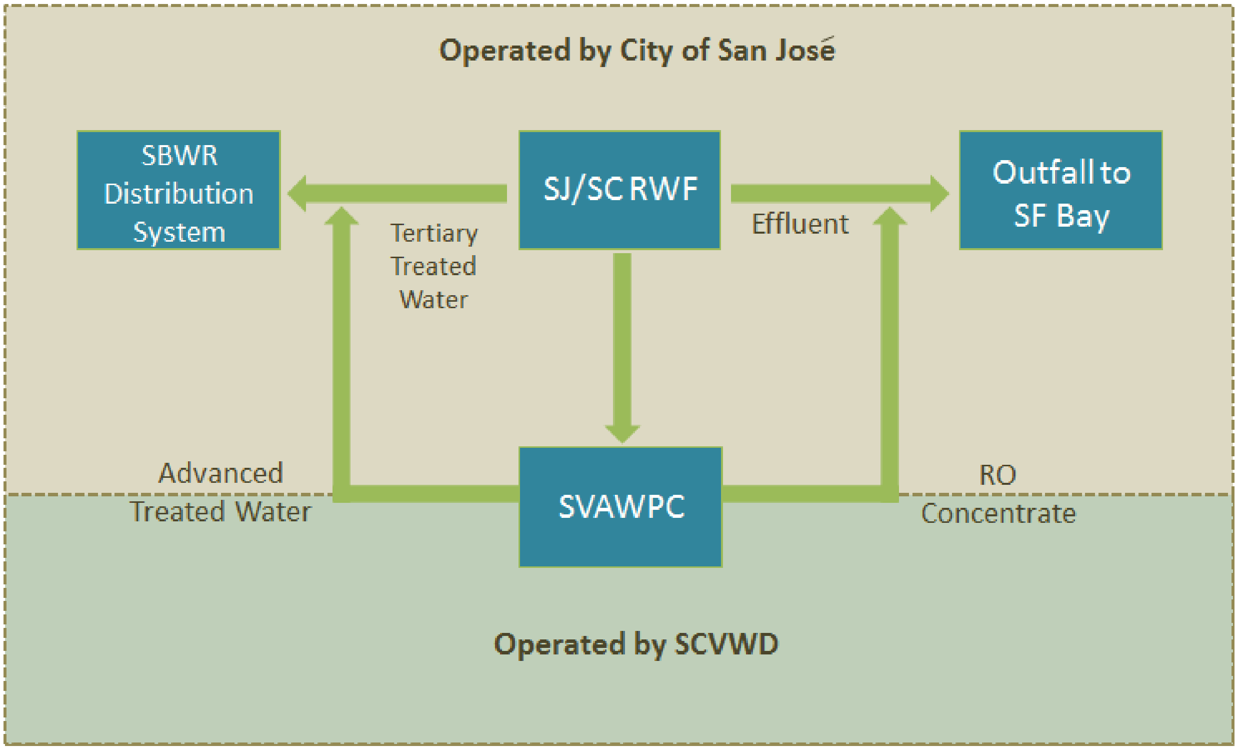
It was acknowledged in the Collaborative that, in order to make final recommendations and develop the necessary institutional and financial framework, additional details on these options needed to be developed. Follow-up discussion and coordination between the RWF and the District led ultimately to the Integration Agreement.

In March 2010, the San José City Council approved the Integration Agreement between the City and District which provided a framework for the City and District to financially and administratively support the SVAWPC and the production and use of recycled water in Santa Clara County consistent with each party's separate and distinct interests: wastewater treatment and disposal for the City, and water quality and supply for the District. It also provides a framework to coordinate and cooperate to achieve the most cost effective, environmentally beneficial use of recycled water to meet both water supply and wastewater treatment and disposal needs. The Integration Agreement was a significant step toward establishing a partnership between the City and District to support the burgeoning water supply interest in SBWR. Moving forward, the provisions of this agreement need to be aligned with SBWR's existing TPAC oversight structure. This institutional complexity is one of the drivers for consideration of alternative governance structures as SBWR evolves as a water supply-driven initiative.

Another outcome of the Collaborative, helping to facilitate an increase in recycled water use, was that the District partnered with the City to build the SVAWPC on RWF lands. The SVAWPC, which is operated by the District, takes secondary treated effluent from the RWF and treats it with microfiltration (MF), reverse osmosis (RO) and ultraviolet (UV) disinfection prior to blending with the current Title 22 quality recycled water, thereby enhancing the overall quality of recycled water distributed by SBWR (i.e., lower TDS). Another purpose of SVAWPC is to demonstrate the ability of advanced treatment technologies to produce a product of sufficient quality and reliability to support future potable reuse.

The existing SBWR governance structure is illustrated in Figure 11-1.

Figure 11-1: Existing SBWR Operating Structure



11.2 Review of Example Governance

To complement this previous body of work on governance, a review of existing regional water recycling initiatives involving both NPR reuse and potable reuse was conducted. The purpose of this review was to identify the operating structures and revenue-generating strategies used by other agencies to achieve broad success with water recycling.

The following sections present the context and results of the governance review of existing regional water recycling systems.

11.2.1 Definition of Recycled Water System Components

Governance may be considered in terms of both the breadth of services provided and the institutional framework used to provide those services. To aid in this discussion, recycled water systems (similar to SBWR) may be broken into component parts, each with its own particular functions, facilities, owners, operators, beneficiaries, funding sources, and decision-making structures. Each component has unique permitting requirements as well. Recycled Water System components are organized as follows:

1. Wastewater treatment/effluent management – This component includes sewer systems, primary and secondary treatment facilities, and effluent management facilities (e.g., outfalls). It

is considered part of the "recycled water system" for the purposes of this discussion since some recycled water institutional frameworks include wastewater treatment functions.

2. Tertiary Treatment – This component includes tertiary treatment facilities. Tertiary treatment systems are typically driven by either a wastewater treatment need (NPDES discharge requirements) or a recycled water need (Title 22 recycled water quality requirements), or both. WDRs and Water WRRs typically establish the operational and water quality requirements for tertiary treatment.
3. Advanced Water Purification – This component is typically included to improve recycled water quality for potable reuse (groundwater replenishment) or TDS and nitrogen reduction for various NPR end uses. AWP facilities in Southern California most often utilize MF, RO, and AOP to achieve quality objectives. Depending on the end use, these facilities can have dedicated pipelines or can supply water to a regional or local distribution system along with Title 22 quality water (i.e., blending for irrigation purposes). WDRs and WRRs typically establish the operational and water quality requirements for AWP.
4. Wholesale Distribution – This component includes pipelines, operational storage, appurtenances, and pump stations. They generally involve larger-diameter, "backbone" pipelines that serve a regional distribution purpose.
5. Retail Distribution – This component includes pipelines, operational storage, appurtenances, and booster stations. They generally involve smaller-diameter pipelines that serve a local distribution system. This component also includes customer interface functions such as site supervisor training, assistance with on-site conversions, coordination with state and county public health agencies, and billing at individual site meters.
6. Indirect Potable Reuse (IPR) – This component includes facilities for recharging water to the groundwater aquifer, such as spreading basins and injection wells. WRRs typically establish the operational requirements for IPR facilities.
7. Pumpers – This component includes production wells and other facilities used to extract groundwater supplies from underlying aquifers. It is not considered part of the "recycled water system" for the purposes of this discussion, but it is included to provide context since some recycled water institutional frameworks include specific responsibilities to pumpers (e.g., water wholesaler acting as a groundwater basin manager or watermaster).

11.2.2 Breadth of Services

First, the breadth of services for a recycled water system is considered. The RW component parts mentioned above may be organized such that more or fewer of them are grouped together under one organizational structure. For the purposes of this discussion, breadth of services is grouped into one of three categories: "all inclusive", "hybrid", or "all separate".

The "All Inclusive" breadth of services means that a single entity owns/operates all recycled water components (or nearly all). It involves the fewest number of decision-makers (i.e., boards or councils), the broadest set of services, the most control over expansions and upgrades, and the least amount of coordination. On the other hand, this configuration can be difficult to initially set up, depending on the number of agencies already involved in providing water resources services in the area. The "all inclusive" breadth of services typically requires only one permittee for recycled water facilities, especially if the agency provides wastewater treatment services. An example of this breadth of services is Inland Empire Utilities Agency (IEUA).

The "Hybrid" breadth of services means that one entity owns/operates more than one recycled water component but not all components. All aspects of this breadth of services fall in between the "all inclusive" and "all separate" configurations. Examples of "Hybrid" organizations are Orange County Water District (OCWD) and West Basin Municipal Water District (WBMWD).

The "All Separate" breadth of services means that different entities own/operate each of the recycled water components. It involves the highest number of decision makers, the most focused set of services (per agency), the least control over expansions and upgrades, and the most coordination. The "all separate" breadth of services typically requires several permittees for facilities. An example of this configuration is the recycled water system owned/operated by Long Beach Water Department (LBWD) in cooperation with Los Angeles County Sanitation Districts (LACSD), Water Replenishment District of Southern California (WRD), and Los Angeles County Department of Public Works (LACDPW).

11.2.3 Institutional Framework

Second, the institutional framework of recycled water systems is considered. Once the breadth of services has been determined, three different institutional frameworks may be implemented: (1) the special district, (2) the joint powers agreement/authority, or (3) "agreements only".

The **special district** is a framework that may be suited for an "All Inclusive" or "Hybrid" breadth of services, though the institutional framework is technically independent of the breadth of services. State law defines a special district as "any agency of the state for the local performance of governmental or proprietary functions within limited boundaries." These agencies derive their authority from separate "principal acts", generic statutes that apply to all special districts of that type (e.g., municipal water districts). They are formed by the Local Agency Formation Commission (LAFCO) and require voter approval in the geographic area that will be impacted by fees and services. Special districts are governed by elected boards and provide only those services allowed by state law. Advantages of special districts are that they tailor services specifically to local needs, they link costs more directly to benefits, and they tend to be more responsive to constituent needs. Disadvantages may include some degree of inefficiency (if too many are operating), hindrance of regional planning, and in some cases decreased accountability (as special district board elections tend to have low voter turnout).

A **Joint Powers Agreement** or **Joint Powers Authority** may also be suited for an "All Inclusive" or "Hybrid" breadth of services. A JPA is a formal, legal agreement between two or more public agencies that share a common power and want to jointly implement programs, build facilities, or deliver services. JPA's derive their authority from a joint exercise of powers act, are formed by joint exercise of powers agreement, are governed as determined by JPA member agencies, and may provide any services agreed upon by the participating agencies. Advantages of JPAs are that they are flexible and easy to form, they tend to be more efficient, they can sell bonds and raise funds, they provide a framework for cooperation on regional solutions, and they help to obtain competitive grant funding that relies on demonstrated partnerships. Disadvantages may be that they require mutual trust, they can be hard to keep together, they can be hard to dissolve, and they can be hard to understand.

An **"Agreements Only"** institutional framework may be suited for an "All Separate" breadth of services. In this type of framework, each of the participating agencies may itself be a special district and/or a JPA. Advantages of this arrangement are that few, if any, changes are necessary other than the terms of the agreements between participating entities. Disadvantages are that there may be a lack of consistency in the terms of agreements (more potential for this the more parties there are) and that there is likely to be a large number of elected board members necessary for any decisions about expansions or upgrades to a recycled water system.

11.2.4 Examples of Recycled Water Systems

This section presents a brief summary of several existing recycled water systems in Southern California that have approached organizational structure in different ways. The research for this section was conducted using information available from websites, existing documents, and interviews conducted with staff. The following staff were contacted and interviewed as shown in Table 11-1.

Table 11-1: Agency Staff Contacted About Recycled Water Governance

Name	Agency	Position	Phone Number
John Kennedy	OCWD	Executive Director of Engineering and Local Resources	(714) 378-3304
Earle Hartling	LACSD	Water Recycling Coordinator	(562) 908-4288, x2806
Shivaji Deshmukh	WBMWD	Assistant General Manager	(310) 217-2411
Chris Berch	IEUA	Executive Manager of Engineering/Assistant General Manager	(909) 993-1762
Sylvie Lee	IEUA	Manager of Planning and Environmental Compliance	(909) 993-1646
Ted Johnson	WRD	Chief Hydrologist	(562) 275-4240
Margie Nellor	NEA, Inc.	President (regulatory/permitting)	(512) 374-9330

The "All Inclusive" – Inland Empire Utilities Agency

IEUA is included as the example of an "all inclusive" breadth of services because it controls nearly all of the recycled water system components. IEUA was formed in 1950 as Chino Basin Municipal Water District, for the purpose of supplementing water supply in the region with imported water. In 1973, the agency assumed control of all sewerage facilities, ultimately expanding its responsibilities to include regional wastewater treatment with domestic and industrial disposal systems and energy recovery and production facilities. The agency officially became IEUA in 1988 to reflect the expansion of the breadth of services.

The IEUA recycled water system was originally constructed using funds from the United States Bureau of Reclamation (USBR) Title XVI program, State Revolving Fund (SRF) grants, low-interest loans, and local funding provided by the Metropolitan Water District of Southern California (MWD). Retail distribution was constructed by the member agencies. Future investments in the system would be financed as summarized in Table 11-6 (Section 11.2.5).

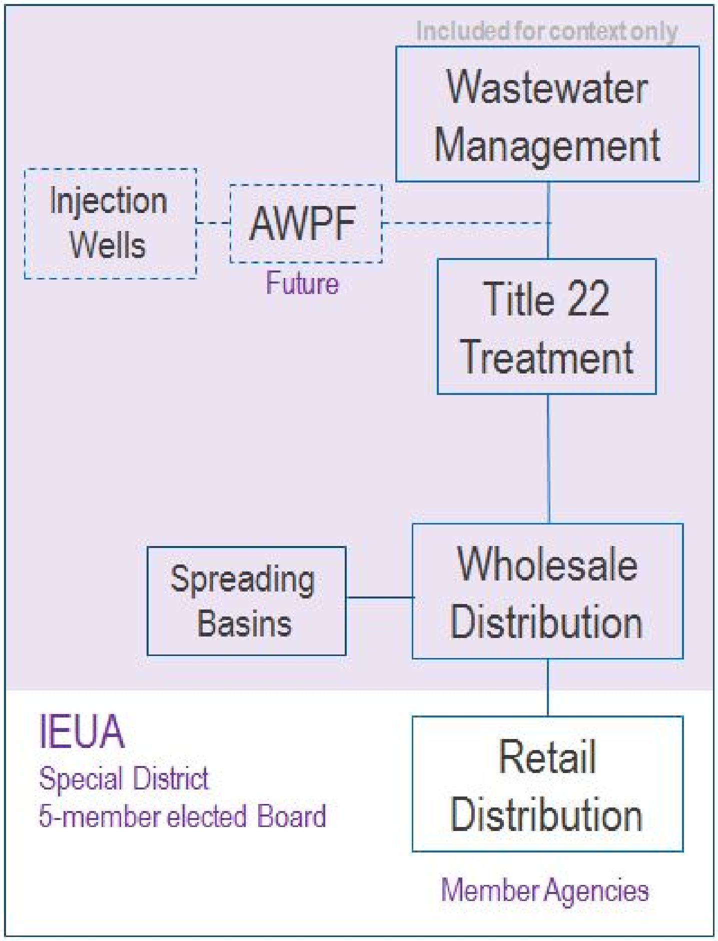
Today, IEUA provides imported water, wastewater treatment, recycled water, compost, energy, and groundwater replenishment services to eight member agencies that include both cities and water districts. IEUA’s service area is 35 miles east of Los Angeles, spanning 242 square miles in the southwest corner of San Bernardino County. IEUA’s recycled water system began in 1995 with service to El Prado Park and Golf Course. The system was later expanded to include groundwater recharge operations in the late 1990’s. IEUA now has five water reclamation plants and currently produces approximately 40,000 AF of recycled water compared to 5,000 AF in 2000.

IEUA is one of five agencies that owns and operates spreading facilities for the Chino Basin. There are a total of nineteen spreading facilities used for recycled water recharge, each with separate permitting requirements. As IEUA’s service area is nearly contiguous with the Chino Groundwater Basin and since the pumpers in the basin are all IEUA member agencies, IEUA works in cooperation with the Chino Basin Watermaster to manage recharge and pumping in the basin. The Chino Basin Watermaster is responsible for paying the operational costs to spread recycled, imported, and stormwater in Chino Basin (with replenishment fees) in conjunction with IEUA. Spreading basin operations are governed by a four-party agreement between IEUA, the Watermaster, Chino Basin Water Conservation District, and the San Bernardino Valley Flood Control District. NPR recycled water service is governed between IEUA (wholesale) and member agencies (retail) by the “Regional Contract”. Individual ordinances are used to set rates.

Currently, IEUA does not have any AWP facilities, but the agency is considering expanding their recycled water system to include advanced treatment to provide capacity for year-round groundwater recharge with recycled water. Desalting facilities owned and operated by IEUA are a part of the agency’s overall strategy to increase recycled water use in their service area. These facilities are currently used to create a hydraulic control barrier to prevent high salinity groundwater from entering the Santa Ana River. A Non-Reclaimable Wastewater System (NRWS) provides removal of salts from the service area.

As mentioned above, IEUA is set up as an “all inclusive” organization. The agency owns and operates most of the components of the system, from wastewater management all the way to IPR operations, some spreading basins, wholesale distribution, some retail distribution functions, and the desalting facilities. Water Recycling Requirements for the system are issued jointly to IEUA and the Chino Basin Watermaster. IEUA does not own or operate the retail recycled water distribution systems for its member agencies. The breadth of services for IEUA is shown in Figure 11-2.

Figure 11-2: Conceptual Breadth of Services for IEUA



This agency is set up as an "all inclusive" because the initial relationships to member agencies were configured to provide wholesale imported water and replenishment services for groundwater pumpers. Then, the recycled water system was built using a strategy of making recycled water available for seasonal agricultural use and using the status of a "regional system" to gain access to grant funding from federal and state sources. The retail status of each individual member agency was preserved when the recycled water system was developed, but many of the support services are provided by IEUA.

In general, IEUA feels that the governance as a special district has allowed them the autonomy to make relatively independent decisions about recycled water expansion and to take advantage of multiple state and federal funding sources as a larger, "regional" entity. At the same time, they have been able to maintain the separation of services desired by their member agencies for retail potable and recycled water. IEUA does participate in some customer interface activities, such as education and site supervisor training. The regional nature of the agency also allows them to take a leadership role in other types of programs, such as an in-lieu groundwater recharge program wherein agricultural entities cease pumping, a member agency pays for recycled water supply to the agricultural demands, and the member agency receives groundwater pumping credit from the Chino Basin Watermaster. However, there are some institutional issues that need to be addressed as the agency continues to expand the recycled water system. For example, the pro rata formula for establishing entitlement to recycled water for each member agency no longer effectively apportions recycled water now that demands for recycled water in peak months is approaching the limit of available supplies.

The management of the various recycled water components for IEUA is summarized in Table 11-2, including function(s), facilities, ownership, operation, beneficiaries, funding sources, decision-making, and governance structure for each component.

Table 11-2: Summary of Recycled Water System Components – IEUA

Function	Facilities	Owner (CIP)	Operator (O&M)	Beneficiary	Funding	Expansion Decisions	Gov. Structure
Wastewater Management							
Sewerage Collection	Sewers, PS, ocean outfall	IEUA	IEUA	Wastewater ratepayers	Capacity Charges Service Rates	5-member IEUA Board	Special District
Treatment	Primary, Secondary	IEUA	IEUA	Wastewater ratepayers	Capacity Charges Service Rates	5-member IEUA Board	Special District
Tertiary							
Treatment	Dual media filters	IEUA	IEUA	Member Agencies (Pumpers)	RW whole-sale rates	5-member Board	Special District
AWP (potential future for injection)							
Treatment	MF/RO/ UV	IEUA	IEUA	Member Agencies (Pumpers)	RW whole-sale rates	5-member Board	Special District
Wholesale Distribution							
Regional Distrib.	Pipelines, PS, etc.	IEUA	IEUA	Member Agencies (RW retailers)	RW whole-sale rates	5-member Board	Special District
Retail Distribution							
Local Distrib.	Pipelines, booster stations, customer interface	Chino, Chino Hills, FWC, MVWD, Upland, Ontario, CVWD		Member Agency Retail NPR Ratepayers	Member Agency RW retail rates	Boards and Councils	Special Districts and Cities
GW Replenishment							
Replenish-ment	Spreading Facilities	IEUA SBCFCD SCE CBWCD Upland	IEUA	Member Agencies (pumpers)	Water-master Replen-ishment Fee	Boards and Councils	Special Districts and Cities
Provide Blend Water	n/a	IEUA	IEUA	Member Agencies (pumpers)	Water-master Replen-ishment Fee	5-member Board	Special District
Monitor-ing	Monit. wells	IEUA	IEUA	Member Agencies (pumpers)	Water-master replen-ishment fee	5-member Board	Special District
Pumping							
Pump GW Supply	Production Wells	Member Agencies (pumpers)		Member Agencies (pumpers)	Water-master replen-ishment fee	Boards and Councils	Special Districts and Cities

The "Hybrids" – Orange County Water District and West Basin Municipal Water District

Two examples of the "hybrid" breadth of services are described in this section for OCWD and WBMWD.

Orange County Water District

Initially formed in 1933 by a special act of the California Legislature as a special district, the agency's original purpose was to protect Orange County rights to surface water from the Santa Ana River. The mission has evolved over time. Today, the OCWD manages the Orange County Basin that provides high-quality groundwater to 19 municipal and special water districts and ultimately to approximately 2.4 million people in north and central Orange County. Total water demands for OCWD's service area are 450,000 AFY.

OCWD's primary objective is to recharge the groundwater basin with surface water from Santa Ana River, imported water from MWD, and recycled water from Orange County Sanitation District (OCSD). To accomplish this, the district maintains percolation ponds in the cities of Anaheim and Orange and operates facilities to provide each type of replenishment water supply. The groundwater basin is not adjudicated, so OCWD does not control pumping amounts or new well construction; but the district does function as the groundwater basin manager and has the power to set rates for pumping. The 19 member agencies that pump groundwater managed by OCWD operate 400 wells.

OCWD's recycled water system began with Water Factory 21, which operated from 1976 to 2004 to provide reliable, drought-resistant water supply to the Orange County Seawater Intrusion Barrier. This facility used advanced treatment to generate 15 mgd of recycled water and 5 mgd of reverse osmosis recycled water for blending with the overall recycled water supply to reduce TDS. Starting in 2004, the Interim Water Factory 21 operated while the GWRS was being constructed, to provide barrier water and to serve as a training facility.

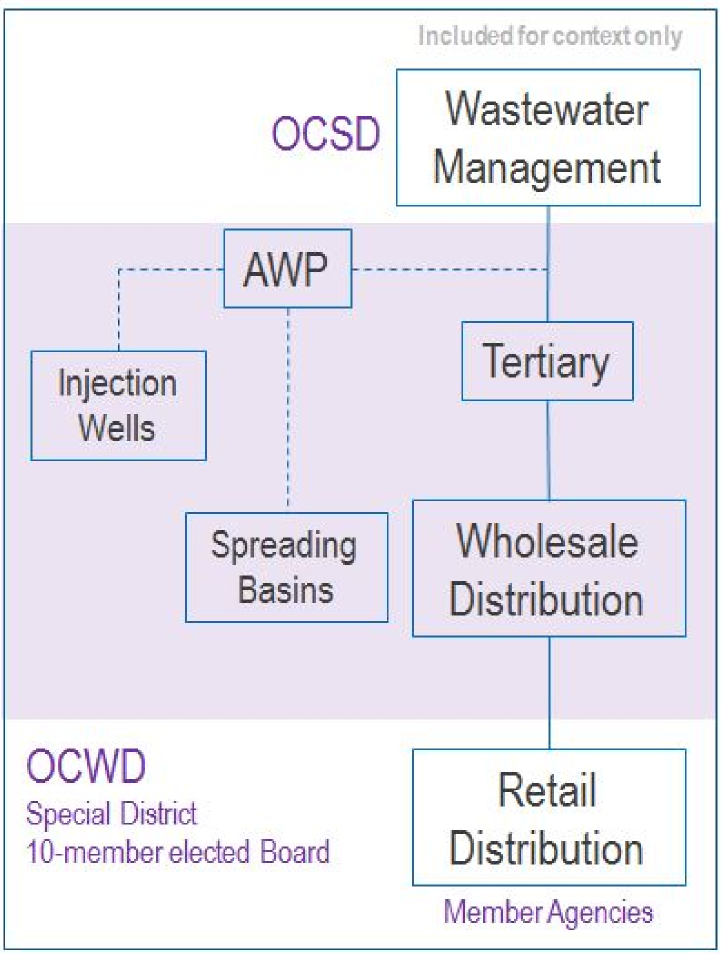
In parallel with the seawater barrier system, and in response to the drought period of the late 1980s, a tertiary recycled water program known as "Green Acres" was developed in 1991. The program provides recycled water for landscape irrigation at parks, schools, golf courses, and some industry. Today this system generates approximately 8,800 AFY of supply for Costa Mesa, Fountain Valley, Huntington Beach, Newport Beach, and Santa Ana. It includes a recently purchased reservoir from Santa Ana.

The GWRS is the centerpiece of OCWD's recycled water system. It was developed as a partnership between OCSD and OCWD, both of whom signed a Joint Cooperative Agreement (but not a JPA). OCSD agreed to pay a portion of the GWRS capital costs to avoid the construction of a new ocean outfall. The agreement also includes a provision for OCSD to provide secondary-treated effluent to OCWD at no charge. OCWD's role in GWRS was to pay the other portion of capital costs and to operate and maintain the facilities. The district's objectives for the project were to address fluctuations in available replenishment water from the Santa Ana River and imported sources and to expand the overall capacity of Water Factory 21 to continue to successfully operate the Seawater Intrusion Barrier. The GWRS currently produces 70 mgd of AWP recycled water; approximately 30 mgd is provided to the Seawater Intrusion Barrier and 40 mgd is conveyed to a pump station, 13-mile pipeline, and finally to the Kraemer, Miller, and Miraloma Recharge Basins for percolation to the aquifer. Turnouts for potential future direct injection were included in the pipeline design. OCWD also operates a series of monitoring wells associated with the recharge operations.

The OCWD Green Acres system was originally constructed using funds from the SRF program, certificates of participation long-term debt, and a reserve fund. Retail distribution was constructed by the member agencies. The GWRS system was funded jointly by OCWD and OCSD in addition to Prop. 13, DWR, SWRCB, USBR, CEC, and EPA grants. Future investments in the system would be financed as summarized in Table 11-6 (Section 11.2.5).

With respect to the recycled water system, OCWD is set up as a “hybrid”. The district owns and operates most of the components of the system, from tertiary treatment all the way to IPR operations, including both the barrier and the spreading basins. However, OCWD does not provide retail recycled water service to its member agencies. Water Recycling Requirements for the GWRS system are issued to OCWD and for the Green Acres system are also issued to OCWD. Brine concentrate from the GWRS is discharged into OCSD’s final effluent stream prior to ocean discharge and is regulated under OCSD’s NPDES permit. The breadth of services for OCWD is shown in Figure 11-3.

Figure 11-3: Conceptual Breadth of Services for OCWD



This agency is set up as a "hybrid" because the initial relationships with member agencies were to provide replenishment and groundwater management services only, not retail potable water service. The member agencies in this region prefer to provide the retail distribution component. In its primary capacity as a groundwater management agency, OCWD had a specific set of benefits to achieve from the GWRS that pertain to groundwater recharge and overall water supply reliability. To this end, regional facilities like backbone pipelines and the "Green Acres" reservoir are collectively managed, owned, operated, and funded by OCWD. But the customer interface with recycled water end users is not.

In general, OCWD feels that the "hybrid" arrangement works well for the entities in this region because it allows the agency to operate independently using pre-existing institutional frameworks. Retail potable water providers have been able to continue in this capacity as retail recycled water providers. The autonomy of a special district governance has given them the flexibility to plan, design, and construct an extremely innovative groundwater replenishment project that provides a locally-sustainable supply. The GWRS will further expand from 70 mgd (current) to 100 mgd and then 130 mgd in two more phases.

The management of the various recycled water components for OCWD is summarized in Table 11-3, including function(s), facilities, ownership, operation, beneficiaries, funding sources, decision-making, and governance structure for each component.

Table 11-3: Summary of Recycled Water System Components – OCWD

Function	Facilities	Owner (CIP)	Operator (O&M)	Beneficiary	Funding	Expansion Decisions	Gov. Structure
Wastewater Management							
Sewerage Collection	Sewers, PS, ocean outfall	OCSD	OCSD	Wastewater ratepayers	Fees, charges, prop. tax	25-member Board (cities, sewer agencies)	Special District
Treatment	Primary, Secondary	OCSD	OCSD	Wastewater ratepayers	Fees, charges, prop. tax	25-member Board (cities, sewer agencies)	Special District
Tertiary							
Treatment	Dual media filters	OCWD	OCWD	Costa Mesa, Fountain Valley, Huntington Beach, Newport Beach, Santa Ana	RW whole-sale rates	10-member Board	Special District
AWP							
Treatment	MF/RO/ UV	OCSD/ OCWD	OCWD	Member Agencies (GW pumpers)	Replen-ishment Assessment (RA); Basin	10-member Board	Special District

					Equity Assessment (BEA)		
Wholesale Distribution							
Regional Distrib.	Pipelines, PS, etc.	OCWD	OCWD	19 Member Agencies (RW retailers)	RA; BEA	10-member Board	Special District
Retail Distribution							
Local Distrib.	Pipelines, booster stations, customer interface	Costa Mesa, Fountain Valley, Huntington Beach, Newport Beach, Santa Ana	NPR Retail Customers	Member Agency RW retail rates	Boards and Councils	Special Districts and Cities	
GW Replenishment							
Replenish-ment	Spreading Facilities	OCWD	OCWD	19 Member Agencies (RW retailers)	RA; BEA	10-member Board	Special District
	Seawater Intrusion Barrier	OCWD	OCWD				
Provide Blend Water	n/a	OCWD	OCWD	19 Member Agencies (RW retailers)	RA; BEA	10-member Board	Special District
Monitor-ing	Monit. wells	OCWD	OCWD	19 Member Agencies (RW retailers)	RA; BEA	10-member Board	Special District
Pumping							
Pump GW Supply	Production Wells (400)	19 Member Agencies (GW Pumpers)		19 Member Agencies (RW retailers)	RA; BEA Assessment	10-member Board	Special District

West Basin Municipal Water District

Originally formed in 1947 as a special district, this agency is a water district that provides imported and recycled water to a 185 square mile service area that includes 17 coastal cities and nearly 1,000,000 people. Specifically, WBMWD purchases imported water from the Metropolitan Water District of Southern California (MWD) and wholesales approximately 220,000 AFY to cities and private water companies.

In addition to wholesaling imported water, WBMWD also initiated a recycled water program in the early 1990s. The agency obtains secondary-treated effluent from the City of Los Angeles, Bureau of Sanitation (LA SAN) Hyperion Treatment Plant and conveys it in a pump station and pipeline that WBMWD owns and operates. The effluent is treated to five different water quality levels at the agency's Edward C. Little Water Reclamation Plant (ECLWRP) and at three satellite treatment facilities, all operated by WBMWD. These five levels of recycled water quality are:

1. **Title 22 tertiary** recycled water for industrial, commercial, and landscape irrigation end users
2. **Nitrified tertiary** recycled water for industrial cooling towers
3. **Softened reverse osmosis** recycled water for groundwater recharge in the West Coast Basin Barrier Project (WCBBP), a series of injection wells operated to prevent seawater intrusion into the regional coastal aquifer underlying WBMWD's service area
4. **Pure reverse osmosis** recycled water for industrial refinery low-pressure boiler feed water
5. **Ultra-pure reverse osmosis** recycled water for industrial refinery high-pressure boiler feed

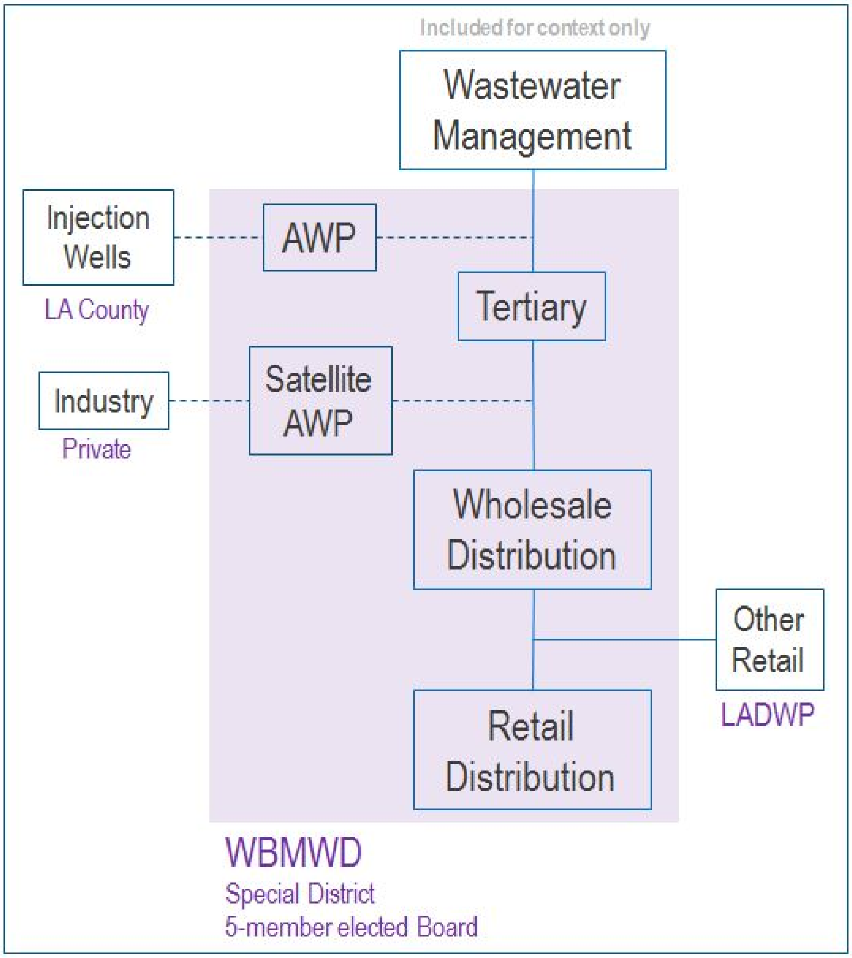
The district provides approximately 36,000 AFY of recycled water in total, with the largest user being WCBBP.

The WBMWD system was originally constructed using funds from the USBR Title XVI program, state grants under DWR, the US Army Corps, and debt which is supported by water rates. This includes the retail distribution systems. Future investments in the system would be financed as summarized in Table 11-6 (Section 11.2.5).

With respect to the recycled water system, WBMWD is set up as a "hybrid". The district owns and operates many of the components of the system, from tertiary treatment all the way to retail distribution. The only exception to this characterization is that the agency does not own or operate the wastewater management component or the WCBBP (i.e., the IPR component). [19] Water Recycling Requirements are issued to WBMWD for the NPR system and to both WBMWD and LACDPW for the WCBBP. Brine concentrate from the AWP operation is discharged to LA City's Hyperion Pump Station and ocean outfall under a separate NPDES permit issued specifically to WBMWD. The breadth of services for WBMWD is shown in Figure 11-4.

[19] WBMWD provides recycled water to one retail water purveyor that operates a separate distribution system, the Los Angeles Department of Water and Power (LADWP).

Figure 11-4: Conceptual Breadth of Services for WBMWD



The district was set up as a "hybrid" recycled water agency in the 1990s mainly due to a combination of a very proactive and forward-thinking Board of Directors, who wanted to support long-term local water supply reliability solutions (driven partially by a recent period of drought at the time), and a lack of initiative from any of the smaller water districts and cities in the area. WBMWD also had a very proactive general manager who supported taking a leadership role in developing a regional recycled water program. The local water agencies that could have provided retail potable water services preferred to set up a "pass through" arrangement, whereby WBMWD owns and operates all recycled water distribution pipelines and provides all customer interface functions. The retail water agencies only add a mark-up charge to account for loss of potential sales in their respective service areas.

In general, WBMWD feels that the organization as a "hybrid" agency and special district has allowed the flexibility and autonomy to develop a fast-growing and very diverse recycled water system while also offering realistic incentives for industrial users and the WCBBP. The configuration as a "hybrid" agency for recycled water has been supported by the special district structure and has allowed expansion decisions to be managed by the WBMWD Board with very little interference or opposition from constituents within the region. WBMWD funds the recycled water system with recycled customer rates and with a Reliability Service Charge (RSC) that is paid by potable water customers. Operating costs for the barrier injection wells are provided by the Los Angeles County Flood Control District (LACFCD) Flood Maintenance Fund.

The management of the various recycled water components for WBMWD is summarized in Table 11-4, including function(s), facilities, ownership, operation, beneficiaries, funding sources, decision-making, and governance structure for each component.

Table 11-4: Summary of Recycled Water System Components - WBMWD

Function	Facilities	Owner (CIP)	Operator (O&M)	Beneficiary	Funding	Expansion Decisions	Gov. Structure
Wastewater Management							
Sewerage Collection	Sewers, PS, ocean outfalls	LA SAN (City of LA)	LA SAN (City of LA)	Wastewater ratepayers	Sewer Service Charge	5-member LADPW Board	City Bureau with Director
Treatment	Primary, Secondary	LA SAN	LA SAN	Wastewater ratepayers	Sewer Service Charge	5-member LADPW Board	City Bureau with Director
Tertiary							
HTP PS & Treatment	Dual media filters	WBMWD	WBMWD	NPR ratepayers	RW rates and RSC	5-member Board	Special District
AWP							
Treatment	MF/RO/ UV	WBMWD	WBMWD	Industrial/ WCBBP ratepayers	RW rates and RSC	5-member Board	Special District
Wholesale Distribution							
Regional Distrib.	Pipelines, PS, etc.	WBMWD	WBMWD	All WBMWD ratepayers	RW rates and RSC	5-member Board	Special District
Retail Distribution							
Local Distrib.	Pipelines, booster stations, customer interface	WBMWD LADWP (West Side)	WBMWD LADWP (West Side)	All WBMWD ratepayers LADWP NPR ratepayers (West Side)	RW rates and RSC LADWP RW rates	5-member Board 5-member Board of Commiss.	Special District Municipal
GW Replenishment							
Replenish-ment	WCBBP injection wells	LACDPW	LACDPW	WRD and Groundwater pumpers	LACFCD Flood Maint. Fund	5-member Board of Supervisors	County
Provide Blend Water	n/a	n/a	n/a	WRD and Groundwater pumpers	Replen-ishment fee (pumper)	5-member Board	Special District
Monitor-ing	Monit. wells	WRD	WRD	WRD and Groundwater pumpers	Replen-ishment fee	5-member Board	Special District
Pumping							
Pump GW Supply	Production Wells	Water Districts, cities, corporations, individuals		Groundwater pumpers	n/a	Varies	Varies

The "All Separate" – Long Beach Water Department

One example of the "all separate" breadth of services is discussed in this section for the recycled water system partially owned and operated by the Long Beach Water Department (LBWD). The system is also partially owned and operated by the LACSD, the WRD, and the LACDPW.

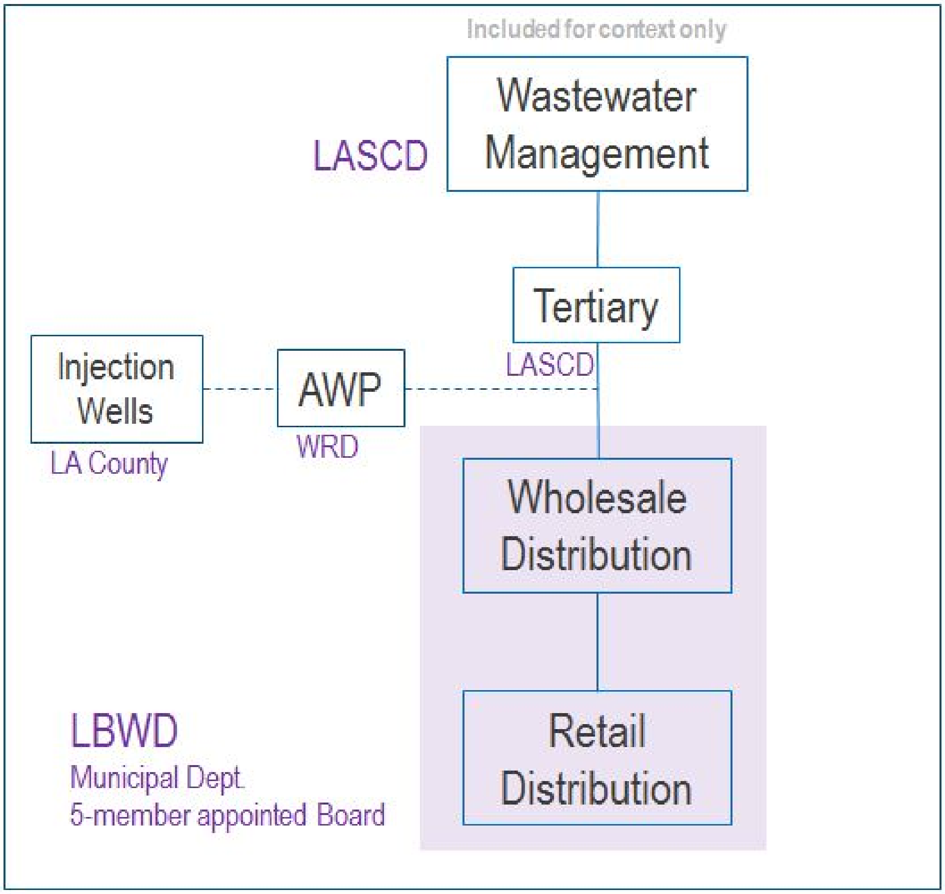
The LBWD was formed in 1911 to deliver dependable water supply to the City of Long Beach. Then, in 1931, an independent 5-member board of commissioners was formed and the agency became a founding MWD member agency. LBWD currently provides water and sewer services to 460,000 people in the city service area.

LBWD's recycled water system was initially completed in 1973 and expanded in 1984. The recycled water supply was always supplied by a tertiary-treatment water reclamation plant owned and operated by LACSD. LBWD began a multi-phase program in 1980 for landscape irrigation. Also, in 1995, recycled water service to the THUMS oil islands was re-established to re-pressurize the oil-bearing strata in the subsurface (initially started in 1971). Finally, in 2005, the Leo J. Vander Lans AWP facility began operation because WRD needed a more reliable water supply for the Alamitos Gap Barrier Project (AGBP).

The LBWD system was originally constructed using funds from debt which is supported by water and recycled water rates. This includes the retail distribution systems. The AWP facility at was constructed by WRD using DWR grant funding and replenishment fee funds. Future investments in the system would be financed as summarized in Table 11-6 (Section 11.2.5).

The current total recycled water provided to customers is approximately 4,500 AFY; expansion plans will increase this amount to 9,000 AFY. Water Recycling Requirements are issued to LACSD for the NPR system and to LACDPW and WRD for the AGBP. The breadth of services for LBWD and its partner agencies is shown in Figure 11-5.

Figure 11-5: Conceptual Breadth of Services for LBWD



The LBWD is set up as an "all separate" system because existing agencies already provided the benefits for each of the recycled water system components, except for AWP. The need for AWP facilities was driven by WRD and need to provide reliable supply to barrier, and there was no reason to have this benefit provided by LACSD or LBWD. In addition, LBWD already provided retail water service to city areas, so it was a simple transition for the agency to begin providing recycled water retail distribution service too.

In general, LACSD feels that the "all separate" breadth of services has worked well for the LBWD recycled water system because each responsible agency "does what they do best." LACSD was already operating the water reclamation plant (with regulated discharge to the San Gabriel River), LBWD already provided retail potable water service, WRD built and operated the AWP facilities to supply the seawater barrier, and LACDPW already operated the barrier injection wells. An arrangement linked by agreements was all that was needed, in this case, to provide each set of services to each set of beneficiaries. Operating costs for the barrier injection wells are provided by the LACFCD Flood Maintenance Fund.

The management of the various recycled water components for LBWD is summarized in Table 11-5, including function(s), facilities, ownership, operation, beneficiaries, funding sources, decision-making, and governance structure for each component.

Table 11-5: Summary of Recycled Water System Components – LBWD

Function	Facilities	Owner (CIP)	Operator (O&M)	Beneficiary	Funding	Expansion Decisions	Gov. Structure
Wastewater Management							
Sewerage Collection	Sewers, PS, ocean outfall	LACSD	LACSD	Wastewater ratepayers	Conn. Fee; Sur-charge	Board of mayors, supervisors	Partnership of Special Districts
Treatment	Primary, Secondary	LACSD	LACSD	Wastewater ratepayers	Conn. Fee; Sur-charge	Board of mayors, supervisors	Partnership of Special Districts
Tertiary							
Treatment	Dual media filters	LACSD	LACSD	Wastewater ratepayers	Conn. Fee; Sur-charge	Board of mayors, supervisors	Partnership of Special Districts
AWP							
Treatment	MF/RO/ UV	WRD	LBWD	West Coast Basin pumpers	Replen-ishment Fee	5-member board	Special District
Wholesale Distribution							
Regional Distrib.	Pipelines, PS, etc.	LBWD	LBWD	NPR customers	RW rates	5-member board	City Charter
Retail Distribution							
Local Distrib.	Pipelines, booster stations, customer interface	LBWD	LBWD	NPR customers	RW rates	5-member board	City Charter
GW Replenishment							
Replenish-ment	Seawater Intrusion Barrier	LACDPW	LACDPW	West Coast Basin pumpers	LACFCD Flood Maint. Fund	5-member Board of Supervisors	County
Provide Blend Water	n/a			West Coast Basin pumpers	Replen-ishment Fee	5-member board	Special District
Monitor-ing	Monit. wells	WRD	WRD	West Coast Basin Pumpers	Replen-ishment Fee	5-member board	Special District
Pumping							
Pump GW Supply	Production Wells	various		West Coast Basin Pumpers	n/a	various	various

11.2.5 Investments in Future Infrastructure

Of particular interest in the consideration of potential future governance structures for SBWR are the historic and potential funding sources and lead agencies involved in the "example" system's investments. Table 11-6 is a compilation of the information provided in the preceding sections. In general, Southern California recycled water systems were built with a combination of debt financing and state and federal grant funds. Expansions are funded with a variety of sources but rely largely on low interest loans, grants, and assessment fees.

Table 11-6: Historical and Future Investments in Recycled Water Infrastructure

Agency	Breadth of Services	Historical Investments:	New Investments (Expansions):
IEUA	WW + T22 + Wholesale (+GW basin manager and some retail support)	Wholesale: IEUA built with Title XVI, SRF grants, low-interest loans, and MWD LPP (original program) Retail: member agencies built AWPF: none existing	Wholesale: IEUA pays for "regional" pipelines[1] with SRF loans, grants, bonds, and wholesale rates/fees; tries for MWD LRP sometimes Retail: member agencies, retail rates AWPF: would be constructed and funded by IEUA using grants, loans, and rates
OCWD	T22 + Wholesale (+GW basin manager)	Wholesale: OCWD built Green Acres (T22 system) with SRF loans, Certificates of Participation long-term debt, and OCWD reserve fund Retail: member agencies built AWPF: built for GWRS by OCSD/OCWD and funded with Prop. 13, DWR, SWRCB, USBR, CEC, and EPA grants ($93M); remainder of $481M capital cost provided by SRF loan and bonds (not connected to T22 system)	Wholesale: OCWD pays for wholesale pipelines with replenishment assessment funds Retail/Retrofits: member agencies using retail rates, or end users pay AWPF: OCWD will build and fund expansion using IRWM grant funding, SRF loans, replenishment funds
WBMWD	T22 + Wholesale + Retail	Wholesale: WBMWD built with rates, standby charges, MWD LRP, fixed payments Retail: WBMWD built along with wholesale system (switches to retail water agencies at customer sites)[2] AWPF: WBMWD constructed and funded with rates, standby charges, MWD LRP, fixed payments	Wholesale: WBMWD pays for wholesale pipelines with rates, standby charges, MWD LRP, fixed payments Retail: WBMWD AWPF: WBMWD constructs and funds with rates, standby charges, MWD LRP, fixed payments
LBWD	Wholesale + Retail	Wholesale: LBWD built with bonds, rates Retail: LBWD AWPF: built by WRD with grant funding and replenishment fee funds	Wholesale: LBWD pays for wholesale pipelines with wholesale and retail rates Retail: LBWD AWPF: WRD will build and fund expansion using IRWM grant funding (Prop. 84), Federal Title XVI, and replenishment fee funds

Notes:

1. *Defined as pipelines that serve more than one member agency*
2. *Exceptions are LADWP and WRD*

11.3 Potential Governance Structures for SBWR

As noted at the beginning of this section, discussion regarding the governance and financing of SBWR occurred periodically beginning in the early 2000's. A key objective of this Strategic and Master planning initiative was to update the ongoing discussion based on potential long-term infrastructure and operational requirements for SBWR and an assessment of example regional water recycling systems that operate both NPR and potable reuse systems. The outcomes of this updated discussion are presented in this section and provide a basis for focused governance and financing discussions to be held as part of the implementation of the Strategic and Master Planning recommendations.

11.3.1 Coordination Issues

As potential governance structures are considered, it is helpful to identify some of the areas of coordination that will be necessary to address ownership, financing, regulatory, and other issues related to governance as the SBWR program continues to evolve. Table 11-7 summarizes some of these areas of coordination identified in this Strategic and Master Planning.

Table 11-7: Governance Coordination Issues

Topic	Issue/Decision	Comment
NPR Wholesale / Retail system interface	Establish ownership and funding of future extensions to the NPR system.	Current SBWR setting is hybrid. Some retailers own/operate extensions; others are included in wholesale system.
Wholesale Recycled Water Rate	Near-Term: Determine District's cost of water as described in Silver Creek Agreement Long-Term Establish methodology and basis for establishing future NPR wholesale rate structure as well as cost of secondary effluent for the IPR/DPR alternatives	Dependent on ownership (above) and regional interest in facilitating expansion of NPR versus potable reuse.
Residuals Management (especially RO Concentrate)	Identify opportunity for residuals management through existing RWF NPDES permit and develop additional/alternative residuals management strategies and costs as needed to support achieving potable reuse goals.	A suite of options was identified during master planning and will need to continue to be assessed based on analysis of SVAWPC RO concentrate testing, evolution of NPDES permit conditions, and conversations with regulators, South San Francisco (SF) Bay environmental interests, and adjacent Bay dischargers.
RWF Discharge to South SF Bay	Develop strategy for maintaining RWF discharge considering South SF Bay environment (water quality, Endangered Species Act) and regional water supply benefits and implications.	The environmental benefits/tradeoffs of establishing a robust regional recycled water supply and maintaining a healthy South SF Bay environment needs to be established to provide the basis for a regional strategy governing discharges to the South SF Bay.
RWF effluent allocation plan	Develop procedure for allocating RWF effluent to alternative market sectors (NPR and potable reuse).	This is predominantly a water entity decision about how recycled water supports local water supply reliability: through water conservation (NPR) or raw water supply augmentation (potable reuse).

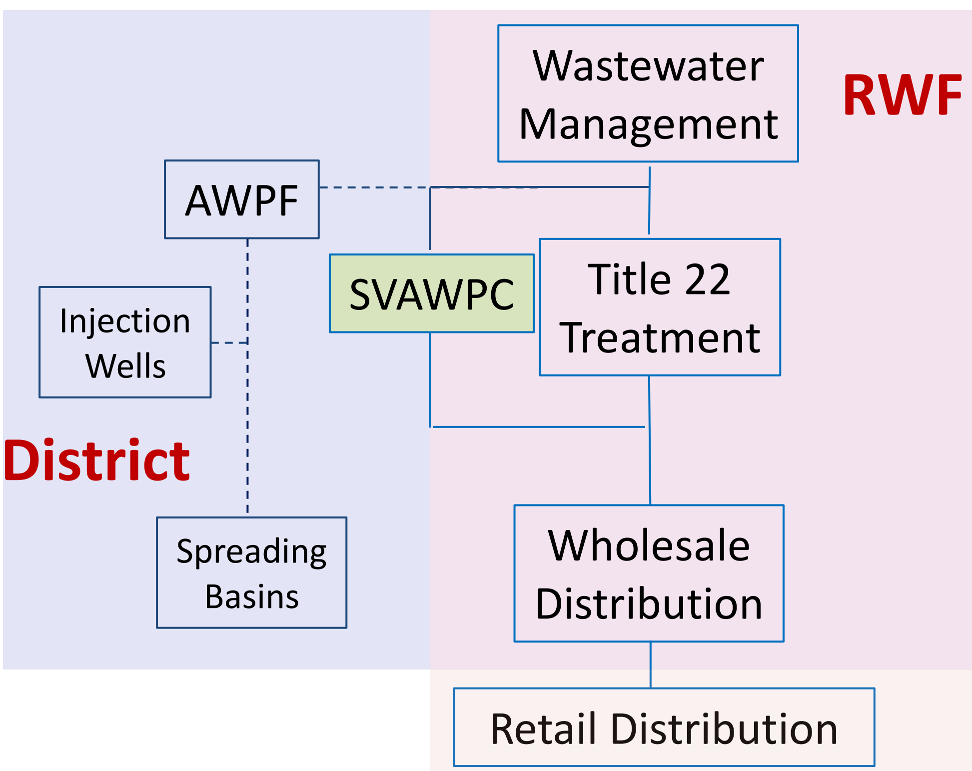
11.3.2 Discussion of Governance

A governance workshop was conducted as part of the Strategic and Master Plan to review past governance outcomes and discuss findings of the existing regional water recycling agency review. This workshop included senior staff from the City, District, City of Santa Clara, and TASC members, and was facilitated and supported by the RMC team. Two key discussion areas of discussion emerged in the governance workshop:

- Evolution of the existing SBWR governance (combination of RWF (partners and tributary agencies) and Integration Agreement (City and District)) into a long-term structure that best supports SBWR as a regional water supply initiative
- Future roles and relationship between the existing SBWR structure and water retailers (currently various agreements and relationships)

Regarding the evolution of SBWR to a regional water supply initiative, it was acknowledged that the existing SBWR governance structure, a combination of RWF (San José/Santa Clara partnership with input by tributary agencies) and the Integration Agreement (City of San José/District), provides a set of mechanisms to move forward to implement near-term recommendations coming out of this Strategic Plan; however, they do not necessarily constitute an optimum structure to accommodate strategies to achieve the long-term SBWR recycled water targets. Figure 11-6 below represents a potential operational structure of SBWR that could be achieved through augmentation of the existing Integration Agreement to include a separate potable reuse system operated by the District.

Figure 11-6: Potential Operational Structure of SBWR to Meet Near-Term Goals

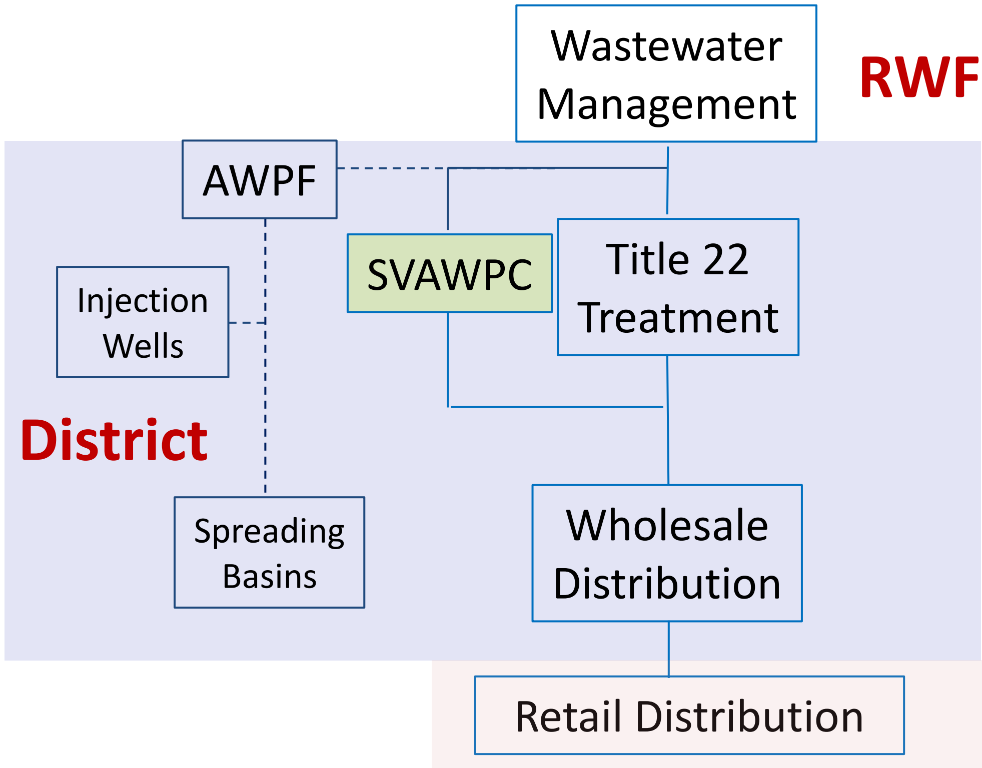


Advantages of using the Integration Agreement as a pathway to govern SBWR include:

- Maintains RWF control to assure continued water recycling and associated diversion. The existing NPDES permit maintains a commitment to water recycling and summer month discharge targets. Although current flow projections suggest that even without effluent diversion through SBWR, the RWF needs to maintain control and authority over SBWR until alternative strategies are established to provide assurance that effluent diversion through water recycling will be maintained.
- Simplifies handling of SBWR legacy debt. Construction of SBWR was funded in part through state and federal grant funding and loans. Funding covenants and the payoff of legacy debt from the construction of SBWR would need to be addressed if another entity were to acquire SBWR facilities.
- Integration Agreement provides appropriate structure. Considerable discussion and effort went into the formulation of the Integration Agreement, which establishes a basic partnership structure and term between the City and the District, an advisory committee, and fiscal oversight capability. This agreement could be amended to include expansion of the SBWR NPR system and provision of secondary effluent to the District in support of a separate potable reuse system.

As noted in the discussion of operating regional water recycling systems, each example governance structure is led by either a regional water wholesaler or a groundwater basin manager. In all cases, the lead entity is a special district. The general observation is that a regional water supply agency, operating as a special district (such as the District), best fits SBWR's future long-term infrastructure and operational needs. This structure is illustrated below in Figure 11-7.

Figure 11-7: Potential Operational Structure of SBWR to Meet Long-Term Goals



Advantages of this structure include:

- Provides maximum assurance that Regional recycled water targets are met. The long-term targets established for the Strategic and Master Plan are based on the District's water supply needs, in terms of both yield and implementation timeframe. As noted, the wastewater diversion needs alone would not support meeting these water supply targets.
- Supports tailoring recycled water options into regional water supply strategy. As noted in Section 9 – Regional Opportunities, the District's water supply plan is centered on maintaining a "full" groundwater basin. Both NPR reuse and DPR support that goal through in-lieu means, i.e. delivering recycled water to customers directly rather than through groundwater replenishment and pumping. IPR, on the other hand, is a direct supplement to the goal of maintaining a "full" groundwater basin. The District will need to establish the appropriate mix of NPR, IPR and DPR to best support this mission through integrated water supply planning.
- Enables spreading recycled water costs across the water supply spectrum. The benefits derived through the expansion of SBWR are primarily water-supply related. The District, through its groundwater and treated water rate structures, is in the best position to align water-related SBWR costs with appropriate revenue-generating pathways as discussed later in this section.

The other key area of governance discussion concerned the future roles and relationships between the existing SBWR structure and water retailers. Currently, SBWR facilities include all delivery infrastructure to the customer meter, including the TPS, remote pump stations, and operational storage. Supplemental system extensions have been added over the years through partnership funding and construction arrangements between SBWR and particular retailers. SBWR maintains wholesale agreements with each retailer, with varying provisions and cost-share arrangements. As SBWR evolves, the relationship and roles of SBWR as a wholesale entity relative to the retailers may evolve. In the IEUA and OCWD operating structures noted previously, retailers maintain conveyance infrastructure distinct from the wholesale system. San Jose Water Company is an example of a retailer that has taken on more responsibility for funding and implementation of its distinct recycled water conveyance infrastructure, and provides an example of how future extensions on the SBWR system could be handled. The relationship and relative roles/responsibilities of SBWR and the retailer is an area that will need to be addressed as the NPR system evolves.

Through the governance discussion conducted as part of the Strategic and Master Planning, it was acknowledged that an amended Integration Agreement could support the recommended pathways of this Strategic and Master Plan and that one special district operating SBWR NPR and Potable Reuse is a potential pathway that aligns with other regional system examples. It is recommended that a working group of SBWR, the District and Retailers be established to continue assessing long-term governance options. These options should focus on 1) consideration of evolving the core NPR and potable reuse systems to a special district (such as the District) operation, and 2) assessing the relationship and roles/responsibilities of SBWR versus retailers in the funding and operating of future NPR extensions.

11.4 Finance

A major consideration for the governance of an evolving SBWR is the identification of funding and financing strategies that match the benefits and beneficiaries of an expanded SBWR and cover ongoing costs, including production and distribution costs, asset management costs, and future investments. Recycled water projects offer a multitude of benefits to the region and benefit assessments are a typical approach used to determine cost share and allocation. As the region evolves from primarily a wastewater disposal program to a water supply program, legacy agreements and management approaches will need to be realigned to match the evolving benefits of recycled water. This section provides an overview of recycled water benefits and describes general financing strategies that could be used to support SBWR expansion.

One key issue for the City is the need to achieve near-term cost recovery of the current system O&M and near-term CIP identified in this Strategic and Master Plan through wholesale recycled water rates. A wholesale recycled water rate model was created to help identify strategies to achieve this near-term cost recovery and longer-term expansion of the NPR system. A component of financing SBWR is the garnering of outside grant funding and low-interest financing. Both near-term and longer-term grant and financing opportunities are identified in Section 12 – Funding.

11.4.1 Benefits and Beneficiaries

As noted, the original driver for SBWR, minimizing effluent flows to the South Bay salt marsh habitat, has dissipated and a new primary driver, water supply augmentation, has emerged. Regional water recycling initiatives provide a wide array of benefits in addition to these primary drivers. Table 11-8 illustrates these benefits and beneficiaries.

Table 11-8: Benefits and Beneficiaries of Water Recycling

Benefit Category	Sub-category	Beneficiaries	Comment
Effluent Diversion	n/a	RWF and Tributary agencies	Lessen value as effluent projections decrease and net environmental benefit conversation emerges
Pollution Reduction	n/a	RWF and Tributary agencies	This category is appropriate for NPR and Potable Reuse to the extent that RO concentrate would be "conditioned" (organics, nitrogen, metals removed) prior to discharge.
Water Supply	Baseline	District and Retail water agencies and associated customers	Provides a direct offset of imported water purchase (and for NPR) treatment/delivery, offsetting associated costs.
Water Supply	Reliability	District and Retail water agencies and associated customers	Value associated with reliable production of local supply.
Infrastructure Savings	Water	District and Retail water agencies and associated customers	Avoided cost of expansion and O&M of District water treatment and conveyance facilities; associated with NPR and IPR (though not DPR)
Infrastructure Savings	Wastewater Treatment	RWF and Tributary agencies	Substantial diversion of secondary flow to AWPF could save RWF filters and associated infrastructure capital (replacement) and O&M
Groundwater Quality Protection	n/a	District and GW pumpers	IPR would provide a substantial groundwater quality improvement (TDS) thanks to full RO treatment
Water Supply Quality Improvement	n/a	District and Retail water agencies and associated customers	Potable reuse (IPR and DPR) would improve domestic water supply quality (TDS)
Energy Conservation	n/a	Global	Greenhouse gas emission reduction associated with avoided future imported supply pumping to the valley (NPR only). Potable reuse (and RO concentrate management) implications need to be assessed.

As discussions evolve regarding the future governance structure and funding strategies for SBWR, it may be appropriate to identify metrics to quantify these benefits and guide this consideration.

11.4.2 Historic SBWR Costs, Funding and Financing

Historically, the SBWR program costs have been funded by wastewater entities and customers. Capital cost/investment from 1997 to March of 2012 totaled about $215.8 million (see *SBWR Valuation Assessment TM* for a detailed breakdown of costs). Table 11-9 summarizes the remaining capital debt service associated with the SBWR program that continues to be funded by the wastewater utility.

Table 11-9: Outstanding Debt Service

FY	2005 Bonds	2009 Bonds	SRF	Total
2013-2014	$6,105,438	$847,375	$4,463,882	$11,416,694
2014-2015	$6,067,688	$847,375	$4,463,882	$11,378,944
2015-2016	$6,096,031	$847,375	$4,463,882	$11,407,288
2016-2017	$5,226,188	$1,561,500	$4,463,882	$11,251,569
2017-2018		$5,880,588	$4,343,237	$10,223,825
2018-2019		$5,523,663	$386,620	$5,910,282
2019-2020		$5,527,088		$5,527,088
2020-2021		$5,526,200		$5,526,200

Notes:

1. *SRF original borrowed amount was $73,566,409.*
2. *2005 and 2009 revenue bond original borrowed amount was $75,440,000.*

Historic operations and maintenance costs have been supported by a combination of revenue from recycled water sales, District recycled water use subsidies (from 1998 to 2009), and wastewater funds. SBWR O&M (FY2013/2014) costs were about $6,100,000.

SBWR has received numerous grant funds, subsidies, and financial support to offset the costs of the program. Historic granting funding and other financial support includes:

- The District historically reimbursed the City $115 per acre-foot of water distributed to customers through the SBWR system (from 1998 to June 2009). This represented the avoided cost of developing new water supplies deferred by reuse. (1998 Reimbursement Agreement)
- The State Water Resources Control Board (SWRCB) provided $73.6 million in "zero-interest" loans from the SRF Loan Program (Approximate loan date 1999).
- The USBR granted $15.5 million to the project through Title XVI of the 1992 Central Valley Project Improvement Act in recognition of the state and federal interest.
- District Cost Share of 30-inch Silver Creek Pipeline up to $6.8 million
- Based on City/Calpine Agreement, Calpine Reimbursement for Silver Creek Pipeline based on construction cost (20% to 50% cost share from SBWR to Santa Teresa Boulevard depending on size of pipeline). Based on agreement, Calpine funded cost of lateral to MEC. City/Calpine Agreement also noted $3.13 million sewer connection fee which may have covered a portion of capital investment associated with the recycled water program.
- Proposition 13 - $4.6 million construction loans for the reimbursement of the construction costs of the Silver Creek Pipeline.
- SWRCB Water Recycling Construction Program (Prop. 50, Chapter 7) grant of $4.0 million for Zone 3 reservoir project.
- 2005 USBR Grant of $3.3 million for expansion projects, based on grant application.
- District annual $1,000,000 SBWR expansion support from August 2010.

The SBWR system has expanded in several phases and continues to receive funding for expansion through grants from the USBR's American Recovery and Reinvestment Act (ARRA), WaterSMART 2011, and the California DWR's Proposition 84.

The SVAWPC was added to the SBWR program in 2014 and provides additional Title 22 treatment capacity, storage, and recycled water salinity control. The capital cost of the project was about $65 million. Annual O&M (2014) cost is about $3,500,000.

The SVAWPC was jointly funded by the RWF wastewater agencies and the District. District capital share was funded through revenues from the groundwater rate and grants. Grant funding for the SVAWPC was received from the following programs.

- State Prop. 50, Chapter 8 grant of $2.9 million
- State Prop 84 IRWM grant of $2.4 million
- American Recovery and Reinvestment Act of 2009 grant of $8.25 million

With a mission of financial sustainability into the future, SBWR needs to implement a formal asset management program. Based on the $215 million in capital investment, an appropriate repair and replacement fund reserve of $4,000,000 annually (2014 value) should be initiated. This value should be updated once a formal asset management program is developed.

11.4.3 Financing

Although SBWR is expected to evolve through an expansion of NPR reuse and an addition of potable reuse, financing strategies for various aspects of the system may be different. To illustrate this point, financing strategies for the following future SBWR system improvements categorized are considered:

- Near-term Reliability CIP
- Long-term Extensions to the NPR System
- Centralized Potable Reuse Pathway

Near-Term Reliability CIP

Near term improvements recommended as part of this Strategic and Master Planning support the ongoing operation of the SBWR NPR system. These improvements provide benefits to the wastewater partners and tributary agencies by supporting NPDES recycled water commitments and flow diversion, and they provide benefits to the water retailers by enabling them to continue serving recycled water customers. Although these improvements have historically been covered by a combination of wholesale recycled water rates and RWF funding, SBWR desires to escalate wholesale recycled water rates to cover the full cost of O&M and this near term capital investment.

A wholesale recycled water rate model was developed as part of the Strategic and Master Plan, and alternative strategies to achieve this "cost recovery" through wholesale recycled water rates were tested by this model. This rate model was used as a tool to facilitate a rate workshop conducted with senior staff and TASC members. Appendix 11A presents the details of this rate model tool and analysis.

Long-term Extensions to the NPR System

As discussed previously in the governance section, future extensions to the NPR system could either be implemented by SBWR as a wholesale entity or by a particular retailer. If these extensions are funded by SBWR as a wholesale entity, then the full cost of these improvements would need to be covered predominantly through wholesale rates. If these extensions are implemented by the retailers, then they would need to establish retail recycled water rates sufficient to cover the cost of these improvements and the wholesale cost of recycled water.

As a component of regional water supply reliability, the District could play a role in funding system expansions in either of these settings.

Centralized Potable Reuse Pathways

A major component of a recommended future expansion of SBWR is a centralized potable reuse system, consisting of an AWP facility (that draws secondary effluent from the RWF) and a dedicated purified water pipeline to a variety of injection wells and District percolation ponds. Since this directly replenishes the main groundwater basin, system operation would need to be under the direct control of the District. Example southern California settings with IPR groundwater replenishment systems used some form of groundwater replenishment charge to provide both the capital and O&M funding for these activities. The District has a similar groundwater charge for pumpers, which would provide an appropriate and straightforward means of funding direct replenishment projects. To the extent that the development of NPR reuse systems provides an in-lieu means of recharging the groundwater basin, this groundwater charge could be used to support the long-term NPR extensions alluded to above.

Financing Next Step

Financing strategies to be employed to support the expansion of SBWR through both NPR and potable reuse pathways will need to be assessed concurrently with future governance strategies. As noted previously in the governance discussion, it is recommended that a working group of SBWR, District and Retailers be established to continue discussions on governance and financing in support of the evolution of SBWR. As a reminder, garnering of outside grant funding is a key component of recycled water implementation and is covered in the following section.

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12. Funding Opportunities

A variety of funding opportunities are available to offset the cost of implementing NPR and potable reuse (including IPR and DPR) projects. In addition to customary financing methods, including pay-as-you-go (cash reserves and operating revenues) and traditional bond financing, funding methods such as grant and low-interest loan programs are administered by various state and federal agencies. The following opportunities could be viable for NPR and potable reuse:

- U.S. Bureau of Reclamation (USBR) Title XVI Program grants or low-interest loans
- DWR IRWM grant program
- State Water Resources Control Board (SWRCB) grant and loan programs
- California Infrastructure and Economic Development Bank (I-Bank) Infrastructure SRF Program

This chapter presents near- and long-term funding opportunities and strategies.

12.1 Title XVI Program – USBR

USBR's Title XVI Program is focused on identifying and investigating opportunities to reclaim and reuse wastewater. The total amount of available funds is unknown. Grant funds are made available for the construction of water recycling treatment and conveyance facilities, and are structured to cover 25% of the total project costs (up to $20 million). The remaining 75% or more of total project costs are contributed by project proponents as matching funds. Proposal requirements include technical and budgetary components, as well as a completed Title XVI Feasibility Study, which must be submitted to USBR for review and approval. While compliance with the National Environmental Policy Act (NEPA) is not required during the proposal phase, it is required prior to the receipt and expenditure of Federal funds.

Based on communication with USBR staff, USBR may replace the grant program with a low-interest (1 percent), 30-year loan program. Alternatively, it may create a joint-grant and loan program. The timing and certainty of these changes are currently unknown. More information is available from USBR's website here: http://www.usbr.gov/lc/socal/titlexvi.html/.

12.2 IRWM Program – DWR

DWR administers the IRWM Program, which provides planning and implementation grants to prepare and update IRWM Plans, and to construct and implement water resources-related projects. Currently, funding is available through Proposition 84 (Prop 84), the Safe Drinking Water, Water Quality and Supply, Flood Control, River and Coastal Protection Act of 2006. Additional funding will also be made available through Proposition 1, which was passed by California voters on November 4, 2014. DWR is anticipating the application process for the final round of Implementation Grant Funding from Prop 84 to occur in summer 2015 with applications due in the fall of 2015 (there will be future rounds for Prop 1). Awards would occur in spring 2016. A 25% match is required for the entire proposal (which typically includes multiple projects). In order for a project to receive IRWM grant funding, it must be included in an IRWM Region's IRWM Plan. The SBWR project falls within the San Francisco Bay Area IRWM Region and San Francisco Bay Area funding area. Roughly $41 million will be available to the San Francisco Bay Area IRWM Region in this round. To prepare for the upcoming application process, the San Francisco Bay Area IRWM Region will issue a call for projects by the subregions in early 2015. Prior to submitting the projects for consideration by the subregions, they should be submitted for inclusion in the Bay Area IRWM Plan. This can be done at any time through submittal to an online database.

Figure 12-1 illustrates the steps of the IRWM funding process from project submittal into the BAIRWMP to the subregional ranking to the final project proposal package. It is anticipated that Proposition 1 IRWM funding will carry similar requirements to Proposition 84 IRWM funding, and will be distributed through competitive grants in a similar manner following exhaustion of Proposition 84 funding.

Figure 12-1: IRWMP Grant Process

Additional information about the IRWM grant program can be accessed here:
http://www.water.ca.gov/irwm/grants/index.cfm

12.3 SWRCB Grant and Loan Programs

The SWRCB administers three types of recycled water funding: recycled water facilities planning grants, construction implementation grants and loans, and clean water state revolving fund loans.

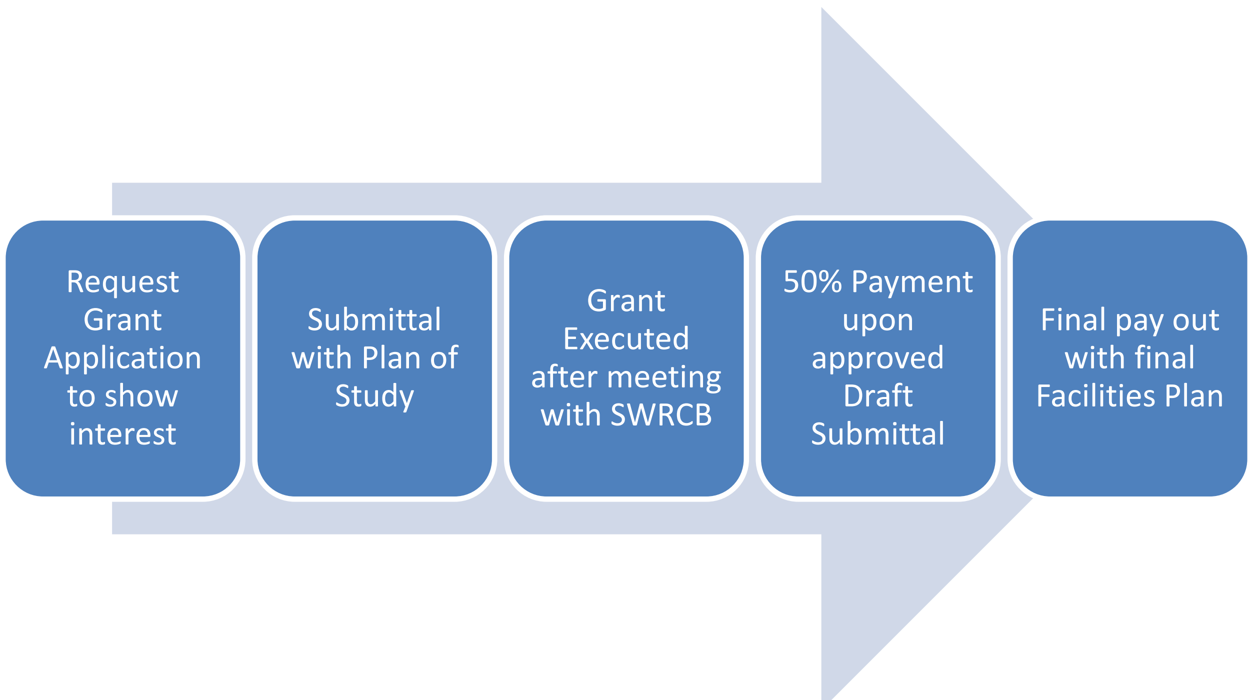
Facilities Planning Grants

Facilities planning grants through SWRCB provide assistance to public agencies to prepare facilities planning documentation for use of recycled water. Facilities planning grants cover 50% of eligible project costs up to $75,000 (e.g., $75,000 out of $150,000), and require a 50% funding match. The planning grants cover the costs for facility planning, including market assessment, alternative analysis, economic analysis, and development of user assurances, as well as environmental documents. An agency can obtain funding for multiple projects; however, projects must be independent in scope from previous projects.

Grants are awarded following a straightforward and streamlined application process, which includes completion of an application form, proposed plan of study and an accepted resolution by the local agency authority to authorize the grant application. Eligibility is contingent on the applicant providing proof of compliance with a water conservation plan, AB2572 water meter compliance and AB1420 water code compliance.

The Facilities planning grant process is described in Figure 12-2 below.

Figure 12-2: Facilities Planning Grant Process



Facilities Construction Grants

The SWRCB currently administers a grants program to cover construction of recycled water facilities. The construction grant will cover 25% of construction costs up to $4 million with design costs eligible retroactively. Eligible costs include allowances for design, legal tasks, construction management and engineering during construction. The application process involves completion of an application package consisting of four separate applications to document general project information, financial security, technical project information, and environmental documentation and placement on the competitive funding list.

Proposition 1 authorizes $725 million for water recycling and desalination projects. It is anticipated that this funding will be used to increase funding levels for the existing facilities construction grants and loans program. Based on discussions with SWRCB staff, it is anticipated that funds will become available

July 1, 2015 and will consist of grants and 2% interest loans. Grants are expected to cover 10-15% of total project costs, with a $20-30 million cap.

Clean Water State Revolving Fund (CWSRF) Loans

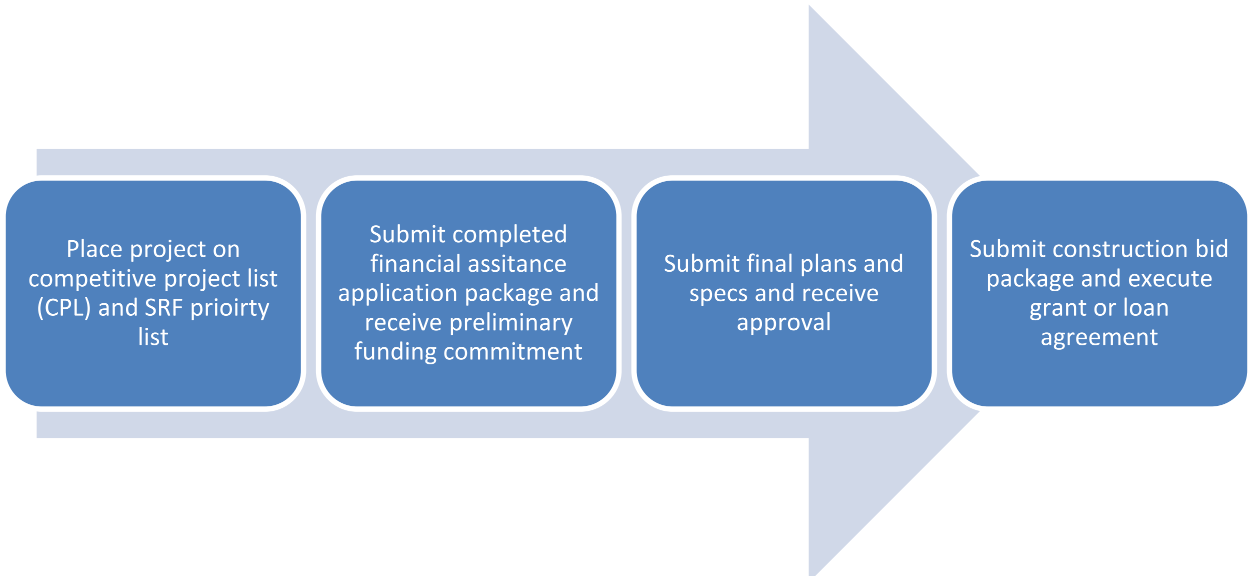
The SWRCB administers the CWSRF Loan Program offering low-interest loans to eligible applicants for construction of publicly-owned facilities including wastewater treatment, local sewers, sewer interceptors, water reclamation facilities, and stormwater treatment; expanded use project including implementation of nonpoint source projects or programs; and development and implementation of estuary comprehensive conservation and management plans. Low-interest loans through the Water Recycling Fund Program (WRFP) fall under the purview of the CWSRF loan program.

The process for securing funds includes submitting a CWSRF application, in addition to additional water recycling project-specific application items. CWSRF loans typically have a lower interest rate than bonds, at half of the General Obligation bond (typically 2.5% to 3%, currently 2.1%) at the time of the Preliminary Funding Commitment. Loans are paid back over 20 or 30 years. Annually, the CWSRF program disburses $200 million to $300 million to agencies in California. There is no award maximum, but a maximum allocation of $50 million per year per agency exists. Repayment begins one year after construction is complete. SWRCB funds projects on a readiness-to-proceed basis. The application process can take up to 6 months; SWRCB recommends collecting required information and applying once the draft California Environmental Quality Act (CEQA) and additional federal requirements (i.e. CEQA+) documents, required resolutions, and financial package are completed. Historically, SWRCB has offered up to $3 million in principal forgiveness (PF) (i.e. grants) to applicants if the project directly benefits a disadvantaged community (DAC). It is anticipated PF/grants will be made available to DACs in the future. Guidelines for the amounts of PF/grants available to DACs are outlined in the annual Intended Use Plan released by SWRCB each year.

In March of 2014, in response to the Drought Emergency declared by Governor Brown, $800 million in 1 % loans was offered to water recycling projects. The WRFP Loans are available at 1% interest until December 2, 2015. While there is no award maximum, any single agency may only receive $50 million per year, and repayment begins one year after construction is complete.

The application process for Construction grants and loans is similar and summarized in Figure 12-3.

Figure 12-3: Facilities Construction Grants and Loans Process



More information about the SWRCB CWSRF Program can be found here:
http://www.waterboards.ca.gov/water_issues/programs/grants_loans/srf/srf_forms.shtml .

12.4 Infrastructure SRF Program – I-Bank

The Infrastructure SRF (ISRF) Program provides low-interest loan financing to public agencies for a wide variety of infrastructure projects such as water supply, parks and recreation facilities, sewage collection and treatment, and water treatment and distribution projects. Funding is available in amounts up to $25 million with loan terms up to 30 years. The interest rate is set at the time the loan is approved. Eligible applicants include cities, counties, special districts, assessment districts, joint powers authorities, and nonprofit organizations. Applicants must demonstrate project readiness and feasibility to complete construction within two years after I-Bank loan approval. Additionally, eligible projects must promote economic development and attract, create, and sustain long-term employment opportunities. There is no required match; however, there is a one-time origination fee of 1% of the ISRF financing amount or $10,000, whichever is greater. Applications are accepted on continuous basis. The I-Bank recommends applications are submitted upon completion of design, as construction must begin within 6 months of the I-Bank's loan commitment.

More information about the ISRF Program can be found here:
http://www.ibank.ca.gov/infrastructure_loans.htm

12.5 Near Term Funding Plan Strategy

The recommended SBWR near-term production and system CIP projects would support a combination of additional non-potable customer connections and the Ford Pond IPR project, together increasing recycled water use by 7,000 acre-feet year (AFY). The Ford Recharge Pond project would be the region's first indirect potable reuse project. Existing ponds operated by the SCVWD with recharge capacity of 1,100 AFY will be converted to offline ponds, while an additional 15 acre recharge pond will be constructed to allow 4,200 AFY of recharge. These projects are well-documented and ready for implementation, resulting in a wide range of available funding opportunities.

It is recommended that the City and SCVWD pursue funding together as partners and describe the program as a combination of projects that together will enhance security for future water reliability within the southern Bay Area region. Combining the SBWR Near-Term CIP and the District Ford Pond IPR project enhances the attractiveness of each project relative to the potential funding opportunity by expanding the geographic scope and impact and adding a multi-agency collaboration component. Moving quickly to secure funding for those projects which have already been internally approved will enhance the chances of receiving funding made available by Prop 1 early-on by packaging them favorably per the selection criteria. This partnership and collaborative planning approach establishes the proposed projects as attractive targets for outside funding. In addition, combining the projects in a joint funding application will enable the Ford Recharge Pond project to proceed, due to improved production capacity and shared infrastructure.

Table 12-1 presents the estimated capital costs for the recommended near term projects.

Table 12-1: Estimated Capital Costs for Near Term Projects

Project Cost Elements	Estimated Cost Range
SBWR Near-Term CIP	
Increase Production Capacity to 45 mgd	
Increase TPS Capacity	$1 – $million
Increase Filter Flux Rate and Reduce CT Requirement (Filtration Flux and Free Chlorine Disinfection Studies/Implementation)	$500k - $1million
Improve Distribution System Stability	
Upgrade Pump Station 5 Bypass	$300 - $500k
Zone 1 Storage	$33 million
Installation of additional TPS Pump	$1 million
Restore/Rehabilitate Existing Condition-Related Deficiencies	
54-inch Flow meter	$50k
PS 5 VFDs	$60k equipment
PS 5 and PS8/11 Electrical Room HVAC replacement	$150 – 250k
Other Condition Assessment Projects (2014-2015 Projects)	$2 million
Valve Exercising Program	<$100k
Update Control Strategies/Equipment to Improve Operational Efficiency	
Distribution System Automation	$650k – $2.15m
Automate Zone Bypass Valve at Pump Station 8/11	<25k
Provide Operator Operations Support	
Update SBWR Systems Operations Manual	$100 - $200k
Total Cost of CIP	$40 – $50 million
Ford Recharge Pond IPR Project	
Increase Treatment Capacity	
Satellite Advanced Water Purification Facility	$30.5 million
Product Water Pump Station	$1.4 million
Provide Conveyance to New Recharge Location	
SBWR source water pipeline and easement	$2.2 million
Product water pipeline and easement	$4.4 million
Concrete disposal pipeline and easements	$1.0 million
Establish Increased Recharge Ability	
Civil allowance to construct new recharge ponds	$8.8 million
Land purchase for new recharge ponds	$7.0 million
Total Cost of Ford Pond IPR Project	$55.3 million
Total Cost for Near Term Projects	**$95 - 105 million**

Near Term Funding opportunities focused on implementation should be pursued to allow recommended near-term projects that are ready to construct to proceed as quickly as possible. Funding for planning grants can allow further development of projects requiring studies prior to implementation.

It is recommended that the following near-term funding opportunities be pursued in the first quarter of 2015.

- USBR Title XVI Funding: The City of San Jose is in a unique competitive position for Title XVI funding. Already authorized under PL 102-575, the City is not required to demonstrate project feasibility in its Title XVI grant applications. The City is authorized to spend up to $430 million for construction projects with 25% reimbursement. To-date, the City has spent $250 million, leaving $180 million remaining. The City can utilize federal funds as matching funds for state grants, allowing the City to further leverage these funds. Although, the deadline for the next grant opportunity is in mid-December 2014, it is anticipated that additional funds will be available in the future.
- IRWM Program funding: Round 3 of IRWM program funding will begin in 2015. The first step to ensure the projects are eligible is to submit projects to the BAIRWMP. Submitting projects is accomplished through an on-line form and can be submitted at any time. Once a Call for Projects has been issued by the subregion, the projects should be proposed for consideration. The Bay Area region is expected to receive roughly $41 million in grant funds in Round 3.
- SWRCB Facilities Planning Grant: Applying for the Facilities Planning Grant administered by SWRCB will provide funds towards development of necessary environmental documents such as for the Zone 1 storage project. Concurrently, the City should apply for SRF Loans through the WRFP program before the end of 2015 to secure the 1% low interest loan.

12.6 Long Term Funding Plan Strategy

Long term NPR demand will require additional storage tanks, pump stations and backbone pipeline to serve projected NPR water needs of member agencies. It is anticipated that the additional infrastructure will be funded by member agencies.

The three IPR projects being considered include mid-basin injection wells, Los Gatos recharge ponds, and Westside injection well. Funding for these projects should be pursued together by SCVWD as a joint program. Each project will require development of preliminary and final design reports for treatment, pipelines and recharge facilities, permitting, and institutional agreements for land procurement. Funding opportunities to perform necessary planning studies and to position for longer term construction loans are identified below.

A combination of SWRCB Facilities Grants and Loans under the CWSRF and WRPF program could provide SCVWD with additional financing to plan, implement, and eventually construct the projects. In order to position for the grants and loans for long term IPR projects, SCVWD should begin to formulate the strategic plan to move forward. Funding to assist in Long Term IPR project planning documents for each IPR project can come from additional Facilities Planning Grants but need to be different in scope from one another. Having Facilities plans in place will position SCVWD projects for funding that should become available from Proposition 1 funding. Proposition 1 will make available $725 million statewide for recycled water projects and may be available as construction grants or low interest loans. Although, the details have not yet been determined, it is anticipated that funding opportunities may be announced within 2015.

Alternative loan options for future long term funding include I-Bank which provides loans for projects with an economic benefit. Projects that increase water supply for additional growth, such as the SCVWD IPR projects could qualify for such a loan. The application project can take up to six months to complete and construction must be finished within two years of loan approval.

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