Brown AND Caldwell

Prepared for Valley Water

Countywide Water Reuse Master Plan
(CoRe Plan)

June 2021

Valley Water

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Acknowledgements

After three years of collaborative effort and dedication, the Countywide Water Reuse Master Plan (CoRe Plan) is an example of applying innovative thinking to inform pivotal vision and direction related to exploring future potable reuse opportunities through integrated, regional efforts. The CoRe Plan reflects valuable contributions from many entities, organizations, and individuals working together toward a shared goal for the future. Without the contributions and collaboration of those listed here, this work would not have been possible.

Valley Water Teams

Core Project Team: Recycled and Purified Water Unit

Hossein Ashktorab	Unit Manager, Executive Sponsor
Miguel Silva	Project Manager (PM)
David Tucker	Assistant PM

Under the direction of:

Enrico (Rick) Callender	Chief Executive Officer
Aaron Baker	Chief Operating Officer, Water Utility
Vincent Gin	Deputy Operating Officer, Water Supply Division
Kirsten Struve	Assistant Officer, Water Supply Division

Valley Water Technical Review Team

Anthony Mendiola	Henry Barrientos	Neeta Bijoor
Bhavani Yerrapotu	Jason Chiar	Samantha Greene
Darin Taylor	Jeannine Larabee	Taylor Lipps
Eric Olson	Luisa Sangines	Vanessa De La Piedra
George Cook	Medi Sinaki	Zachary Helsley
Gina Adriano	Metra Richert	

Other Contributors

Apollonia Ross	Helen Hoang	Luis Jaimes
Ava Bobby	Jerry De La Piedra	Melene Agakanian
Bassam Kassab	Katrina Jessup	Nina Hawk
Calvin Nguyen	Keila Cisneros	Norma Camacho
Erin Baker	Kristen Lester	Paolo Baltar
Garth Hall	Linzi Bhatta	Serena Desai

Board of Directors

John L. Varela	District 1	Nai Hsueh	District 5
Barbara Keegan	District 2	Tony Estremera, Chair	District 6
Richard P. Santos	District 3	Gary Kremen, Vice Chair	District 7
Linda J. LeZotte	District 4		

Project Partners

City of Morgan Hill
Anthony Eulo
Chris Ghione
James Sylvain

City of Gilroy
Karl Bjarke
Saeid Vaziry

City of San José
Amit Mutsuddy
Henry Louie
Jeff Provenzano
Kerrie Romanow
Pedro Hernandez

City of Santa Clara
Gary Welling
Shilpa Mehta

City of Palo Alto
Diego Martinez Garcia
Karin North
Karla Dailey
Lisa Bilir
Phil Bobel
Samantha Engelage

City of Mountain View
Ankit Sharma
Elizabeth Flegel
Lisa Au
Nirmal Sajjan
Salman Hosseini

City of Sunnyvale
Bryan Berdeen
Mansour Nasser
Ramana Chinnakotla
Steve Hogg

San Francisco Public Utilities Commission (SFPUC)
Manisha Kothari
Paula Kehoe

Other Contributors
Alison Turner
Dan Repp
Girum Awoke
Gregg Hosfeldt

Independent Advisory Panel

Panel Members
Adam Olivieri, Dr.P.H., P.E. (Co-Chair)
James Crook, Ph.D., P.E., BCEE (Co-Chair)
Jean Moran, Ph.D.
Katherine Cushing, Ph.D.
Mehul Patel, P.E.
Shane Snyder, Ph.D.

Other Contributors
Kevin Hardy
Suzanne Sharkey

Consultants

Brown and Caldwell	Project Role
Jenny Gain, P.E.	Consultant Team Project Manager
Julia Schmitt, P.E.	Deputy Project Manager
Wendy Broley, P.E.	Executive Sponsor/Facilitation Lead
Melanie Holmer, P.E.	Feasibility-level Technical Lead/Treatment Design Manager
Marc Nakamoto, P.E.	Conceptual-level Technical Lead/Treatment Design Manager
Erin Mackey, Ph.D., P.E.	Environmental Regulations Lead
Katie Ruby, P.E.	Facility Sizing (Flow Capacity and Yield)
Rene Guillen, P.E.	Treatment Design Engineer
Marissa Tsuruda, P.E.	Project Engineer/Satellite Treatment Facility
Joe Burg, P.E.	Economic Evaluation Lead
Adam Zacheis, Ph.D., P.E.	Treatment Design Reviewer/SME
Brett Farver, P.E.	Quality Manager
Jessica Rowe	Deliverable Enhancement
Andrew Buick	Graphic Design

HydroScience Engineers

Curtis Lam, P.E.	Conveyance Infrastructure Design Lead
Navina Venugopal	Project Engineer/Conveyance Design
Alex Park, P.E.	Project Engineer/Hydraulic Modeling/SBWR System Planning
Jonathan Machorro, P.E.	Project Engineer/Hydraulic Modeling/SBWR System Planning

Trussell Technologies

Brian Pecson, Ph.D., P.E.	Potable Reuse Regulatory Compliance Lead
Brie Post, P.E.	Project Engineer/Regulatory Strategy
Anya Kaufman, P.E.	Project Engineer/Regulatory Strategy
Shane Trussell, Ph.D., P.E.	Potable Reuse Technical Reviewer/SME

Katz & Associates

Patricia Tennyson	Public Outreach Strategy

Data Instincts

Mark Milan	Public Outreach Strategy

Geotechnical Consultants/ENGEO

Dustin Agnew, P.E.	Project Engineer/Geotechnical Preliminary Study
Jim Thurber, P.G., C.HG.	Geotechnical Reviewer/SME

Other Contributors

Beth Linskens	Desmond Orsinelli	Martin Steinpress	Rucker Alex
Bill Leever	Dolly Chen	Phillippe Daniel	
Dennis Mulacek	Kirk Westphal	Roger Chu	

Preface: A Living Document

The Countywide Water Reuse Master Plan (CoRe Plan) is envisioned to be a living document to support future decision-making related to Valley Water's recycled (non-potable reuse) and purified water (potable reuse) programs. As direct potable reuse (DPR) regulations and other influencing factors/conditions (e.g., advances in treatment technologies) continue to evolve and fundamentally change the basis of projects, Valley Water will review and assess such updates relative to the CoRe Plan. As described here, the adaptability incorporated into Valley Water's approach is already being tested and demonstrated.

As Valley Water and its project team were finalizing this CoRe Plan, the State Water Resources Control Board's Division of Drinking Water released an initial draft of DPR regulations on March 22, 2021. With initial draft regulations becoming available after a multi-year effort to complete the CoRe Plan—including development of preliminary treatment trains for DPR portfolios (both raw water augmentation and treated water augmentation) and a regulatory compliance assessment—Valley Water and its project team performed a cursory review of the initial draft regulations and found the anticipated DPR requirements identified in the CoRe Plan adhere closely to those in the draft regulations. Significant elements of the draft regulation include:

- **Technical, managerial, and financial (TMF) capacity**: The draft regulations significantly increase required TMF capacity for DPR projects and clarify the State Board's proposed approach for evaluating TMF capacity of a DPR project's responsible agency (e.g., Valley Water) and respective project partners. The State Board will evaluate TMF capacity across multiple domains, including funding continuity, interagency agreements, staffing, and operator certification. Compliance will require documentation through an extensive suite of reports, programs, and plans beyond those currently required for indirect potable reuse (IPR) projects.
- **Chemical control**: The draft regulations include prescriptive requirements for additional treatment (including design, operation, and performance), expanded monitoring requirements, significant expansion of source control programs, and more stringent control and response limits.
- **Pathogens**: DPR will require significantly higher log reduction value requirements than IPR for all pathogens. The regulations further clarify how those values must be met in terms of the number, types, and diversity of barriers, as well as protocols for validation and continuous verification of the performance of each treatment process.
- **Monitoring and control**: the draft regulations require a higher degree of monitoring (i.e., frequency, locations, and range of contaminants) and more stringent operational control (e.g., automatic diversions and shutdowns) to prevent distribution of water that is not compliant with requirements.

Because many of these requirements were anticipated, the DPR treatment trains included in the CoRe Plan will comply with most of the draft requirements without significant alterations to the process trains. However, the draft regulations have a larger impact on the regulatory compliance assessment given the clarification on several topics previously less defined, such as enhanced source control and TMF capacity requirements. Valley Water will continue to monitor DPR regulatory development and its impact to the CoRe Plan and will provide necessary updates to maintain the efficacy of this planning document for future potable reuse implementation.

Executive Summary

Santa Clara County faces water supply challenges driven by reoccurring droughts, growing population and businesses, California's changing climate, and increasing uncertainty of imported supply reliability. Record-setting temperatures and extreme weather in recent years signal climate change and may foreshadow impacts that are anticipated to increase in frequency and severity.

To adapt to increasing uncertainties and secure a reliable, sustainable water supply for the region, Valley Water set a goal to meet 10% of Santa Clara County's total water demands with recycled and purified water for non-potable and potable reuse by 2025. Reuse improves resilience to future uncertainties, including drought and climate change. The Board also established a long-term goal of producing up to 24,000 acre-feet per year (AFY) of purified water for potable reuse (drinking water) by the year 2040 to bolster supplies. Complementing the potable reuse goal, Valley Water's 2015 Urban Water Management Plan estimates that 33,000 AFY of 2040 demand will be met with recycled water for non-potable reuse (NPR).

Early stakeholder discussions began in 2016 to frame a Countywide water reuse vision. Shortly thereafter in 2018, Valley Water initiated the Countywide Water Reuse Master Plan (CoRe Plan) effort to identify feasible opportunities for expanding reuse as part of the strategy to improve water supply reliability and increase regional self-reliance for Santa Clara County's nearly 2 million residents and growing economy. Developing the plan involved substantial collaboration between Valley Water and its four wastewater Partner Agencies to identify and evaluate reuse opportunities. This CoRe Plan identifies a range of opportunities for expanding reuse through recycled water for NPR and purified water for PR.

What is Water Reuse?

Water reuse is the recycling of wastewater for potable (drinking) and non-potable purposes. Non-potable reuse (NPR) supports landscape irrigation, agricultural, and industrial uses (e.g., cooling systems, fire protection, and toilet flushing). Potable reuse (PR) means recycled water is treated to drinking water standards using advanced purification technology, making it suitable for human consumption as potable water.

As a locally controlled and drought-resistant supply, water reuse allows Valley Water to:

- improve resilience to drought and prepare for climate change impacts,
- reduce the region's dependence on imported supplies (i.e., water originating outside of the region), which accounts for over 50% of Santa Clara County's water use, and
- improve sustainability by reducing energy use and environmental costs related to conveying imported supplies to the region.

The Countywide reuse vision is programmatic and aims to:

1 **Integrate existing recycled water systems and expand NPR**

2 **Develop purified water systems in partnership with recycled water producers/suppliers and other interested parties to enable potable reuse**

The CoRe Plan evaluates a wide range of reuse opportunities and, rather than recommending one defined path forward, provides a framework for collaborative decision-making and flexible, adaptive implementation.

Projects were evaluated based on criteria such as cost, ease of obtaining permits from regulatory agencies, environmental impacts and benefits, flexibility in future expansion, the scale of construction and engineering feasibility, and potential risks to disrupt, delay, or halt projects.

The CoRe Plan explores five different ways of expanding local water supplies through potable and non-potable reuse.

Enhanced Non-potable Reuse (NPR+): blending recycled water with advanced-treated purified water to reduce salinity, allow for more end-uses, and help protect groundwater quality

Groundwater Recharge (GWR): replenishing the groundwater aquifer with purified water

Surface Water Augmentation (SWA): supplementing reservoirs, lakes, or channels with purified water

Raw Water Augmentation (RWA): sending purified water into a pipeline system that delivers untreated water to a drinking water treatment plant

Treated Water Augmentation (TWA): sending purified water directly into the drinking water system

Refer to the glossary at the end of this document for definitions of words and concepts used throughout the CoRe Plan. Within the glossary, an infographic visually depicts the various forms of reuse.

In evaluating and ranking portfolios, Valley Water and its Partner Agencies built upon and integrated existing planning-level studies and reports that identify reuse projects (potable and non-potable) and demonstrate regional benefit. Additionally, Valley Water and its partners identified new projects that show promise in contributing to regional resilience and the 2040 potable reuse goal. Reuse projects were combined into portfolios, primarily distinguished by wastewater source (i.e., Partner Agencies' facilities) and reuse type, then evaluated for feasibility.

As summarized in Table ES-1, project portfolios evaluated in this CoRe Plan include:

Recycled water system expansions

NPR/NPR+ Expanding recycled water distribution systems for NPR countywide (assumed baseline, applied to all portfolios).

Purified water production at one the following locations for potable reuse:

SJ Constructing a new advanced water purification facility (AWPF) adjacent to the existing Silicon Valley Advanced Water Purification Center in San José for potable reuse through either groundwater recharge, raw water augmentation, or treated water augmentation.

PA + SV Building an AWPF in either Palo Alto (PA [+SV]) or Sunnyvale (SV [+PA]) to purify supply originating from their respective wastewater treatment facilities and for potable reuse through groundwater recharge.

PA/SV Building separate AWPFs in both Sunnyvale and Palo Alto for groundwater recharge.

MH Building a satellite wastewater treatment facility and AWPF in Morgan Hill for groundwater recharge or surface water augmentation.

Table ES-1. Programmatic Approach for Evaluating Reuse Opportunities

Countywide Expansion of NPR/NPR+ (Recycled Water Distribution Systems)	North County Portfolios		South County Options
	San José	One AWPF in San José **1a:** SJ GWR **1b:** SJ RWA **1c:** SJ TWA, Milpitas Pipeline **1d:** SJ TWA, new pipeline	**MH-1:** NPR+ **MH-2:** GWR **MH-3:** SWA
	Palo Alto & Sunnyvale	One regional AWPF with combined flows from Palo Alto and Sunnyvale **2a:** PA (+SV) GWR **2b:** SV (+PA) GWR	
		Two separate AWPFs in Palo Alto and Sunnyvale **4:** PA/SV GWR	
Alternative Elements and Future Opportunities **Alternative pipeline alignments, interties, and delivery points. Resized designs. Additional TWA opportunities.**			

In addition to the project portfolios, Valley Water and its Partner Agencies also considered opportunities that may be further explored in the future and alternative elements that could replace some aspects of the portfolios.

Valley Water's Project Team created two tools to compare portfolios: an evaluation tool and a risk tool. The evaluation tool compares portfolios relative to one another based on prioritization criteria identified by Valley Water and its Partner Agencies. The risk tool supports assessment of each portfolio separate from the overall evaluation focusing on aspects that may disrupt, delay, or halt projects and considering the likelihood and consequence of risks. The tool returns a calculated composite risk score for each portfolio; an example is shown in Figure ES-1.

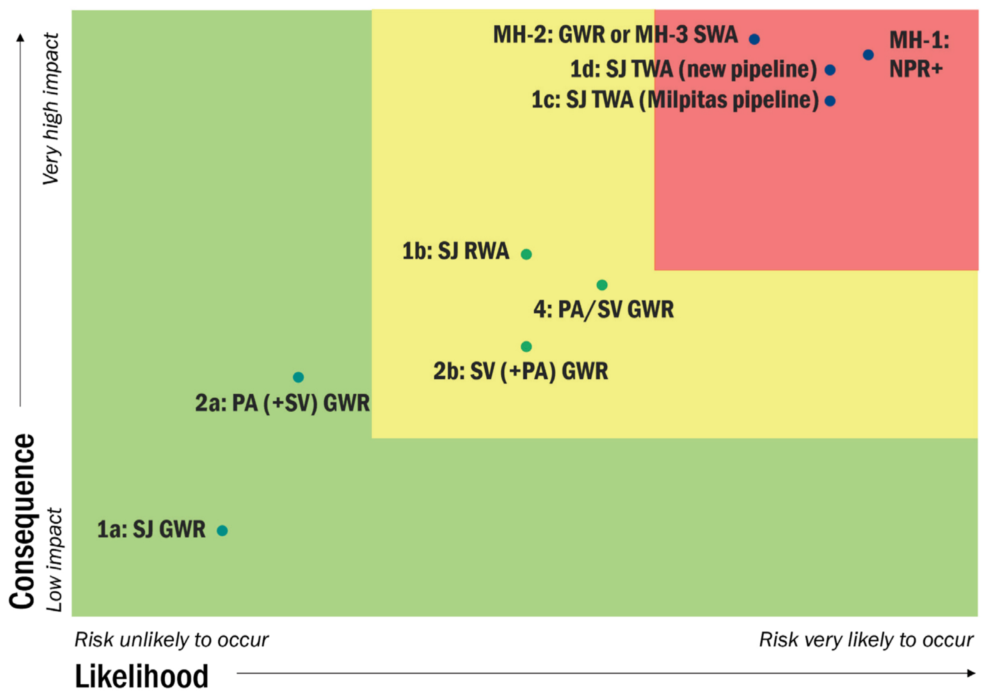


Figure ES-1. Example of risk assessment tool results to compare CoRe portfolios and options

Given the wide range of reuse scenarios considered in this CoRe Plan, implementation planning needs to incorporate flexibility and support future decision-making. While implementation involves many considerations, several that are critically important are addressed in the CoRe Plan including:

- Strategy for regulatory compliance and permitting, including protection of public health and the environment, and strategies for managing residual waste streams generated from AWPFs
- Rate impacts
- Public outreach and engagement
- Partnerships and governance
- Policy issues
- Environmental review and documentation
- Program funding

Valley Water's Project Team also developed cost estimates for the portfolios and for alternative elements. Estimated portfolio costs vary widely based on supply source, AWPF location, production capacity, delivery points, and reuse type, among other factors. To produce around 24,000 AFY of purified water for potable reuse, portfolio capital cost estimates range between $555-$850 million, and unit costs are estimated to range between $2,100-$3,300/AF for 100-year life cycle and $2,500-$4,300/AF for 30-year life cycle.

The cost of implementing reuse opportunities identified in this plan would be met by ratepayers within the relevant groundwater benefit zones. Using preliminary cost estimates documented in previous drafts of this plan, Valley Water staff estimated the anticipated incremental percent increase to the municipal and industrial groundwater production charges for each portfolio and option for a planning period of fiscal years (FY) 2022 to 2030. Incremental rate increases would be in addition to anticipated rate increases unassociated with this plan's portfolios and options.

On average, County residents would pay an additional **$1 to $2 per month*** for this **drought-resistant, local water supply.**

**depending on the portfolio*

Valley Water staff estimated that implementation of a North County portfolio would result in an incremental increase to the Groundwater Benefit Zone W-2 groundwater production charge ranging from 1.6% to 1.9% per year, depending on the portfolio. Rate impacts may be lower with receipt of external funding such as grant awards or low interest loans.

In South County, the implementation of a Morgan Hill option was estimated to incrementally increase the Groundwater Benefit Zone W-5 groundwater production charge by a range of 2.2% (MH-1 [NPR+]) to 4% (MH-3 [SWA]) per year. Based on recently updated cost estimates, rate impacts for MH-2 (GWR) and MH-3 (SWA) are likely to be higher than this estimated increase. Note that Groundwater Benefit Zones W-7 and W-8 in South County do not benefit from the provision of recycled water.

As directed by its Board of Directors, Valley Water is implementing a purified water project that will align near-term source water availability from one of its partners with updated water supply needs. As part of this near-term project, Valley Water is currently investigating a flexible implementation approach that can support potential reuse expansion in the future. The term flexible implementation ("flex implementation") refers to a prudent planning approach for designing and constructing a near-term GWR project (anticipated by 2028) with sufficient flexibility to support potential future increases to treatment facility hydraulic capacity and purified water deliveries, opportunities associated with development of direct potable reuse regulations, and treatment process enhancements as applicable based on reuse type.

Valley Water developed cost estimates for the near-term project under several flex implementation scenarios. As envisioned at this planning level, the near-term project is anticipated to involve construction of a smaller size AWPF (10 mgd production capacity) located in San José or Palo Alto to yield approximately 11,000 AFY of purified water for GWR at the Los Gatos recharge ponds system. To enable future flexibility, Valley Water has assumed the near-term project will include a 36-inch diameter pipeline for purified water conveyance from an AWPF to the recharge system. A 36-inch pipeline would allow Valley Water to potentially expand the 10-mgd treatment facility to produce up to 24 mgd and increase annual deliveries of up to 24,000 AFY for GWR, RWA, and/or TWA, as shown in Figure ES-2. Based on these assumptions of a 10-mgd AWPF designed for recharging around 11,000 AFY and a 36-inch purified water pipeline capable of delivering up to 24,000 AFY, capital cost estimates of the near-term project range between $445-$485 million. This same flex implementation scenario translates to unit costs estimated at $2,600-$3,300/AF (100-year and 30-year life cycles, respectively) for an AWPF located in San José and similarly $2,700-$3,600/AF (100-year and 30-year life cycles, respectively) for an AWPF located in Palo Alto.

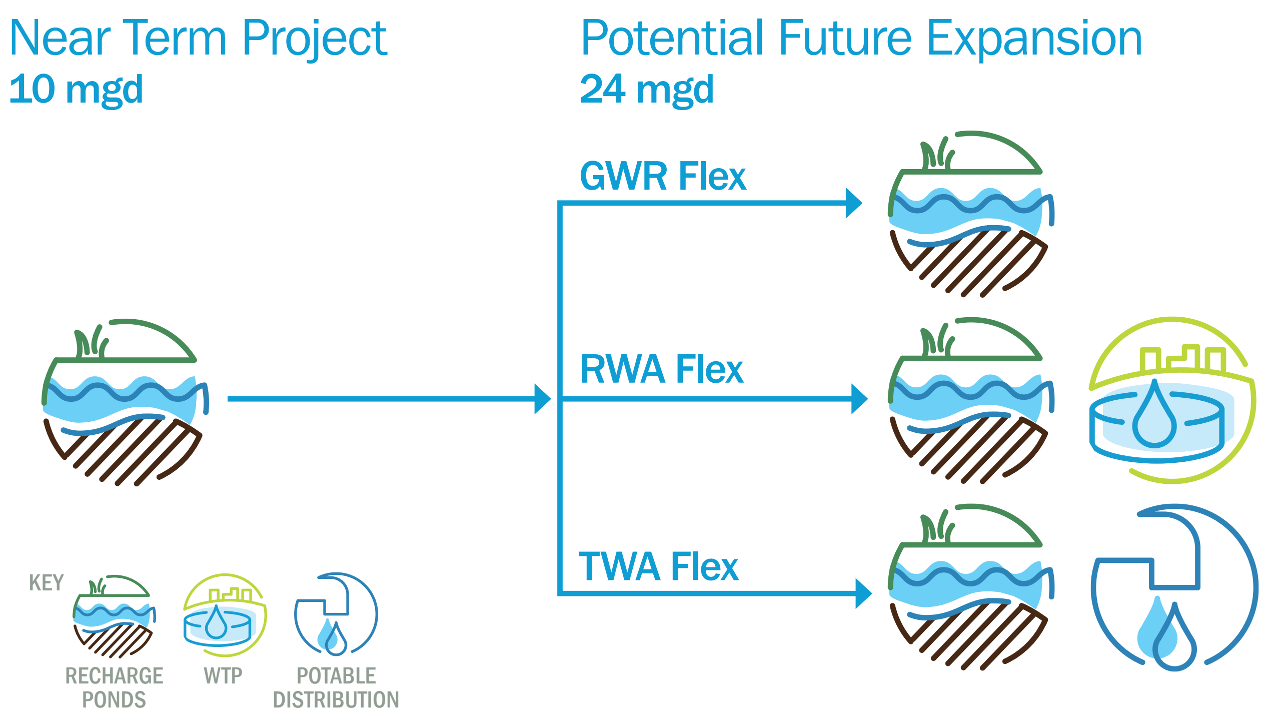


Figure ES-2. Conceptual overview of flexible implementation scenarios

While these planning level potable reuse cost estimates exceed those of existing supplies, Valley Water's current (FY 2020-21) groundwater production charge of $1,374/AF for North County municipal and industrial users is anticipated to surpass $3,000/AF by FY 2029-30 to maintain with necessary investments in water supply infrastructure and increasing operations and maintenance costs. **Santa Clara County is rapidly approaching a tipping point where purified water is cost competitive with other supplies.**

Beyond being cost competitive with other supplies, recycled and purified water offer many additional benefits to Silicon Valley, Santa Clara County communities, and the environment, such as:

Drought-resilient water supply that could reduce dependence on imported water and groundwater.

Saltwater and tidal habitat preservation due to reduced freshwater discharges to the San Francisco Bay in North County and minimized treated wastewater discharge to the Pajaro River in South County.

Ecosystem improvements, including fish habitat, in source watersheds due to reduced imported water reliance.

Removal of emerging contaminants (when using reverse osmosis in advanced treatment) that have become increasingly common to detect, due in large part to refinements in analytical methods and tools.

Improved adaptation to climate change impacts.

The CoRe Plan's Vision was used to chart the path ahead, relying on a robust set of tools and guidance, including:

- Baseline to support ongoing collaboration and reuse partnerships
- Consistent method for evaluating availability of treated wastewater for reuse
- Options for reaching up to 24,000 AFY of Countywide reuse
- Feasibility of potable reuse types (GWR, SWA, RWA, TWA)
- Potential future opportunities (interties, RWA/TWA, onsite reuse)
- Right-sizing infrastructure, including conveyance pipelines
- Decision support tools (risk analysis, alternatives evaluation)

The CoRe Plan is a blueprint for reuse for the next few decades -- a living document -- built to adapt to changing water supply and demand conditions, stakeholder input, ongoing research and evolving regulations.

Section 1: Introduction

The mission of Santa Clara Valley Water District (Valley Water) is to provide Silicon Valley safe, clean water for a healthy life, environment, and economy. Achieving this mission requires a holistic One Water approach.

1.1 One Water Approach

In support of its mission, Valley Water developed the One Water Plan as a 50-year roadmap for integrated water resource planning on a watershed scale. The plan brings together state, regional, and local policies into a Santa Clara Countywide framework with goals and objectives for Valley Water's three mission components of flood protection, stream stewardship, and water supply. One Water seeks to provide guidance from an overarching perspective and look for opportunities to further protect and enhance water resources.

Valley Water's holistic, forward-looking approach to water resource management and stewardship includes the One Water approach. This approach leverages partnerships to diversify local water resources, integrate systems to maximize water quantity and quality, and deliver projects that provide multiple benefits. Key objectives include:

- **Reliable water supply**
- **Sustainable groundwater**
- **High-quality water**
- **Flood risk reduction**
- **Expanded floodplains**
- **Supportive stream flows**
- **Resilient habitats**
- **Climate change adaptation**
- **Emergency preparedness**
- **Community engagement**

One Water Countywide Framework

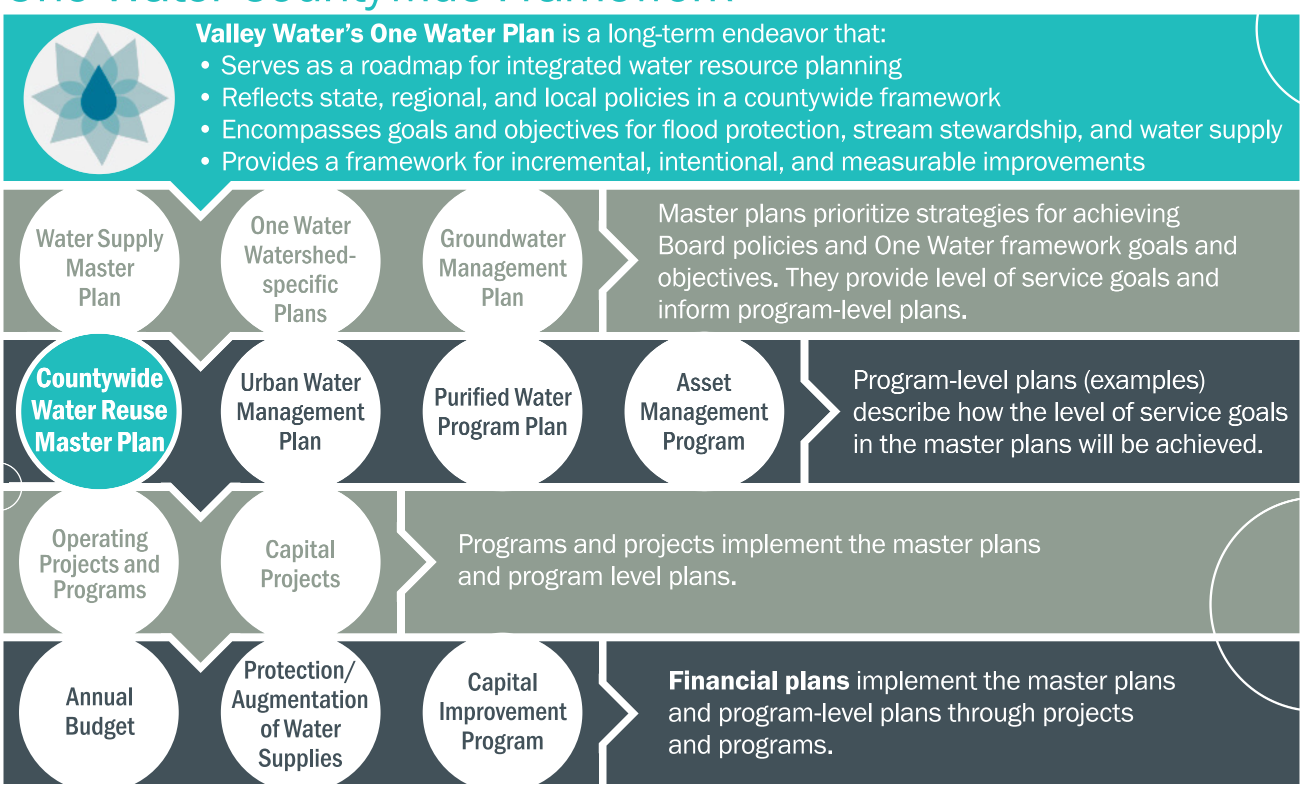


Figure 1-1. Valley Water's One Water Plan as a Countywide framework

1.2 Water Supply Planning

In support of its mission, Valley Water has invested in programs and projects over many decades to manage water demands, develop/protect water supplies, maintain existing infrastructure, and construct new facilities. As described in Valley Water's Water Supply Master Plan 2040 (WSMP 2040), these past and ongoing investments enable Valley Water to manage natural variability in demands and supplies to reliably meet Santa Clara County's current water needs in all but critical drought years—and yet, the County's need for water, particularly reliable dry-year supplies, will continue to grow.

Valley Water's Board of Directors established a goal to increase recycled water use, such that reuse supplies meet 10% of total Countywide demands by 2025 and up to 24,000 acre-feet per year (AFY) by 2040. There are many drivers for diversifying and expanding the County's water supply portfolio—including population/ economic growth, increasing climate uncertainty, and other challenges to supply resilience. Recent technological advancements and regulatory developments further support Valley Water's interest in pursuing water reuse as a viable local, drought-resistant potable (drinking water) supply.

The WSMP 2040 evaluates Valley Water's ability to meet Santa Clara County's projected water demands through year 2040 under various conditions and scenarios. Hydrologic conditions considered range from normal water years to six sequential drought years, and scenarios begin with a baseline water supply system and build by layering various potential supply projects to address anticipated shortfalls based on comparing projected future demands and supplies. The baseline water supply system reflects an increase in water retailers' non-potable reuse (NPR) from 18,000 AFY in 2018—an estimated 6% of Countywide demands that year—to about 28,000 AFY in 2025 and 33,000 AFY in 2040.

Based on the WSMP 2040 water demand forecasts, meeting the Board's goal requires designing and constructing new facilities to begin producing at least 9,000 AFY of potable reuse (PR) supply by 2025.

Further, the WSMP 2040's strategy identifies key strategies and projects to improve water supply reliability and drought resilience over the next two decades, including reuse of 57,000 AFY (14% of projected Countywide demands) by 2040—composed of 33,000 AFY for NPR and 24,000 AFY for PR.

To assess water supply reliability and estimate costs and schedule, the WSMP 2040 assumes a placeholder potable reuse project that involves using purified water for groundwater recharge (GWR) at Los Gatos recharge ponds system (LGRP, or LGRS[1]). Valley Water plans to update the modeling assumptions as necessary to reflect consistency with changes to Board-established reliability goals and a confirmed investment strategy. Valley Water's WSMP 2040 acknowledges that the CoRe Plan will identify and evaluate other options for achieving the 2040 reuse target. At the Board's direction, Valley Water will update the WSMP 2040 analysis and project recommendations to align with the CoRe Plan.

[1] Valley Water's system of recharge ponds located in Los Gatos are referred to as Los Gatos Recharge Ponds (LGRP) system in past documents. In recent documents and going forward, Valley Water is referring to the same facility as Los Gatos recharge system (LGRS).

Achieving Valley Water's goal of meeting at least 10% of the County's 2025 water demands using recycled water requires developing potable reuse and increasing non-potable reuse consistent with Partner Agencies' recycled water system expansion plans.

> "We are the primary water resources agency for all of Silicon Valley, so it's our job to manage and plan for current and future water needs to ensure our region's sustainability," Valley Water Board member Barbara Keegan said. "This includes not just managing the day-to-day water needs for Silicon Valley's residents, businesses, and environment, but also investing in innovative technologies and long-range planning for the region's water needs. By taking a comprehensive, integrated approach to this vital resource, we can protect and preserve it for the benefit of both current and future generations, as well as our valley's environment."
>
> — U.S. Water Alliance One Water Spotlight, March 2016

1.3 CoRe Plan Goals and Objectives

Over decades, Valley Water methodically advanced water reuse in the County by leading planning efforts, developing wholesale recycled water programs, and constructing new infrastructure.

Valley Water initiated the CoRe Plan effort to identify feasible opportunities for expanding reuse as part of the strategy to improve water supply reliability and increase regional self-reliance for Santa Clara County's nearly 2 million residents and growing economy.

Critical to a successful outcome, the CoRe Plan aligns with Valley Water's One Water Plan and WSMP 2040. Developing the plan involved substantial project partner engagement and collaboration to identify and evaluate reuse opportunities.

The Countywide reuse vision evolved over recent years and expanded into a programmatic approach that aims to:

1. Integrate existing recycled water systems and expand NPR
2. Develop purified water systems in partnership with recycled water producers/suppliers and other interested parties to enable potable reuse

The CoRe Plan provides a framework to make collaborative decisions and implement integrated actions to increase water supply reliability throughout the region.

Other CoRe Plan objectives are to:

Determine source water availability and reuse benefits.

Identify sources and flows of recycled water reliably available for reuse, the appropriate split between NPR and PR, and regional (Countywide) and local-level (individual project partner) benefits from NPR and PR.

Evaluate potential regional integration.

Optimize use of supply and infrastructure, build on existing planning studies, and improve system reliability and flexibility.

Consider innovative approaches and provide a basis for collaboration, interagency agreements, and governance related to residuals management, permitting, and land use decisions.

Support regional collaboration and establish a foundation for continued outreach.

Develop and evaluate reuse opportunities—individual projects and collective portfolios that combine projects—and consider implementation pathways.

Increase public support of water reuse through outreach.

To achieve these objectives, Valley Water is collaborating with Partner Agencies (introduced below) that own and operate four separate wastewater treatment plants (WWTP) and recycled water distribution systems in the County.

Figure 1-2 identifies the sewersheds contributing flow to each of the four WWTPs:

- Palo Alto Regional Water Quality Control Plant (RWQCP)
- Sunnyvale Water Pollution Control Plant (WPCP)
- San José-Santa Clara Regional Wastewater Facility (SJ/SC RWF)
- South County Regional Wastewater Authority (SCRWA)

Characteristics of these existing facilities are further described in Section 4.

The four WWTPs produce source water for reuse, and recycled water distribution systems deliver the supply to end users. In some circumstances, a water supplier purchases recycled water from a recycled water producer (i.e., from a WWTP) on a wholesale basis, and the recycled water wholesaler provides the recycled water supply to a retailer that delivers water directly to end users.

The collaboration between Valley Water and the Partner Agencies builds on existing partnerships, plans, and infrastructure; explores a wide range of reuse opportunities that support Valley Water's goals; and yields multiple benefits for the region.

Partner Agencies include:

Recycled Water Producers (WWTPs)

Palo Alto RWQCP

The Palo Alto RWQCP treats wastewater flows from the cities of Palo Alto, Los Altos, Los Altos Hills, and Mountain View; East Palo Alto Sanitary District (EPASD); and Stanford University. The RWQCP produces and distributes tertiary treated recycled water through the Palo Alto/Mountain View Recycled Water System (RWS).

Sunnyvale WPCP

The Sunnyvale WPCP treats wastewater flows from the City of Sunnyvale and portions of Cupertino and San José. A portion of flow at the WPCP receives tertiary treatment that is then distributed as recycled water to retail customers through the Sunnyvale RWS.

SJ/SC RWF

As the largest WWTP in the County, the SJ/SC RWF treats wastewater flows from the cities of San José and Santa Clara (co-owners of the RWF); the cities of Milpitas, Cupertino, Los Gatos, Saratoga, and Monte Sereno; and County Sanitation District Nos. 2-3 (collectively known as Tributary Agencies). In the 1990s, projected population growth and the RWF's effluent discharge limitations set by the National Pollutant Discharge Elimination System (NPDES) permit inspired San José and Valley Water to collaborate in planning development of the South Bay Water Recycling (SBWR) system, a resource recovery system that reuses treated effluent from the RWF for non-potable purposes. Originally, SBWR was constructed to comply with regulations protecting salt marsh habitat by reducing SJ/SC RWF effluent discharges to the San Francisco Bay (SF Bay). In short order, SBWR's water supply benefits became evident.

SCRWA

The cities of Gilroy and Morgan Hill are members of this joint powers authority (JPA) formed to manage treatment of wastewater flows from these two municipalities in the southern portion of Santa Clara County (South County) at the SCRWA WWTP in Gilroy. The South County RWS distributes tertiary-treated recycled water from the WWTP to NPR end users in Gilroy.

Recycled Water Systems

Palo Alto/Mountain View RWS

Palo Alto distributes recycled water from the RWQCP to end users (retail sales) within its service area and provides Mountain View up to 3 million gallons per day (mgd), measured as an instantaneous flow, on a wholesale basis. In 2019, Valley Water, Palo Alto, and Mountain View executed a long-term, 75-year agreement establishing terms for Valley Water to receive 9 mgd of RWQCP effluent for future potable reuse and for subsidized funding of a new 1.125- to 2.25-mgd local advanced water purification facility (AWPF) in Palo Alto. Purified water from the AWPF will blend with tertiary-treated effluent from the RWQCP to reduce total dissolved solids (TDS)—i.e., remove salts—resulting in improved recycled water quality. This blend is referred to as enhanced NPR, or NPR+, and enables broader application of recycled water for non-potable end uses.

Sunnyvale RWS

The Sunnyvale RWS recently expanded with construction of the 2.5-mile Wolfe Road Pipeline—the outcome of a partnership between Valley Water and Sunnyvale that began in 2013 with designing the pipeline to serve customers south of the San Lucar Pump Station and within Cupertino. As part of this institutional arrangement, Valley Water acts as a recycled water wholesaler and provides recycled water to the California Water Service Company (Cal Water), a retailer serving customers on the Wolfe Road Pipeline. The pipeline was designed to allow Cal Water to deliver recycled water from Sunnyvale's RWS to Apple's campus in Cupertino. Valley Water and Sunnyvale are jointly evaluating additional water reuse alternatives, including an AWPF near the Sunnyvale WPCP.

South Bay Water Recycling

SBWR is a recycled water wholesaler and regional permit holder overseeing regulatory compliance for the quality of recycled water produced at the SJ/SC RWF and its use in the cities of San José, Santa Clara, and Milpitas. Operated by the City of San José, SBWR is funded by the SJ/SC RWF capital and operation budget and wholesale recycled water sales to four local water retailers: the cities of San José (via San José Municipal Water), Santa Clara, and Milpitas; and San José Water (an investor-owned utility). Over decades, Valley Water and San José have executed a variety of agreements pertaining to reuse. An agreement established in 2010 set terms for constructing the Silicon Valley Advanced Water Purification Center (SVAWPC), which began operations in 2014. Currently, purified water from the SVAWPC is blended into the SBWR system to improve recycled water quality and reduce TDS. Separately, Valley Water and San José established the Silver Creek Pipeline Agreement that allows Valley Water to wholesale for 5 mgd of SBWR recycled water within a dedicated service area.

South County RWS

SCRWA's recycled water system began operating in 1977 during a historic drought. Operations became intermittent due to a lack of consistent demand for NPR and variabilities in recycled water quality until the 1990s. In 1999, Valley Water and SCRWA executed agreements that established cost-sharing terms and partnering to develop a reuse master plan and capital improvement program, and to define their respective roles pertaining to South County reuse—namely SCRWA as the NPR producer, Valley Water as the wholesaler, and the two municipalities as retailers (though Morgan Hill does not currently have a recycled water distribution system). Terms of one executed agreement establish that SCRWA may sell flows of recycled water that exceed the annual delivery quantity (a mutually agreed-upon flow established each year) to other wholesalers/end users, and Valley Water may sell recycled water to be used by end users outside of the South County RWS service area (with SCRWA's approval).

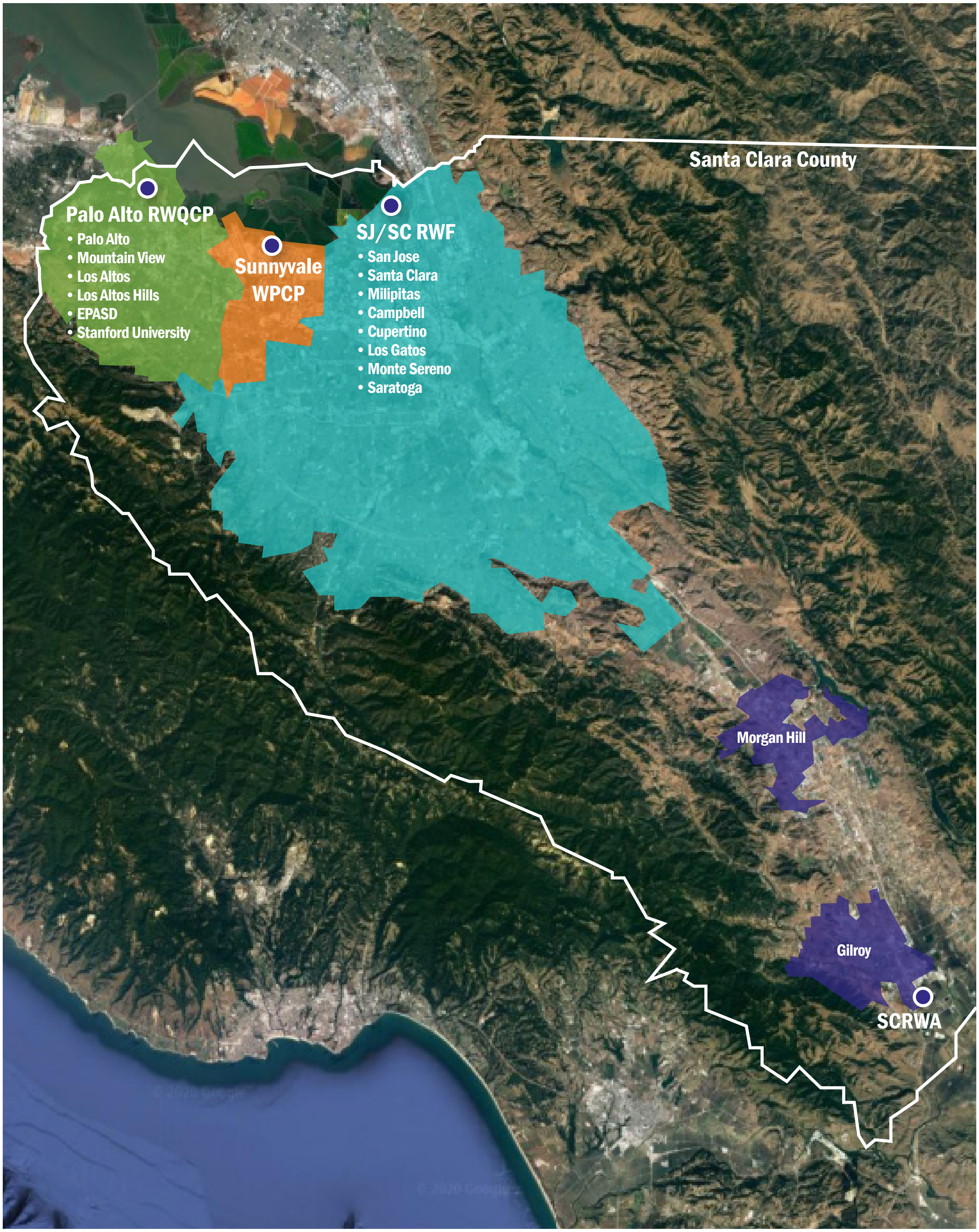


Figure 1-2. Partner Agencies' sewersheds contributing flow to each of the four WWTPs

Section 2:
Partnerships and Engagement

Creating a blueprint for a new regional reuse program requires early, frequent, and meaningful collaboration among Valley Water, Partner Agencies, and stakeholders.

To develop and sustain a common vision for the region, robust engagement across various interest groups and levels is imperative. A Countywide approach can benefit the collective region by enhancing water supply reliability, increasing use of existing infrastructure investments, facilitating water transfers during critical shortages, and improving resilience to droughts and climate change.

The engagement approach for developing the CoRe Plan enabled opportunities for a myriad of agencies and subject matter experts to offer input to the plan's development, garner good will, and generate support (as shown on Figure 2-1).

Staff from Valley Water's Recycled and Purified Water Unit led development of this plan as a Countywide Reuse Project Team, in coordination with:

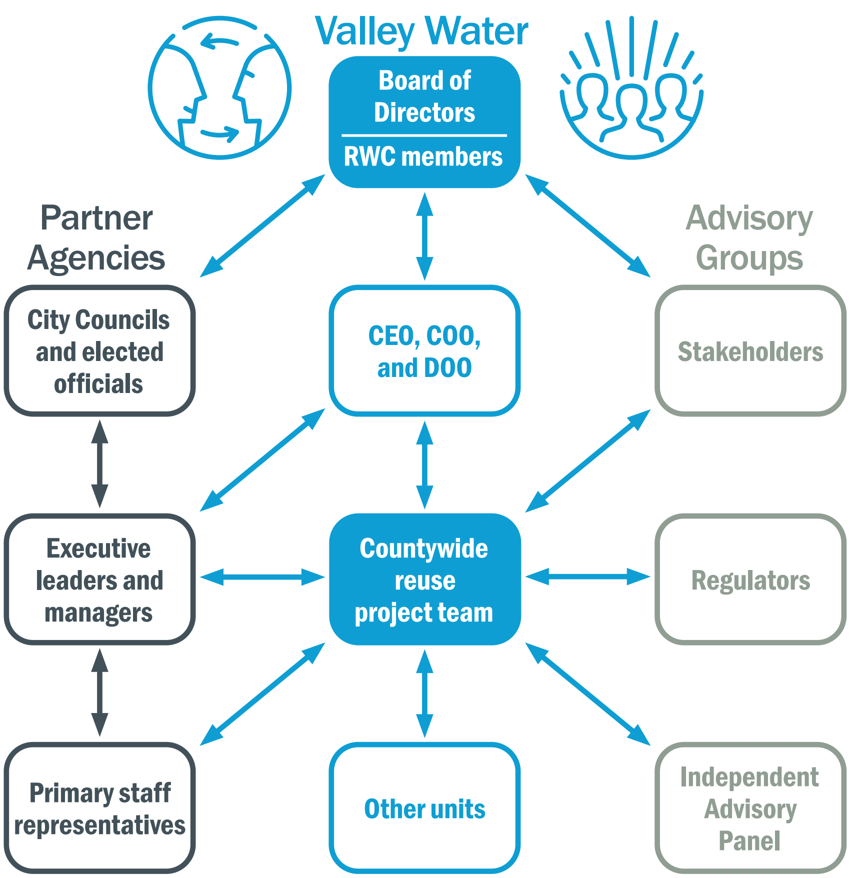


Figure 2-1. Blueprint for robust engagement and collaboration at multiple levels across various groups to inform the CoRe Plan development

Note: CEO = Chief Executive Officer; COO = Chief Operating Officer; DOO = Deputy Operating Officer

VALLEY WATER'S POLICYMAKERS

Valley Water's Board of Directors, composed of seven elected representatives responsible for adopting policies to govern processes and the Board's Recycled Water Committee (RWC)

PARTNER AGENCIES

Partners' staff representing various levels of authority and roles, complementary to those of Valley Water, such as: policymakers (joint committees composed of elected officials and policymakers from Valley Water's RWC and Partner Agencies' city councils or policy advisory committees), executive managers, and staff representatives

ADVISORY GROUPS

Three distinct groups, defined as follows:

- **Stakeholders** invited to participate as task force members, including representative interests/organizations related to business/ economy, chambers of commerce, planning, public policy, environmental advocacy, environmental justice, medical community, diversity, stormwater, groundwater, other water and recycled water suppliers/agencies
- **Regulators** including the State Water Resources Control Board's Division of Drinking Water (DDW) and Regional Water Quality Control Boards, Region 2 (San Francisco Bay) and Region 3 (Central Coast)
- **Independent Advisory Panel (IAP)**, a third-party body composed of leading potable reuse researchers and subject matter experts

While each aspect of the engagement strategy is important, collaboration with Partner Agencies is uniquely critical to the CoRe Plan's success.

Partnerships between Valley Water and recycled water producers are key to unlocking a path forward for regional reuse. Separately, recycled water producers and Valley Water lack required resources to achieve regional supply reliability through reuse, but together, partnerships create win-win solutions whereby smaller retailers achieve reuse goals through Valley Water's financial support while Valley Water secures source water needed to achieve Countywide reuse goals and increased local self-reliance. Long-term agreements between project partners are a critical premise for securing reliably available source water for reuse; the absence of which would call into question the realistic feasibility of implementing a Countywide program. Valley Water and Partner Agencies have invested substantial time and effort in collaborating to develop the CoRe Plan. Each Partner Agency provided valuable contributions and unique insight and perspective through group forums, one-on-one meetings, and written feedback that have been considered and, to the extent possible and practicable, addressed in the plan.

Engaging partners early in the process and at key decision points helps build support and pave the way forward.

This engagement approach sets the tone for continued collaboration as implementation of regional reuse strategies continues. Moving forward, Valley Water's collaboration strategy will continue to emphasize meaningful engagement across various groups and decision-making levels, including the public.

Valley Water will continue efforts to establish partnerships and create new institutional structures to support a common vision for the region. Throughout this planning process and in the future, Valley Water is committed to proactively addressing governance issues to help forge consensus among diverse stakeholders, memorialize commitments, and articulate the vision in actionable planning documents, such as this one.

The mechanism for input varies depending on influencing factors—such as group composition, project milestones/status, schedule sequencing/interdependencies—and takes the form of group meetings, strategic workshops, one-on-one meetings, and written comments. Facilitated meetings and workshops start with empowering stakeholders with critical information to establish a clear, level baseline of working knowledge and support productive group dialogue and decision-making.

2.1 Reuse Roles and Responsibilities within Santa Clara County

A seven-member Board of Directors is elected in overlapping four-year terms to represent geographical districts in the County and govern Valley Water. At the Board's direction, Valley Water's CEO and other executive managers oversee operations and performance of staff.

Valley Water's roles and responsibilities are shaped primarily by California state law (i.e., the District Act) along with various Board-established policies and institutional agreements with other parties. Additionally, Valley Water is considered an independent "special district", informally defined as a separate local government that delivers public services to a particular area.[2] Table 2-1 shows Valley Water's roles and responsibilities related to water reuse.

Table 2-1. Valley Water's Responsibilities as a Leader and Partner Advancing Countywide Reuse

Role	Valley Water's Responsibility
Countywide and regional planning for sustainable, resilient water supplies	Develop strategies to secure and optimize the use of existing water supplies and infrastructure and to expand water reuse and long-term water conservation savings. Lead Countywide water supply planning and coordinate with water retailers, reuse partners, and external interest groups. Participate in the Bay Area Regional Reliability (BARR) partnership with other water suppliers to improve integrated regional water management, drought mitigation, and supply resilience.
Water retailer assistance	Coordinate and collaborate regularly with the 13 local water retailers (including 7 with treated water contracts) in the County to share information, offer technical support, and help develop regional alliances.
Reuse planning, funding, and facilities	Lead collaborative efforts and partnerships to plan reuse projects; cost-share to fund reuse projects; and construct, operate, and maintain reuse facilities.
Reverse osmosis concentrate management	Facilitate collaborative workshops with stakeholders to develop solutions for managing reverse osmosis concentrate (ROC)—a concentrated waste stream resulting from filtration using reverse osmosis—in addition to conducting pilot-scale testing of treatment alternatives.
Water conservation	Lead Countywide water conservation efforts with innovative, comprehensive programs.
Local surface water management	Operate and maintain 20 appropriative water rights licenses and 1 water rights permit[3] filed with the State Water Resources Control Board to capture local runoff and store local and imported supplies totaling more than 227,300 AFY.
Groundwater management	Lead Groundwater Sustainability Agency (under California's Sustainable Groundwater Management Act) to manage the County's groundwater through comprehensive programs and investments, including in-lieu recharge and storage of surface water in groundwater basins for use in dry years.

[2] Per Government Code §16271 [d], a special district is an agency of the state for the local performance of governmental or proprietary functions within a limited boundary. Separate generic statutes apply to special districts that are municipal water suppliers. While the respective Local Agency Formation Commission (LAFCO) administers the formation process, establishing a special district requires voter approval by individuals residing within the geographic area who would be influenced by its proposed fees/services. Special district formation typically requires a majority vote, though two-thirds voter-approval is needed if a proposal involves new special taxes. Special districts are governed by elected boards and may only provide public services allowed by state law.

[3] Under California law, appropriative water rights allow diversion of surface water at a specific point and for beneficial use in a different location. In contrast, riparian rights are based on ownership of property adjacent to a waterbody.

As described in Section 1, project partners for this plan include Valley Water and the Partner Agencies that operate the four WWTPs in the County and currently fulfill roles related to treatment and delivery of recycled water through existing distribution systems. Figure 2-2 depicts project partners' roles in the treatment, delivery, and sale of recycled water. Wholesalers sell water to retailers, while retailers sell water directly to customers and provide customer service. A single entity may serve all roles as a recycled water producer, owner/operator of a recycled water system, wholesaler, and retailer—such as Palo Alto and Sunnyvale.

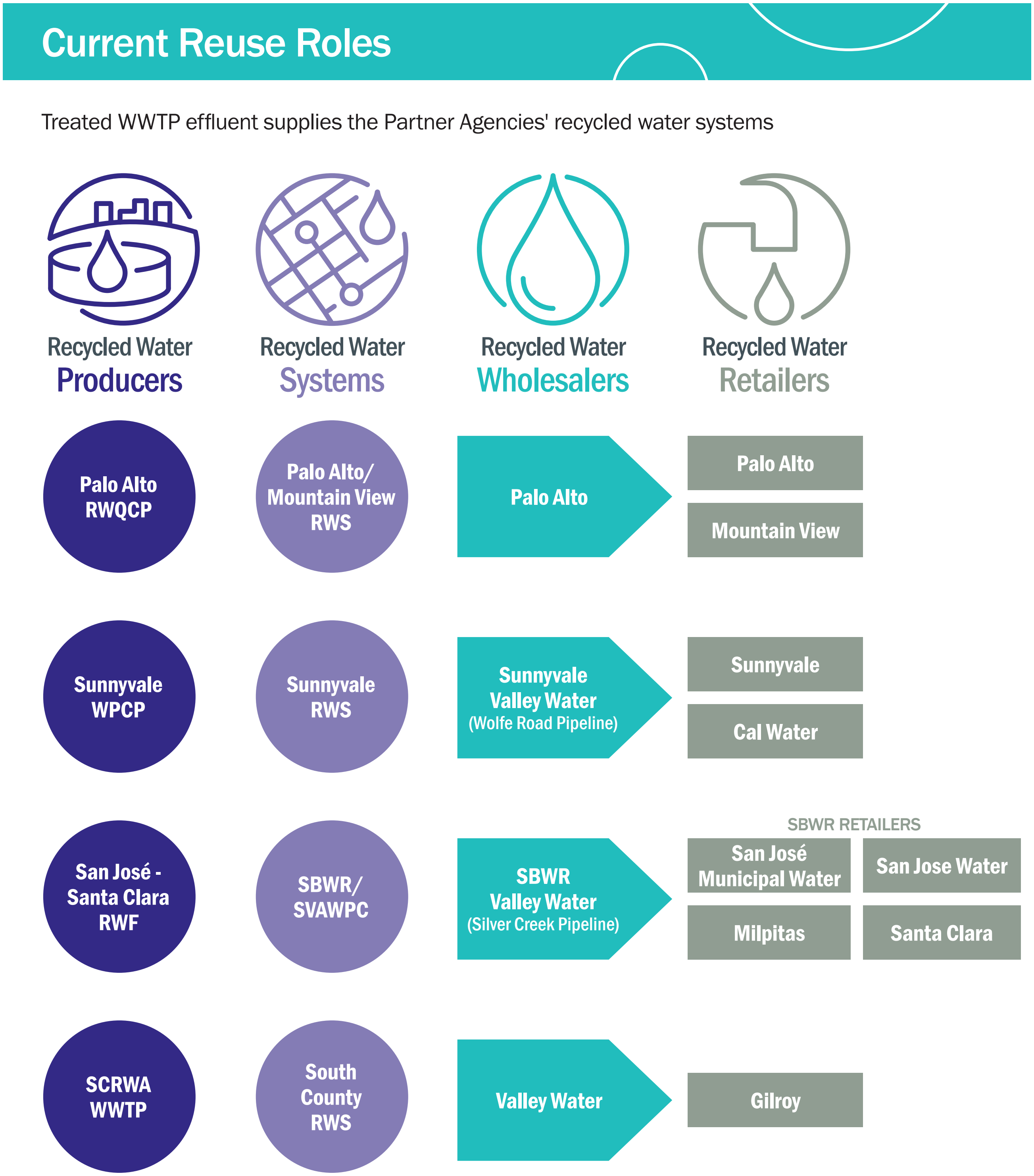


Figure 2-2. Current roles and interagency relationships supporting reuse throughout the County

2.2 Relevant Institutional Arrangements

Current agreements between Valley Water and the Partner Agencies relevant to the CoRe Plan are summarized below. A comprehensive list of past and current agreements is included in Attachment B of ***Appendix D*** (Project Definition, Roles, and Responsibilities). Additional arrangements will be necessary to implement various project elements, as discussed in Section 8.3.

Palo Alto / Mountain View; 2019 Cost Sharing and Supply Agreement

[Expires December 10, 2095]

In December 2019, Valley Water executed an agreement with the cities of Palo Alto and Mountain View that defined cost-sharing and supply commitments related to reuse. The agreement extends until December 10, 2095. Key provisions include:

- Cost-sharing for constructing a $20 million local AWPF in Palo Alto for enhanced NPR (NPR+) or other alternatives that benefit RWQCP partners.
- Commitment of 9 mgd of effluent (minimum annual average flow) from Palo Alto to Valley Water at a cost of ~$100/AF for treatment at a regional AWPF.

Sunnyvale; Wolfe Road Pipeline

[Expires 2025; renews every 5 years]

In 2015, Valley Water, Sunnyvale, Apple, and Cal Water agreed to cost-share construction of the Wolfe Road Pipeline. Key provisions of the Recycled Water Supply and Distribution Agreement between Sunnyvale (producer) and Valley Water (wholesaler) include:

- Valley Water owns, but Sunnyvale operates and maintains, the pipeline. Recycled water conveyed through the Wolfe Road Pipeline is owned by Valley Water and may be resold to Valley Water's other customers, regardless of their location.
- For recycled water from Sunnyvale flowing through Wolfe Road Pipeline, a commitment of at least 500 AFY for Valley Water's distribution to users outside the city and an entitlement of up to 595 AFY (and option to purchase more, subject to Valley Water's approval) for Sunnyvale's end users within the city.

City of San José; SBWR Expansion and Silver Creek Pipeline

[Expires January 22, 2027]

In 2002, Valley Water and San José entered into a 25-year agreement to develop a framework for long-term ownership, operation, maintenance, and future expansion of SBWR, and to share costs for the Silver Creek Pipeline. Per the agreement, the City owns the pipeline and acts as wholesaler for recycled water to be delivered to the Metcalf Energy Center and other end users within San José Municipal Water's service area. Valley Water has rights to 5 mgd of recycled water from the Silver Creek Pipeline with the potential for more depending on availability.

City of San José; SVAWPC Agreements

[Expire June 30, 2050]

Under the Ground Lease and Property Use Agreement, Valley Water must operate and maintain the SVAWPC, accepting up to 12 mgd of secondary effluent from the SJ/SC RWF to provide up to 8 mgd of purified water for NPR+ (targeting TDS levels of about 500 to 550 milligrams per liter (mg/L), which corresponds with the TDS limit for potable water and supports protection of groundwater quality).

The Operations and Maintenance Agreement for SVAWPC requires the SJ/SC RWF to accept 1.5 mgd of waste stream discharge and 2 mgd of ROC.

SCRWA; Producer-Wholesaler Agreement

[Expires December 31, 2026]

In October 1999, Valley Water and SCRWA executed a series of three 20-year Producer-Wholesaler agreements (updated in 2006) that established SCRWA as the producer, Valley Water as wholesaler, and the City of Gilroy as retailer of recycled water. As part of the agreements, SCRWA may sell recycled water that exceeds the annual delivery quantity (a mutually agreed-upon flow established each year) to other wholesalers or end users, and Valley Water may sell recycled water to end users outside of the Producer's service area (with approval by SCRWA).

In addition to Valley Water agreements, Partner Agencies have other contractual arrangements that establish financial/supply obligations and other requirements. In some cases, these obligations restrict flow for certain uses, and new or amended agreements may be required to make flow available for projects considered within this CoRe Plan. For example, under a current agreement that expires in 2060, Palo Alto is required to make recycled water available to Mountain View on a demand basis with a peak flow rate of up to 3 mgd. Both Palo Alto and Mountain View have the right to approve or reject proposals to extend their respective distribution systems and transfer recycled water through their own infrastructure and out of their service areas, provided they do not exceed their recycled water allocations.

Terminology: Units for measuring flow and yield

mgd = million gallons per day: Used in context of defining capacity (maximum possible, or peak, flow) for treatment and conveyance facilities and/or characterizing average water/ wastewater use over any timescale.

AFY = acre-feet per year: Used when referring to annual supply or demand over a longer timescale (one or more years). Overall project yield uses AFY.

Appendix A-2 (Compendium of Flow Assessments, Facility Design Capacity, and Annual Yield) provides additional details.

Section 3:
Regulatory Framework

The CoRe Plan considers a wide range of reuse scenarios, giving way to a spectrum of applicable regulatory and permitting requirements. In general, regulations for water reuse fall into two categories: public health protection (consumption) and environmental protection (discharges).

Since the California Legislature began regulating water reuse in 1969, the state has enacted over 100 relevant statutes. Regulations and permit requirements are integral to shaping more detailed aspects of reuse projects. The intended use(s) of reuse supply and potential impacts to human health and the environment are at the core of these regulations and requirements, establishing clear, enforceable boundaries in the public interest. While end uses for reuse supply typically drive the selection of treatment processes, other factors are considered, such as programs requiring and overseeing source water quality control, monitoring, and response. In addition, the technical, managerial, and financial (TMF) capacities of agencies responsible for treatment, conveyance, storage, and distribution of reuse supplies is a critical consideration.

While this section merely introduces reuse regulations, ***Appendix B-2*** (Regulatory Framework Technical Memorandum [TM]) addresses the topic in substantially more detail.

3.1 Regulators and Respective Purviews

Upon adopting the Porter-Cologne Act in 1969, the California Legislature established a comprehensive program to protect water quality and beneficial uses of water, along with an agency with relevant statutory authority—the State Water Resources Control Board (State Board). The State Board is responsible for setting statewide water quality policy, establishing and enforcing water regulations, and overseeing water reclamation requirements (WRR) and waste discharge requirements (WDR).

The Act also established nine Regional Water Quality Control Boards (**Regional Boards**) under the State Board's overall authority with roles defined by their respective individual geographic boundaries. Regional Boards hold the responsibility of administering permit systems to enforce compliance with water quality criteria for recycled water and discharge regulations.

Regional Board

Enforcement of **Environmental Discharge Criteria:** Water quality requirements to protect surface water and groundwater quality for all designated beneficial uses

The State Board's **Division of Drinking Water** (DDW, formerly California Department of Public Health) has statutory authority over two aspects of water reuse:

1. Regulation of public water systems in accordance with the California Safe Drinking Water Act (Health and Safety Code Section 116270 et seq.); and
2. Development and adoption of water recycling criteria as required by Section 13521 of the California Water Code.

DDW

Enforcement of **Public Health Protection Criteria:** Requirements for treatment, monitoring, and effluent water quality for the end use (e.g., landscape irrigation and GWR)

Primary responsibilities of the Regional Boards and DDW are further described as follows.

Regional Water Quality Control Boards

Regional Boards implement water quality planning and regulatory decisions for their specific regions, such as issuing waste discharge requirements (i.e., discharge permits), administering National Pollutant Discharge Elimination System (NPDES) permits for receiving surface water bodies, and enforcing Salt and Nutrient Management Plan (SNMP) requirements for groundwater protection.

The SF Bay Regional Board (Region 2) regulates discharge facilities in the northern part of Santa Clara County (North County), while the Central Coast Regional Board (Region 3) regulates SCRWA's discharges in the South County (see Glossary [figure labeled Visual Glossary-3] for locations).

NPDES permits for discharges to surface waters contain specific requirements that limit the pollutants in discharge effluent.

Regional Boards are responsible for specific regulatory areas affecting water reuse:

- Approving pollutant source control programs for wastewater systems
- Issuing and enforcing water reclamation (reuse) requirements to producers and users
- Defining beneficial uses of surface water bodies and groundwater basins through water quality control plans
- Regulating treatment facility operators
- Determining water rights regarding reuse

In context of the CoRe Plan, three contemplated activities trigger the need to seek new or modified NPDES permits or WDRs/WRRs[4] through Regional Boards, including discharging:

1. Purified water to spreading basins for GWR
2. Purified water to Anderson Reservoir for surface water augmentation (SWA)
3. ROC discharge through surface water outfalls or to local evaporation ponds

Most PR applications in California use full advanced treatment (FAT), which involves reverse osmosis and produces a ROC waste stream that may contain concentrated levels of TDS, nutrients, metals, and toxicity. ROC discharge to a surface water body requires NPDES compliance accomplished through either modifying an existing NPDES permit or obtaining a new one. Modifying an existing permit warrants careful review of potential impacts that may compromise compliance with effluent discharge water quality requirements and trigger further waste stream treatment and/or permit modifications. Other ROC management strategies, such as deep well injection or evaporation ponds, require a WDR permit. Like discharges to surface water bodies, these ROC streams also need to comply with the applicable Basin Plan requirements.

[4] WDR may be applicable to ROC management involving deep well injection or evaporation ponds, while WRR and WDR both may be applicable to product water released to spreading basins for GWR.

SNMPs establish pertinent water quality objectives (WQOs) to protect groundwater quality from potential degradation. Although NPR for irrigation may increase salts and other contaminants in groundwater, NPR+ water supplied by SBWR helps protect groundwater quality by supplementing recycled water with purified water that contains less salts and other contaminants and results in a target TDS concentration between 500 to 550 mg/L. Palo Alto is constructing a new local AWPF to create NPR+ supply, and Sunnyvale may opt for NPR+ supply in the future, further decreasing risk of degraded groundwater quality from use of recycled water for irrigation.

Division of Drinking Water

DDW develops and enforces public health protection requirements contained in the California Code of Regulations (CCR) Title 22 Uniform Water Recycling Criteria. DDW regulations around potable reuse depend on the type of reuse. For NPR, DDW set increasingly stringent water quality requirements proportionally with the potential for public exposure. For GWR, water quality requirements are more stringent for subsurface injection than for surface spreading. DDW has set a high bar for SWA water quality requirements to protect public health. DDW is currently working on DPR regulations for both RWA and TWA; these regulations are anticipated for release as early as 2023.

DDW specifies public health requirements for water reuse, such as:

- **Pathogen control**
- **Chemical control**
- **Source control**
- **Monitoring/control**
- **Retention/response time**
- **TMF capacity**

3.2 Independent Advisory Panel

The Independent Advisory Panel (IAP) is a third-party body composed of six leading potable reuse researchers and subject matter experts that were invited to review and provide feedback on proposed CoRe Plan projects, portfolios, and options related to technical feasibility and regulatory compliance. IAP members include:

- James Crook, Ph.D., P.E., BCEE
- Katherine Cushing, Ph.D.
- Jean Moran, Ph.D.
- Adam Olivieri, Dr.P.H., P.E.
- Mehul Patel, P.E.
- Shane Snyder, Ph.D.

The IAP met in July 2020 to share input on the Countywide reuse portfolios, as reflected in the Draft CoRe Plan completed earlier that month. Panel members noted that GWR has the highest likelihood of meeting the current target completion date of 2028 given the maturity of the associated regulations. However, the IAP cautioned that even GWR via surface spreading can take substantial time to implement and requires strong partnerships with participating agencies. The IAP also provided valuable input on CoRe Plan details such as proposed treatment trains, source control planning, and monitoring considerations, which are summarized in ***Appendix B-1***.

3.3 Non-Potable Reuse (Recycled Water)

Water recycling is a form of resource recovery and can be referred to as NPR when serving non-potable end uses, such as irrigation, landscaping, commercial dual-plumbed facilities (i.e., toilet and urinal flushing), or industrial processes (e.g., mechanical cooling systems). In centralized systems, recycled water is typically treated at a WWTP, distributed through a dedicated purple-pipe system (separate from the potable distribution system), and sold to recycled water users.

California regulates recycled water according to CCR Title 22 including treatment, discharge, end use, and cross-connection control. Title 22 addresses water-related issues in the context of environmental health and defines four categories of recycled water based on level of treatment and resulting water quality, as described in greater detail in ***Appendix B-2***.

Each of the Partner Agencies produces and distributes recycled water that is consistent with Title 22's highest level of treatment for NPR—disinfected tertiary. Further, some Partner Agencies distribute (or will soon distribute) a blend of recycled water and purified water that surpasses the requirements for disinfected tertiary, referred to as NPR+ (meaning, enhanced NPR). Blending purified water with recycled water helps to improve water quality by reducing salinity (TDS) and constituents left untreated through tertiary treatment, such as constituents of emerging concern (CECs) including PFAS. State regulations do not require the monitoring of CECs in recycled water supply serving non-potable applications. Regardless, Valley Water will continue to track potential developments in terms of relevant research and regulations and assess potential impacts of CECs in recycled water on groundwater quality.

3.4 Potable Reuse

California's regulations acknowledge five specific types of PR (Figure 3-1), each subject to specific permitting requirements. In many cases, these differences are linked to the existence and size of an environmental buffer. As the buffer diminishes in size—or is eliminated in many direct potable reuse (DPR) scenarios—regulatory requirements for other project components increase.

Environmental buffers provide a myriad of benefits—less stringent wastewater and AWPF treatment requirements (due to the attenuation of constituents in the environment), dilution to minimize potential chemical contaminant peaks, and/or decreased monitoring requirements due to increased response time.

Compared to IPR, DPR applications (as raw water augmentation [RWA] and treated water augmentation [TWA]) may involve elimination or significant reduction of the environmental buffer. Consequently, enhanced requirements are anticipated for pathogen control, chemical attenuation, real-time monitoring, engineered storage, and blending. Though regulations for RWA and TWA are not yet developed, potential future requirements can be inferred from DDW's recent publications and presentations, the California DPR Expert Panel[5], and the Project Team's engagement in DPR research and permitting. An evaluation of regulatory compliance strategy for the portfolios' PR elements is summarized in Section 8 and presented in more detail in ***Appendix B-1***.

GWR via surface spreading or direct injection is the least-direct form of PR. In 2014, which more than 50 years since California's first successful indirect potable reuse (IPR) project began in 1962, the State finalized GWR regulations.

The extended period between initial GWR implementation and final regulations provided regulators an opportunity to learn how to protect public health while fostering the growth of this alternative water supply. Recently finalized in 2018, SWA regulations developed more quickly, yet still benefited from the lessons learned and process of adopting GWR regulations.

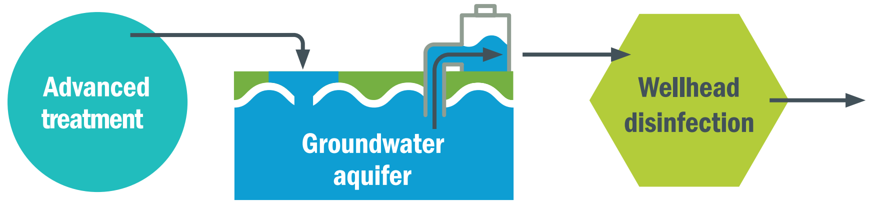
Refer to the glossary at the end of this document for definitions of words and concepts used throughout the CoRe Plan. Within the glossary, an infographic visually depicts the various forms of reuse, including NPR and PR.

[5] DPR Expert Panel members include: Michael Anderson, Ph.D.; Richard Bull, Ph.D.; James Crook, Ph.D., P.E. (Panel Co-Chair); Dr.-Ing. Jörg Drewes; Charles Haas, Ph.D.; Walter Jakubowski; Perry McCarty, Sc.D.; Kara Nelson, Ph.D.; Adam Olivieri, Dr.P.H., P.E. (Panel Co-Chair); Joan Rose, Ph.D.; David Sedlak, Ph.D.; and Timothy Wade, Ph.D.

Forms of Potable Reuse

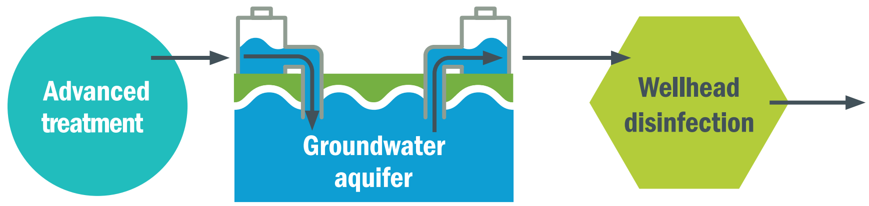
IPR with a substantial environmental buffer: Surface-spreading of full-advanced-treated purified water in percolation ponds for groundwater recharge

Groundwater recharge: surface spreading*



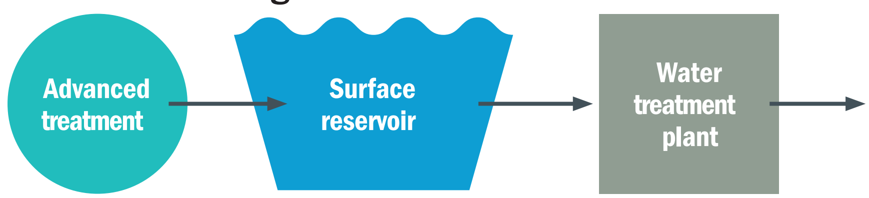
IPR via subsurface injection of full-advanced-treated purified water directly into the groundwater aquifer

Groundwater recharge: subsurface injection



IPR involving addition of full-advanced-treated purified water to a surface water reservoir

Surface water augmentation



DPR via blending full-advanced-treated purified water with raw, untreated surface water upstream of a conventional WTP

Raw water augmentation

DPR in most highly engineered form: Introduction of full-advanced-treated purified water into a potable distribution system downstream of a conventional WTP

Treated water augmentation

** Though California regulations allow using tertiary-treated recycled water for groundwater recharge via surface spreading, Valley Water requires full advanced treatment to protect groundwater quality.*

Figure 3-1. California regulations address five specific approaches to potable reuse

Under legislative mandate in Assembly Bill (AB) 574, the State Board is required to develop regulations for RWA by the end of 2023 (with a potential extension to mid-2025). In August 2019, the State Board issued the second edition of its Proposed Framework for Regulating DPR in California, with various updates to their initial draft.

Notably, DDW indicated the intent to develop a single DPR regulatory package that encompasses requirements for both RWA and TWA. The timeline for the DPR regulatory package remains consistent with the AB 574 deadline of December 2023.

Monitoring for CECs such as PFAS is required for potable reuse projects. The proposed treatment trains are effective at removing many CECs, including PFAS, as noted in Valley Water's PFAS fact sheet (Valley Water, 2020b). Valley Water will track regulations and continue to assess potential risk of purified water and CECs to groundwater. Implementation of future groundwater recharge portfolios would include detailed hydrogeologic modeling and monitoring to assess potential for mobilization of constituents, including CECs or metals.

As also noted in the preface, DDW released an initial draft of DPR regulations in March 2021, as Valley Water and its project team were finalizing this CoRe Plan. With initial draft regulations becoming available after a multi-year effort to complete the CoRe Plan—including development of preliminary treatment trains for DPR portfolios (both RWA and TWA) and a regulatory compliance assessment—Valley Water and its project team performed a cursory review of the initial draft regulations and found the anticipated DPR requirements identified in the CoRe Plan adhere closely to those in the draft regulations.

Section 4:
Existing Reuse Systems

Each of the four WWTPs in the County produces recycled water distributed for NPR. In addition, Valley Water's SVAWPC purifies a portion of SJ/SC RWF effluent. The purified water is blended into SBWR's recycled water for salinity reduction.

Before exploring conceptual and feasible water reuse alternatives, Valley Water and the Project Team gathered up-to-date information for recycled water facilities in the County. ***Appendix E (Baseline Analysis TM)*** provides more detail on the approach used to establish existing conditions for the recycled water facilities and distribution systems in the County, as well as the outcomes. This evaluation also included a preliminary assessment of the volume of water available for reuse, the potential NPR/PR split, and a summary of potential infrastructure improvements. The Baseline Analysis helped to inform development of project alternatives and portfolios.

The baseline conditions (physical characteristics and flows) of existing reuse facilities are summarized in the following subsections and inform the analysis of expanded reuse potential. Figure 4-1 shows the extent of existing recycled water distribution systems, as well as water/recycled water retailers' service areas and sewershed boundaries throughout Santa Clara County.

Currently, recycled water systems in the County serve only NPR end uses. The SVAWPC opened in 2014 to reduce the salinity of SBWR recycled water and demonstrate advanced treatment technology.

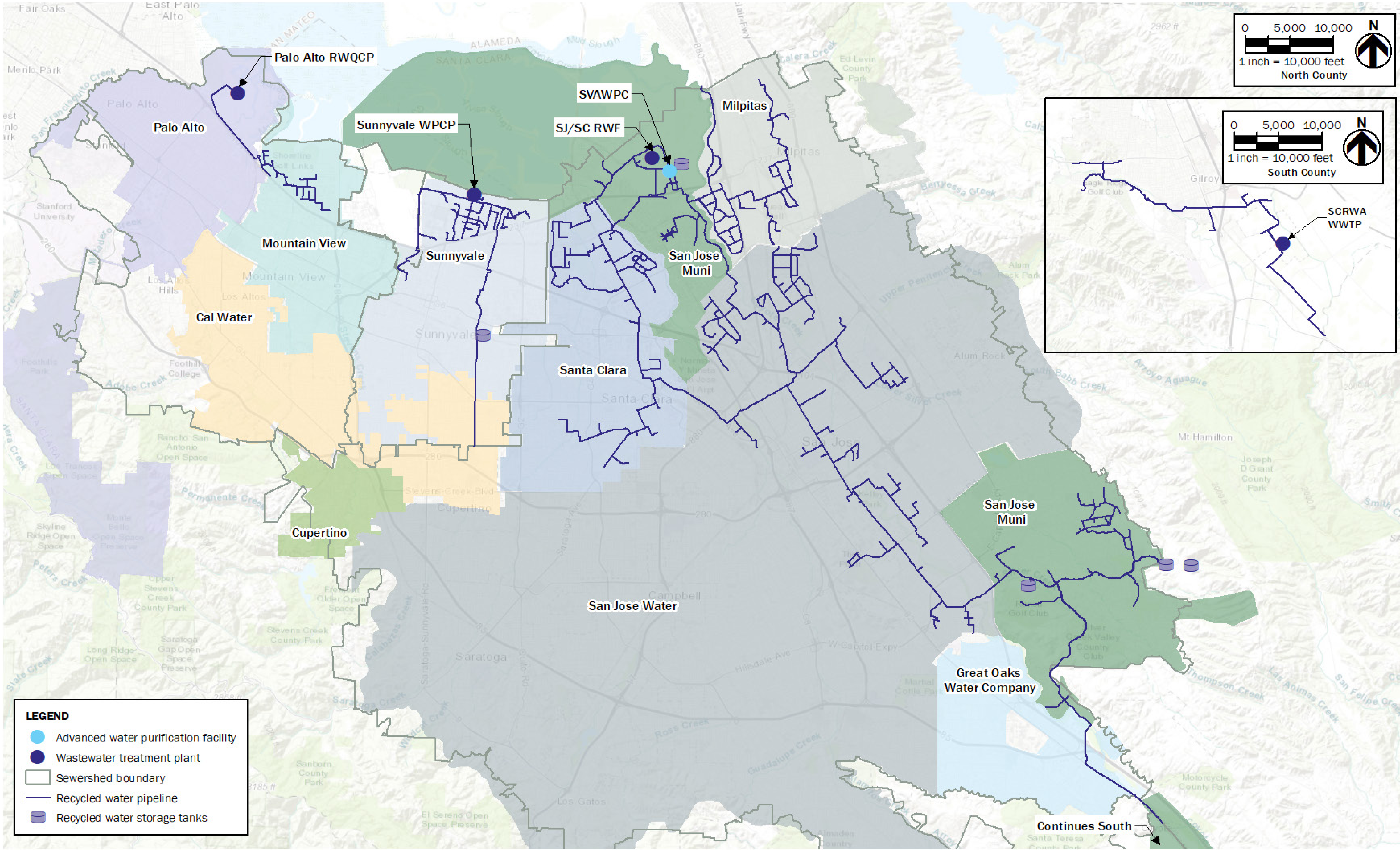


Figure 4-1. Existing recycled water distribution systems, water/recycled water retailer service areas, and sewershed boundaries throughout Santa Clara County

4.1 System Characteristics

Key characteristics of each WWTP and corresponding NPR system are summarized below. Partner Agencies' many planned improvements—including expanded NPR distribution systems and a new AWPF for NPR+ in Palo Alto—align with the CoRe Plan objectives and involve close coordination with Valley Water.

RECYCLED WATER PRODUCERS (WWTPs)

Palo Alto RWQCP, Advanced Secondary Treatment

Average dry weather influent: 18 mgd [a]
NPR production capacity: 5 mgd
Planned improvements: secondary treatment process upgrades (currently in design), parallel outfall (currently in design), headworks, additional recycled water facilities

Sunnyvale WPCP, Tertiary Treatment

Average dry weather influent: 11 mgd [a]
NPR production capacity: 4 mgd
Planned improvements: replacing primary treatment facilities (in construction), rehabilitating secondary and tertiary facilities, converting secondary treatment to conventional activated sludge process (Phase I in design)

SJ/SC RWF, Tertiary Treatment

Average dry weather influent: 102 mgd [a]
NPR production capacity: 38 mgd
Planned improvements: headworks modifications; upgrades to primary and secondary treatment, filtration, and sludge thickening

SCRWA WWTP, Tertiary Treatment

Average dry weather influent: 6 mgd [a]
NPR production capacity: 9 mgd
Planned improvements: addition of a new membrane bioreactor (MBR) process

RECYCLED WATER SYSTEMS (NON-POTABLE REUSE)

Palo Alto/Mountain View RWS

Service area: vicinity of Palo Alto RWQCP and North Bayshore area of Mountain View
NPR demand (peak month): 1 mgd (2015-2017 average); 5 mgd (projected [b])
Current challenges: high salinity, insufficient storage, no potable backup
Planned improvements: distribution system expansion; AWPF for NPR+

Sunnyvale RWS

Service area: Northern Sunnyvale (north of Highway 237) and Apple campus in Cupertino
NPR demand (peak month): 2 mgd (2015-2017 average); 3 mgd (projected [b])
Current challenges: high salinity, color (green tint), insufficient storage
Planned improvements: none planned

SBWR

Service area: San José, Santa Clara, and Milpitas
NPR demand (peak month): 20 mgd (2015-2017 average); 45 mgd (projected [c])
Current challenges: insufficient storage, lack of isolation valves
Planned improvements: maintenance and reliability upgrades

South County RWS

Service area: Gilroy
NPR demand (peak month): 3 mgd (2015-2017 average); 5 mgd (projected [b])
Current challenges: high salinity, no potable backup, peak hour demands near system capacity
Planned improvements: distribution system expansion

PURIFIED WATER FACILITY

Silicon Valley Advanced Water Purification Center (SVAWPC)

Owned and operated by Valley Water, the SVAWPC is located across the street from the SJ/SC RWF in San José. SVAWPC was developed to enhance the quality of SBWR recycled water. SBWR demands are met with a blend of SJ/SC RWF recycled water and purified water from SVAWPC.

SVAWPC employs many treatment processes needed for PR; thus, Valley Water conducts research at the facility to further evaluate purified water as a future water supply option. The current purified water production capacity is 8 mgd.

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[a] *2014-2018 average dry weather influent (i.e., lowest consecutive three-month average) from California Integrated Water Quality System (CIWQS). Sunnyvale WPCP values from CIWQS were reduced by 0.5 mgd to account for a difference in metering location, per direction from Sunnyvale staff.*

[b] *2040 NPR demand projections based on projected annual demands from 2015 Urban Water Management Plans and assuming the same monthly distribution as historical use (2015-2017 average). Values do not fully capture potential allocations per contractual agreements.*

[c] *Updated 2040 NPR demand projections provided by SBWR staff in January 2019. As shown in Figure 4-3, peak summer demands are much higher.*

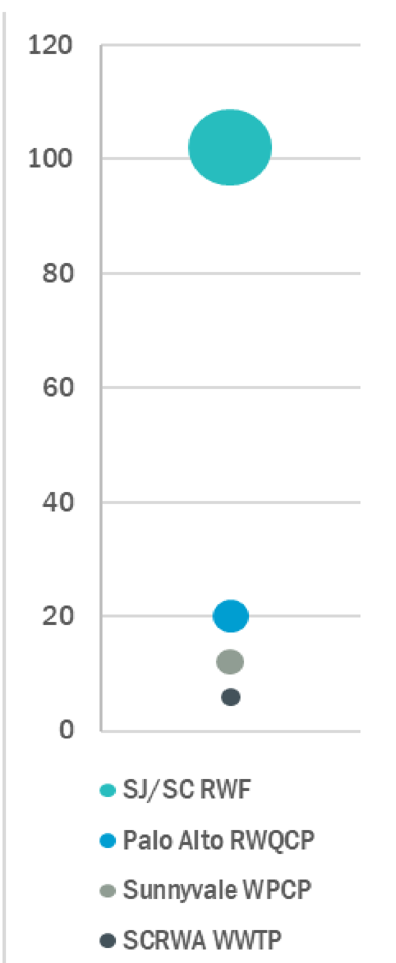
4.2 Existing Flow Conditions

WWTP Influent

Figure 4-2 shows daily influent flows at each of the four WWTPs (2014-2019). Influent varies seasonally, particularly during wet years, with winter flows significantly higher than summer flows. Influent is often characterized as average dry weather flow (ADWF), or the lowest consecutive three-month average, which tends to be much lower than average annual flow.

Flows vary across the four WWTPs, as shown below; thus, scales in Figure 4-2 differ by WWTP.

Scale: Average daily influent flow (in mgd) at Partner Agencies' WWTPs



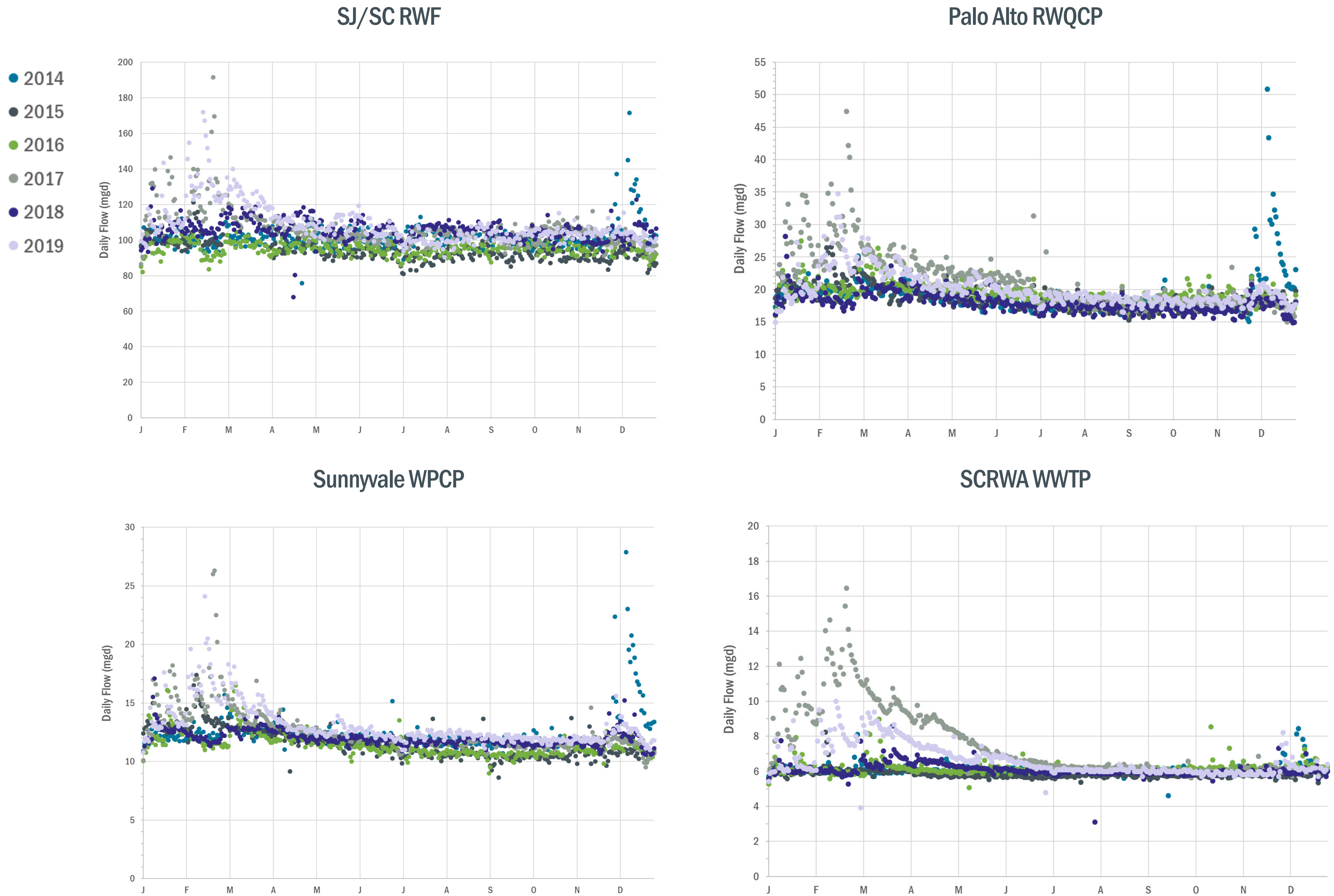


Figure 4-2. Existing flow conditions by Partner Agency, based on daily WWTP influent flows (2014 through 2019)

Note: Scale differs by WWTP.
Source: California Integrated Water Quality System (CIWQS) database (note – Sunnyvale flows were corrected by reducing WPCP influent by 0.5 mgd, per discussion with Sunnyvale staff).

NPR Demands

Average monthly NPR demands (based on 2015-2017 data provided by Partner Agencies) are shown on Figure 4-3. NPR demand tends to be much higher in summer months, as recycled water is largely used for landscape irrigation. To improve water quality and maintain a target TDS below 500 to 550 mg/L, SBWR currently blends purified water from the SVAWPC with its Title 22 recycled water, resulting in reuse supply referred to as enhanced NPR, or NPR+. Palo Alto is planning a local AWPF for NPR+ in the future. Sunnyvale and SCRWA currently do not have a need for NPR+.

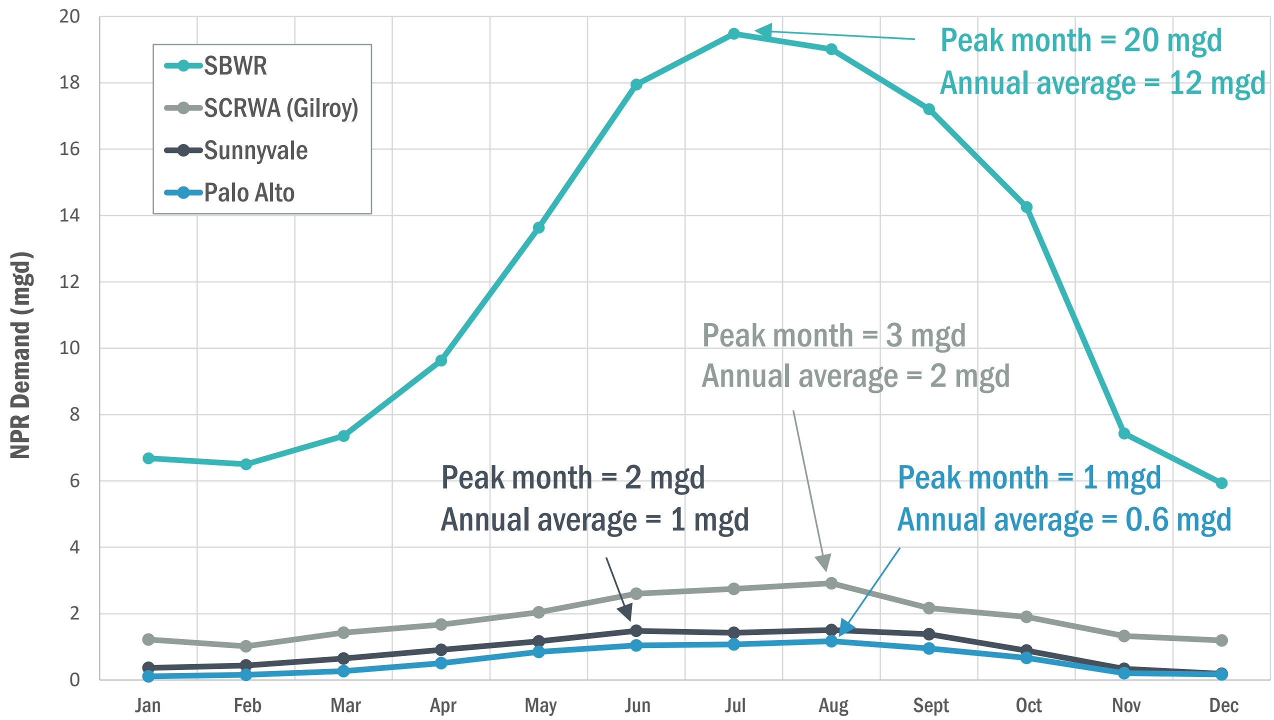


Figure 4-3. Existing NPR demands by Partner Agency, based on average monthly use (2015-2017)

Environmental Flow Requirements

Depending on circumstances, regulatory permits may specify conditions for systems to support ecosystem health by providing environmental flows dictating the quantity, timing, and quality of water flowing to natural systems. Currently, Palo Alto RWQCP is the only WWTP in the County obligated under NPDES permit requirements to provide flow for environmental benefit. While the Palo Alto RWQCP's NPDES permit currently requires 1 mgd of effluent to be sent to the Renzel Marsh project, the marsh may be expanded to receive up to 3 mgd. This consumptive use supports habitat preservation but further reduces effluent available for potential reuse, as described further in Section 5.2.

Losses

Depending on the treatment process, some WWTPs experience losses during treatment. For example, the Palo Alto RWQCP recirculates some effluent for in-plant uses (e.g., wet scrubber water and filter backwash) and experiences a 20% loss of the recirculated flow, which equates to approximately 0.3 mgd. Additionally, the Sunnyvale WPCP has some evaporative losses associated with the use of ponds as part of its treatment process. Current evaporative losses are typically between 1 and 2 mgd, though future losses may be up to 4 mgd, including flows for capping and evaporation at their ponds.

4.3 Reuse Research Facilities

In 2014, Valley Water commissioned the SVAWPC, an 8-mgd (vs. 8.0-mgd) state-of-the-art advanced water treatment facility that includes microfiltration, reverse osmosis (RO), and ultraviolet (UV) light disinfection. A pilot-scale advanced oxidation process is also part of the facility, used to test and demonstrate the continued performance of advanced treatment technologies for producing highly treated water (purified water) to be used for IPR and/or potential DPR applications. The facility provides an excellent venue for both IPR and DPR public education. The 2015 PR Demonstration Test Plan prepared by Valley Water demonstrated effective performance of the SVAWPC to further advance secondary treated wastewater to meet or exceed California drinking water standards. Figure 4-4 shows key results of this study.

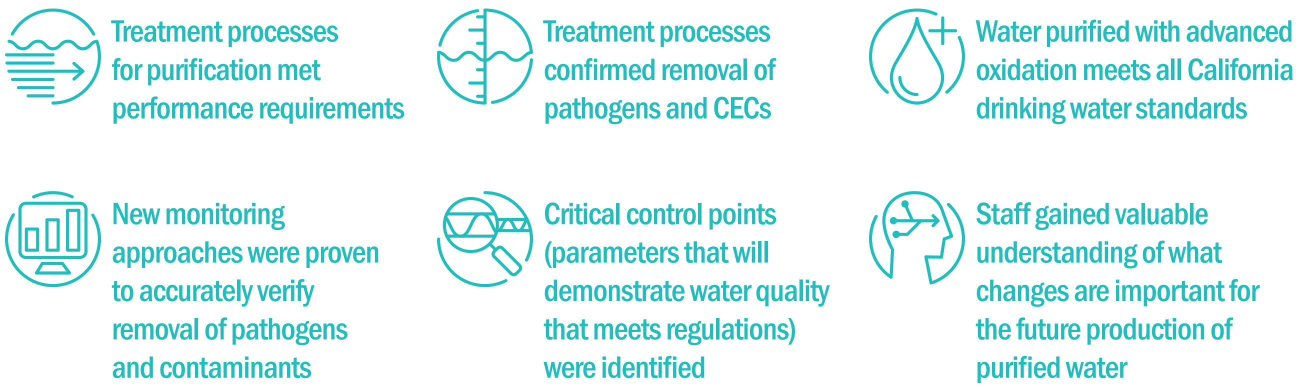


Figure 4-4. Key results of the PR demonstration test plan for SVAWPC

In 2017, Valley Water initiated studies and a planning effort to evaluate viable alternatives for managing ROC from potential advanced water purification facilities that could be built in the County. Together with the University of California Berkeley, NSF Engineering Research Center for Reinventing the Nation's Urban Water Infrastructure, Stanford University, and the San Francisco Estuary Institute, Valley Water studies treatment alternatives by installing, testing, and evaluating a pilot-scale engineered open-cell treatment system at the SVAWPC.

Independent of Valley Water's efforts, Stanford University is currently operating a water reuse research facility in Palo Alto called the Codiga Resource Recovery Center. The center has the flexibility to evaluate multiple mobile treatment systems and to vary feed water quality (lake water, greywater, municipal wastewater [raw sewage], primary effluent, and secondary effluent). The flagship treatment technology is a staged anaerobic fluidized bed membrane bioreactor that treats municipal wastewater to secondary effluent water quality standards and converts organic matter to biogas methane. Benefits of this technology include decreased energy use by avoiding aeration and reduced solids handling costs. The center is also evaluating forward osmosis/RO technology first developed by NASA. Currently, all effluent is returned to the sewer for treatment at the Palo Alto RWQCP.

The successful operation of the SVAWPC, along with these advanced technology and research studies, establishes a foundation to provide regional discussions on the feasibility and development of PR projects.

Section 5: Expanded Reuse Potential

Valley Water's strategy for improving water supply reliability through water reuse is twofold: (1) Integrate and expand existing NPR systems; (2) Develop purified water systems within the County.

Expanded reuse potential—including NPR and PR—was evaluated in partnership with recycled water producers, wholesale and retail water suppliers, end users, regulatory agencies, and other interested parties.

5.1 Projected NPR Demands

Expansion of NPR is a key component of the CoRe Plan, as all four Partner Agencies anticipate increased NPR demand in their service areas. The CoRe Plan assumes that NPR demands will be met before remaining effluent is made available for potable reuse.

Based on the planning horizon for the CoRe Plan, 2040 was used as the timeframe for estimating future flow availability. Water suppliers developed their 2015 Urban Water Management Plans (UWMP)[6] in coordination with recycled water producers and generally contain the most recent NPR demand forecasts. Thus, 2015 UWMPs were used as the basis for future NPR projections with a few exceptions:

- In January 2019, SBWR provided updated recycled water projections that reflect increased NPR+ demand in areas served by the City of Santa Clara and San José Municipal Water (Table 5-1).
- Morgan Hill's 2015 UWMP projected zero long-term NPR deliveries; however, because an NPR project in Morgan Hill may be feasible under a more integrated regional context, the CoRe Plan uses Morgan Hill's conceptual NPR buildout demands from the 2015 South County Recycled Water Master Plan Update.

NPR demand projections by Partner Agency, as summarized in Table 5-1, do not fully capture potential allocations per contractual agreements. For example, Mountain View is contractually entitled to peak flows of up to 3 mgd of recycled water from Palo Alto, though projected NPR demand is less than 3 mgd on average. The CoRe Plan assumes future NPR usage aligns with projected demand, though contractual obligations are considered in the context of project feasibility and implementation as effective limitations on the amount of effluent available for PR.

Although future NPR projections are provided as annual estimates, NPR use varies seasonally. A monthly distribution factor, based on actual NPR data from 2015-2017, was applied to 2040 projections to estimate future monthly NPR demand.

All four Partner Agencies anticipate increased NPR demand in their service areas. The CoRe Plan assumes that NPR demands will be met before remaining effluent is made available for potable reuse.

[6] UWMPs are currently in process of revision and, upon completion (anticipated by mid-2021), will include updated NPR demands.

Table 5-1. Summary of Projected Long-Term NPR Demands by Recycled Water System				
Recycled Water System	Recycled Water Retailers	2040 NPR Demand		Current Contractual Obligation [b]
		mgd (annual average)	AFY [a]	
PA/MV RWS	Palo Alto Mountain View	2.5	2,800	Mountain View has the right to receive up to 3 mgd of peak flow
Sunnyvale RWS	Sunnyvale Cal Water (Cupertino) San Jose Water (Cupertino)	1.5	1,700	Valley Water can receive 595 AFY for distribution within Sunnyvale and at least 500 AFY for distribution outside Sunnyvale's city limits
SBWR	Santa Clara San José Municipal Water San Jose Water Milpitas	27.6 [c, d]	30,900 [c]	Valley Water has the right to at least 5 mgd from the Silver Creek Pipeline (through January 22, 2027, unless a new agreement is established)
SCRWA	Gilroy Morgan Hill	3.3 2.6	3,700 2,900 [e]	Per the existing agreement, SCRWA may sell other wholesalers recycled water available in excess of the annual delivery quantity—a flow mutually determined by SCRWA and Valley Water and established each year, and Valley Water may sell recycled water to end users outside of the South County RWS service area (with SCRWA's concurrence)
Countywide	**Total, excluding Morgan Hill** **Total, including Morgan Hill**	**34.9** **37.5**	**39,100** **42,000** [e]	

a. Projected 2040 NPR demands from 2015 UWMPs within the retail water service areas, rounded to the nearest 100 AFY, except for SBWR and the City of Morgan Hill—see notes (c) and (e).

b. Projected NPR demands do not fully capture potential allocations per contractual agreements.

c. Reflects updated NPR demands provided by SBWR staff in January 2019.

d. Annualized flow is 27.6 mgd; peak month demands are likely to be significantly greater. For example, the 2014 SBWR Strategic Master Plan identifies an average 2040 NPR demand of 34 mgd and peak month demand of 49 mgd.

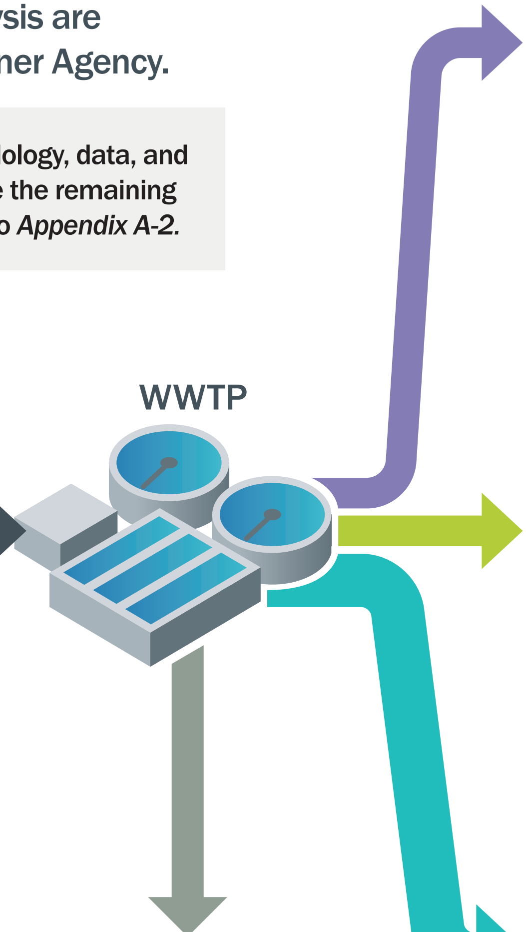
e. Reflects Morgan Hill's conceptual buildout demands per the 2015 South County Recycled Water Master Plan Update.

5.2 Available Source Water for Potable Reuse

In addition to NPR, some WWTP effluent is reserved for other uses, such as for environmental benefit. Figure 5-1 shows a flow balance for typical WWTP that accounts for various flow streams. The Project Team completed a flow balance for each Partner Agency WWTP to estimate the remaining effluent available for discharge, blending, or additional reuse in 2040. Because NPR expansion is already planned by each Partner Agency, the CoRe Plan assumes projected NPR demands will remain intact, and PR projects will be sourced by remaining effluent (minus any effluent reserved for discharge, blending, or other requirements).

Results from the flow analysis are summarized below by Partner Agency.

For more details on the methodology, data, and assumptions used to determine the remaining effluent available for PR, refer to *Appendix A-2.*



Plant influent

Partner Agencies' wastewater and recycled water master plans were used as the starting point for future plant influent projections, though these projections were adjusted downward to align with baseline conditions (using average monthly median flows, 2014-2018). Based on available projections in Partner Agencies' planning documents, 2035 was used as the timeframe for the influent flow analysis; this provides a conservative (low) estimate of available flow in 2040.

To account for uncertainty in future influent projections, a range of flows was considered:

- **The "lower bound" assumes no increase from baseline (flatlined projection).**
- **The "upper bound" assumes same slope (i.e., rate of increase) from Partner Agencies' planning documents.**

Non-potable
(including in-plant uses)

As described in Section 5.1, retailers' 2015 UWMPs served as the source for projected NPR demand, except for SBWR (whose staff provided updated demands in January 2019) and Morgan Hill (conceptual buildout demand from 2015 South County Recycled Water Master Plan Update). For the three North County systems (SBWR, Palo Alto, and Sunnyvale), additional losses associated with NPR+ (i.e., ROC from advanced treatment) were considered.

Environmental flow requirements

The flow analysis assumed 3 mgd of effluent from the Palo Alto RWQCP will be used to meet environmental flow requirements in 2040, including flows to Renzel Marsh. No environmental flow requirements have been identified for the SJ/SC RWF, Sunnyvale WPCP, or SCRWA WWTP. Flow availability may be impacted if environmental flow requirements are identified.

Other losses
(e.g., evaporation)

In general, treatment losses at the WWTPs were assumed to be negligible, unless otherwise specified by Partner Agency staff. Future losses considered 0.3 mgd lost from recirculated flow at the Palo Alto RWQCP and 4 mgd reserved for evaporation and capping at the Sunnyvale WPCP.

Remaining effluent

Remaining effluent (i.e., WWTP influent minus losses, environmental flows, and effluent needed to meet NPR demands) may be available for discharge, blending, or additional reuse. Currently, remaining effluent in North County is discharged to the San Francisco Bay, while remaining effluent in South County is sent to percolation ponds or discharged to the Pajaro River (and eventually Monterey Bay). For this planning-level estimate, it was assumed that all remaining effluent was available for PR, and potential AWPFs were sized accordingly.

Figure 5-1. Typical WWTP flow balance

5.2.1 SJ/SC RWF Flow Analysis

Figure 5-2 displays future WWTP influent projections and effluent needed to meet SBWR's future NPR+ projections through 2040. Because no environmental flows or other losses were identified for the SJ/SC RWF, the remaining effluent available for discharge, blending, or additional reuse is calculated simply as the difference between the projected WWTP influent flows and NPR+ demands and estimated at 71 to 79 mgd on average (based on the range of influent projections). Wastewater availability may be impacted if environmental flow requirements are identified in the future.

The estimated remaining effluent available exceeds the 30.4 mgd AWPF feed flow needed to produce 24 mgd of purified water (considering treatment losses and a 90% online factor) and achieve Valley Water's goal of developing 24,000 AFY for PR. Despite seasonal flow variability, historical influent data suggest the SJ/SC RWF has sufficient effluent to typically produce 24 mgd of purified water year-round, though some effluent may be needed for future discharge, blending, or other uses.

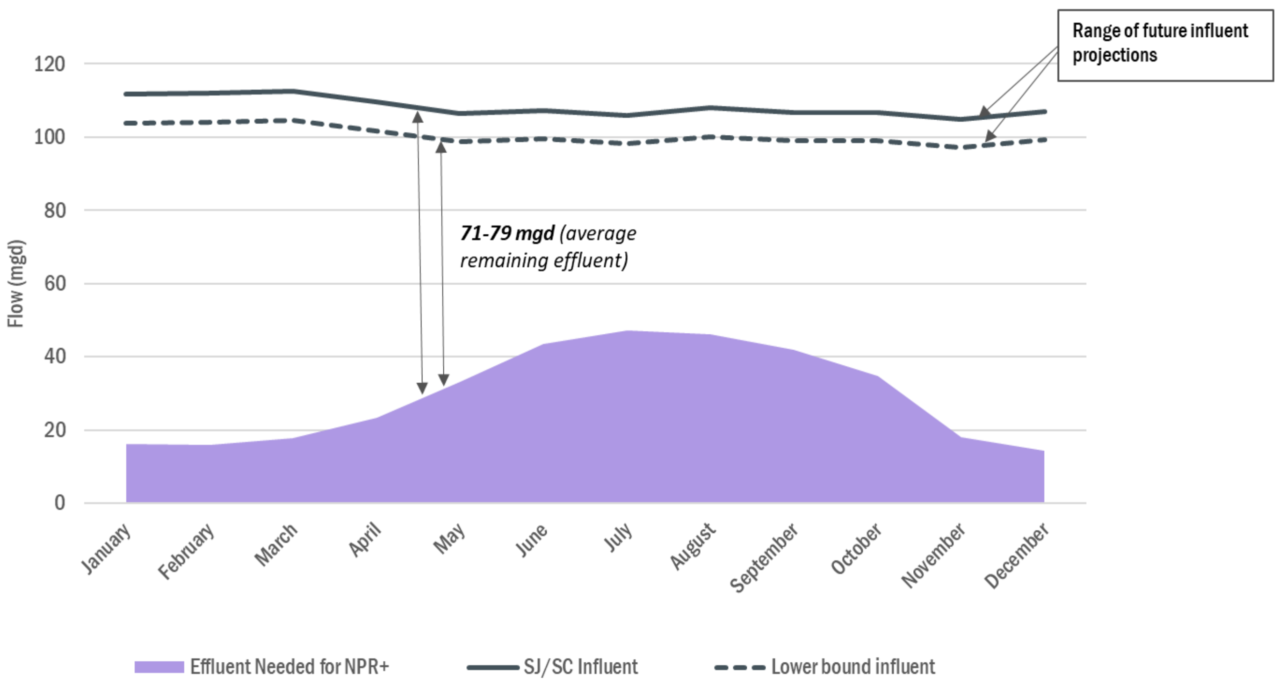


Figure 5-2. Projected flow conditions at SJ/SC RWF considering future influent projections and SBWR NPR+ demands

5.2.2 Palo Alto RWQCP Flow Analysis

The remaining effluent available from the Palo Alto RWQCP is projected to be 13.3 to 15.3 mgd on average (based on the range of influent projections) as shown in Figure 5-3, which displays future influent projections, effluent needed to serve Palo Alto and Mountain View NPR+ demands in 2040, environmental flows (3 mgd), and losses (0.3 mgd).

On its own, the Palo Alto RWQCP does not have sufficient effluent available to produce 24 mgd of purified water. Based on available flows, an AWPF in Palo Alto would be sized at 14 mgd (84% efficiency under "upper bound" conditions). Under "lower bound" conditions, the AWPF would be downsized to 12 mgd to maintain 84% efficiency. AWPF efficiency accounts for the online factor (90% assumed for all facilities) as well as source water availability (projected to be lower in Palo Alto and Sunnyvale than San José). More details on AWPF sizing and utilization are included in ***Appendix A-2***.

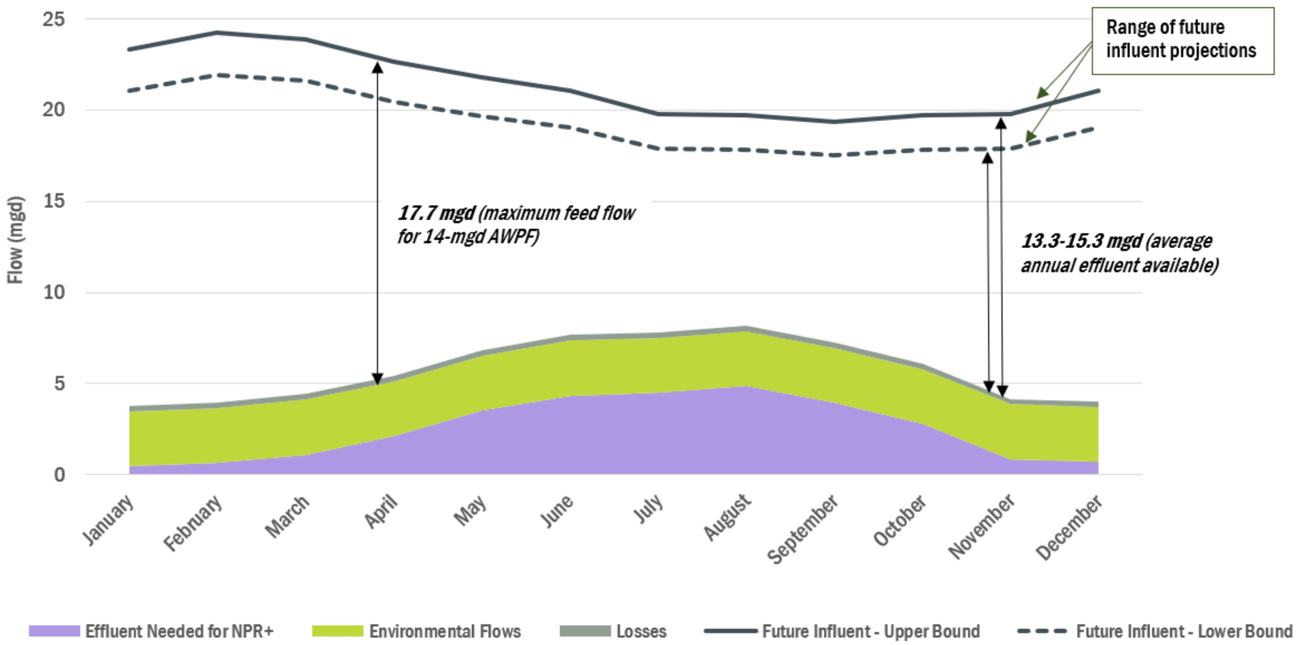


Figure 5-3. Projected flow conditions at Palo Alto RWQCP considering future influent projections and Palo Alto/Mountain View NPR+ demands

5.2.3 Sunnyvale WPCP Flow Analysis

Figure 5-4 displays future influent projections, effluent needed for NPR+, and losses from evaporation and capping associated with Sunnyvale's treatment ponds (4 mgd). No environmental flow requirements are identified for Sunnyvale WPCP. The remaining effluent available is projected to be at least 5 mgd on average.

On its own, the Sunnyvale WPCP does not have sufficient effluent available to produce 24 mgd of purified water. Based on available flows, an AWPF in Sunnyvale would be sized at 10 mgd (88% efficiency under "upper bound" conditions). Under "lower bound" conditions, the AWPF would be downsized to 6 mgd (81% efficiency). Under "upper bound" conditions, Sunnyvale and Palo Alto combined could produce 23,000 AFY of purified water for PR (after accounting for treatment losses and the 90% online factor).

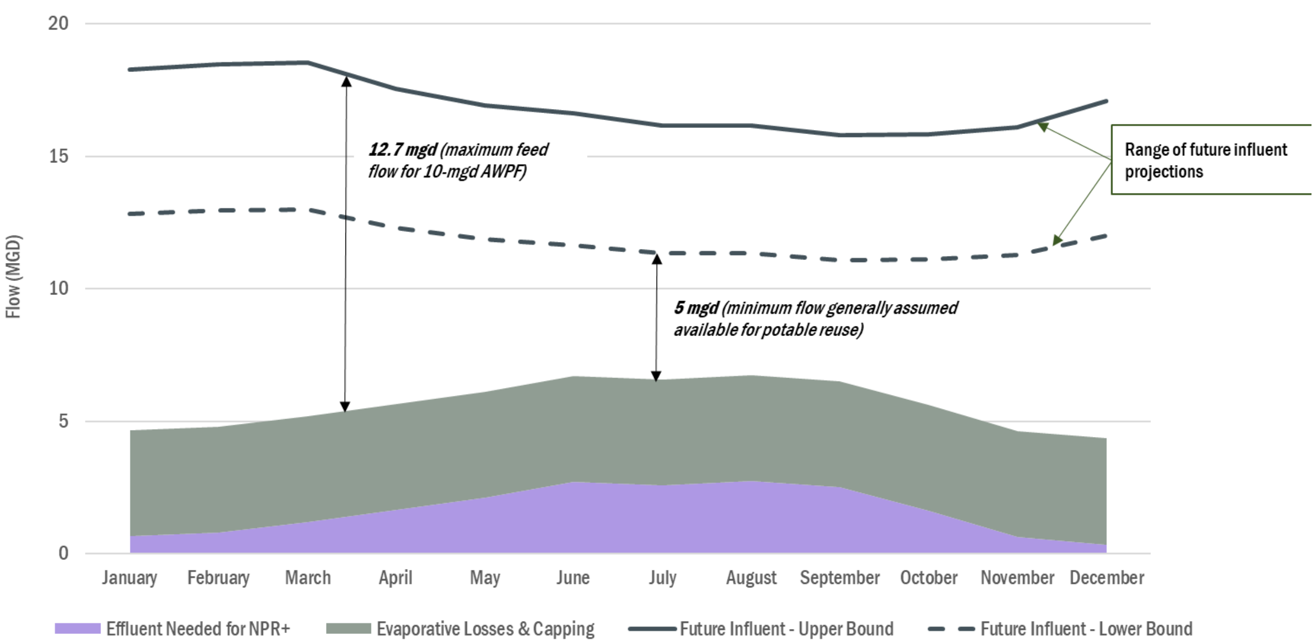


Figure 5-4. Projected flow conditions at Sunnyvale WPCP considering future influent projections and NPR demands

5.2.4 SCRWA WWTP Flow Analysis

SCRWA WWTP influent remained relatively consistent over the past several years (ADWF = 6 mgd) and is projected to be similar in the future. Unlike the WWTPs in North County, only one set of influent projections was considered for SCRWA.

As shown on Figure 5-5, SCRWA WWTP receives wastewater from two cities: Gilroy and Morgan Hill. Currently, NPR is only delivered in Gilroy. During the summer months, a portion of wastewater from Morgan Hill is needed to supply NPR in Gilroy. On average, 3 mgd of remaining effluent is available from SCRWA WWTP. However, if considering satellite treatment in Morgan Hill, only 2.1 mgd of Morgan Hill's wastewater would be available on average, with minimal flow available in the summer months (when needed to supply NPR in Gilroy).

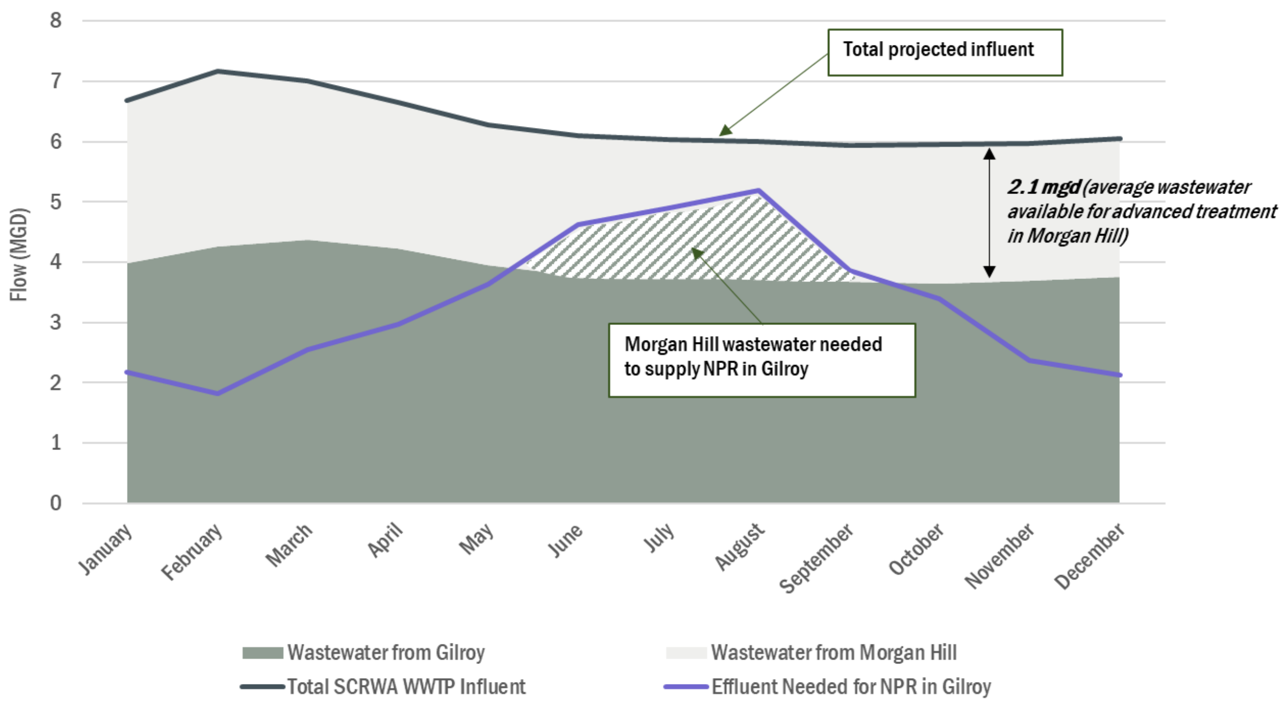


Figure 5-5. Projected flow conditions at SCRWA's WWTP considering future influent projections and South County RWS NPR demands

5.2.5 Summary

Anticipated purified water yields (after treatment losses) are shown in Table 5-2. These values are based on estimated source water availability and do not account for potential limitations at the delivery point (e.g., groundwater basin capacity), which may limit PR in wet years. Annual yields are estimated for planning purposes and cannot be guaranteed.

More details on estimated flows, including summaries of projected monthly flows by Partner Agency and AWPF sizing calculations, are included in ***Appendix A-2***.

Table 5-2. Potential Annual Yield for Potable Reuse Considering Source Water Availability by Producer

Facility	Potential Yield (AFY)[a]
San José AWPF	24,000
Palo Alto AWPF	11,700 – 13,200
Sunnyvale AWPF	5,500 – 9,800
Palo Alto and Sunnyvale (combined)	17,300[b] – 23,000
Morgan Hill Satellite AWPF	1,900

a. *Discussions around source water availability and potential purified water yield are ongoing. Yield may be lower during drought conditions or other scenarios.*

b. *Lower bound for Palo Alto AWPF and Sunnyvale AWPF, when shown separately, differ from combined total due to rounding.*

5.3 Onsite Reuse Considerations

Onsite non-potable reuse systems in the County may have future implications for centralized reuse facilities. Onsite reuse offers benefits to system owners, such as improving resilience/resource independence and meeting sustainability goals. Benefits to surrounding centralized water and wastewater infrastructure systems include reducing the long-term need for new water supply/treatment or wastewater infrastructure, increasing green space, and enhancing water supply reliability. However, if not implemented in close coordination with local water and wastewater agencies, onsite reuse projects may have negative impacts, including reduced wastewater availability for centralized reuse projects, concentrated wastewater streams (prompting corrosion and/or odor concerns), and/or stranded or underutilized assets.

Onsite reuse systems are decentralized building-scale or neighborhood-scale wastewater treatment or rainwater harvesting systems.

The Project Team surveyed the Partner Agencies to collect information on existing and/or planned onsite reuse systems in the County, planned approaches for permitting onsite reuse systems, and perspectives on current and future onsite reuse. Onsite reuse is not yet prevalent within the County: four onsite reuse projects are under development in Mountain View and potential additional projects are being explored elsewhere in the County.

The Pacific Institute recently released *The Role of Onsite Water Systems in Advancing Water Resilience in Silicon Valley* (Pacific Institute, 2021). The authors interviewed 23 stakeholders in Silicon Valley that are working on onsite reuse and gleaned potential outcomes and impacts (positive and negative) associated with onsite reuse systems, as summarized in Figure 5-6.

Future onsite reuse efforts will require coordination among multiple stakeholders, including Valley Water and the Partner Agencies, to evaluate potential impacts on centralized NPR and PR projects. With mindful implementation, onsite reuse could provide an opportunity to forge innovative public-private partnerships and advance reuse in locations lacking in proximity to existing and planned recycled water systems.

	Human Communities and Ecosystems	Water and/or Wastewater Systems	Onsite Non-Potable Reuse System Owners
POSITIVE IMPACT	INNOVATION: Technologies Ownership/operation models Public-private partnerships ——— Augmented water supplies Reduced urban heat island effect Reduced community vulnerability to sea level rise	RESILIENCE: Treatment redundancy Reduced vulnerability to sea level rise ——— Reduced pollutant discharges Reduced energy use Avoided / deferred new infrastructure Reduced long-term capital improvement costs	RESILIENCE: Seen as a leader and innovator Improved employee recruitment and retention ——— Financial flexibility Operational flexibility
NEUTRAL IMPACT	Reduced freshwater discharges into receiving waters	Altered O&M costs Altered NPDES/WDR compliance	
NEGATIVE IMPACT		Inability to meet recycled water commitments Collection system issues (corrosion, odor) Reduced near-term revenue	Increased site costs Increased onsite energy use Under-utilized/stranded assets if abandoned later

Figure 5-6. Anticipated outcomes and impacts of onsite non-potable reuse systems in Santa Clara County

Source: Adapted from Role of Onsite Water Systems in Advancing Water Resilience in Silicon Valley (Pacific Institute, 2021)
Note: Realization of outcomes and impacts, both positive and negative, are depend on local context and extent of onsite reuse implementation.

Section 6:
Project Portfolios

Rather than recommending a single alternative, the CoRe Plan holistically considers reuse opportunities and associated implementation feasibility, benefits, challenges, risks, and costs relative to one another.

Groups of project elements (advanced treatment facilities and conveyance infrastructure) are referred to as "portfolios" in the North County and "options" in the South County. The nomenclature implies the flexibility of potentially combining a South County option with any North County portfolio. The process of defining the portfolios and options was iterative and collaborative, as described in this section and in more detail in ***Appendix A-1*** (Feasible Project Portfolios).

6.1 Conceptual Alternatives/Portfolios

Beginning in 2018, the Project Team created groups of projects and packaged them into five conceptual portfolios (formerly called alternatives) that are consistent with guiding principles agreed upon by the Valley Water and Partner Agencies, including:

1. Leverage existing infrastructure where possible
2. Reflect a mix of NPR/NPR+ and PR projects, including potential TWA concepts as a point of comparison for cost-effectiveness
3. Expand Countywide reuse (NPR and/or PR) using source water from each Partner Agency
4. Consider previously explored projects (but not previously deemed infeasible, unless circumstances have changed) and new projects
5. Aim to develop at least 24,000 AFY of PR supply by 2028 to meet the County's water supply demands (consistent with Valley Water's WSMP 2040)

In coordination with Valley Water and its Partner Agencies, the Project Team evaluated the five conceptual portfolios and narrowed down to three portfolios, defined by AWPF source water and location, to develop through preliminary design and comparatively evaluate based on key attributes, differentiators, and factors critical to implementation.

Five Portfolios Conceptually Explored

Five conceptual portfolios framed at a high level and evaluated using the following criteria: economics, groundwater management and Countywide (regional) supply reliability, environmental impacts/benefits and sustainability, ease of implementation and permitting/regulatory considerations, and engineering feasibility.

→

Three Portfolios Selected

Three portfolios feature a variety of project elements developed through preliminary design and evaluated for feasibility. Defined by source of supply and treatment facility location, the three portfolios include:

Portfolio 1: San José AWPF

Portfolio 2: Combined Palo Alto/Sunnyvale Regional AWPF

Portfolio 4: Separate Palo Alto and Sunnyvale AWPFs

Appendix F (Conceptual Alternatives TM) describes in detail the process of developing and assessing the five conceptual portfolios. After narrowing from five to three portfolios, the Project Team developed conceptual (10%) designs for each portfolio, including some permutations, and added new project elements, including different options for South County and potential future TWA concepts. North County portfolios and South County options are described in this section, and all other elements are described in Section 7.

6.2 Feasible Portfolios

The programmatic approach for the CoRe Plan considers a wide range of reuse opportunities for flexible implementation. Project elements, including AWPFs and conveyance/distribution infrastructure, can be combined in a variety of ways to create CoRe portfolios for comparison on an economic, regulatory, institutional, and environmental basis. Project elements are presented and evaluated in groups:

- **NPR/NPR+ distribution system expansion** applies consistently across all portfolios and, therefore, is not considered a differentiator in the portfolio evaluation.
- **South County reuse options** can be included in combination with any portfolio, and therefore are evaluated separately from the portfolios.
- **Baseline elements** comprise each portfolio and are evaluated collectively by portfolio.
- **Alternative elements** are opportunities that have been explored and remain separate from portfolios, as possible "add-on" items or substitutions (e.g., alternative alignments). These elements are included for consideration due to their potential benefits, though they are not included in the evaluation, which focuses on comparing the differences among portfolios. Alternative elements are described in Section 7.

An overview of North County portfolios and South County options is shown in Table 6-1, while key highlights are included in the following subsections. All AWPFs considered in this plan involve treatment using reverse osmosis membranes, resulting in the production of ROC. Strategies for managing ROC at each AWPF are summarized following each portfolio.

Table 6-1. Programmatic Approach for Evaluating Reuse Opportunities

Countywide Expansion of NPR/NPR+ (Recycled Water Distribution Systems)	North County Portfolios		South County Options
	San José	**One AWPF in San José** **1a:** SJ GWR **1b:** SJ RWA **1c:** SJ TWA, Milpitas Pipeline **1d:** SJ TWA, new pipeline	**MH-1:** NPR+ **MH-2:** GWR **MH-3:** SWA
	Palo Alto & Sunnyvale	**One regional AWPF with combined flows from Palo Alto and Sunnyvale** **2a:** PA (+SV) GWR **2b:** SV (+PA) GWR	
		Two separate AWPFs in Palo Alto and Sunnyvale **4:** PA/SV GWR	
Alternative Elements and Future Opportunities Alternative pipeline alignments, interties, and delivery points. Resized designs. Additional TWA opportunities.			

Highlights of each portfolio follow below, based on preliminary designs. Cost estimates reflect Association for the Advancement of Cost Engineering (AACE) International's Class 5 criteria. Class 5 estimates have an expected accuracy range of -50% to +100%. While the accuracy range is not reflected in values presented in this section, a graphical representation of the level of accuracy is provided in Section 6.4. Section 8 provides potential implementation challenges for each portfolio/option. More detail related to the portfolios and options (e.g., preliminary designs and cost estimates) is included in ***Appendix A.***

6.2.1 San José (SJ) Portfolio

The SJ Portfolio is centered on using available effluent from the SJ/SC RWF to feed a new AWPF adjacent to the existing SVAWPC. Key features, costs, and ROC management assumptions for SJ Portfolio variations are summarized in Tables 6-2 to 6-5, while Figures 6-1 to 6-4 show their respective facility locations and pipeline alignments.

Table 6-2. Portfolio 1a (SJ GWR) Key Features and Costs

1a: SJ GWR Highlights 24 mgd AWPF **Location:** San José **Use:** GWR at LGRP	**Capital Cost:** $655M* **Annual O&M Cost:** $21.4M* **Levelized Unit Costs** • **30-Year Life Cycle:** $2,600-$3,200/AF* • **100-Year Life Cycle:** $2,100-$2,600/AF* **Projected 2040 Yield:** 19,000-24,000 AFY **Pipeline Length/Diameter** • 0.4 miles at 60" • 18.1 miles at 48"	**BENEFITS** SJ/SC RWF flows do not limit projected yield. SVAWPC staff could potentially support new AWPF operation due to proximity. **LIMITATIONS** Minimum flow guarantee for source water requires a long-term agreement with San José. Risks to available yield include drought, environmental needs/impacts, and operations. LGRP recharge potential may limit future yield.

**Cost estimates are rounded up to the nearest $5M for capital costs, $100k for O&M costs, and $100 for life-cycle unit costs. Capital and O&M costs assume the implementation of the most cost-effective ROC management strategy, based on the Evaluation of ROC Management Options Final Report. Unit costs reflect ROC management and potential 2040 yield ranges.*

Table 6-3. Portfolio 1b (SJ RWA) Key Features and Costs

1b: SJ RWA Highlights		
24 mgd AWPF **Location:** San José **Use:** RWA at Penitencia WTP	**Capital Cost:** $650M* **Annual O&M Cost:** $24.5M* **Levelized Unit Costs** • 30-Year Life Cycle: $2,700-$3,300/AF* • 100-Year Life Cycle: $2,300-$2,700/AF* **Projected 2040 Yield:** • 19,800-24,000 AFY **Pipeline Length/Diameter** • 0.4 miles at 60" • 8.9 miles at 48"	**BENEFITS** SJ/SC RWF flows do not limit projected yield. Purified water would be delivered to Penitencia WTP for RWA. From there, existing infrastructure could support operational flexibility, such as delivery to LGRP or Rinconada (with additional costs for improvements needed to connect existing systems), pending regulatory approval. **LIMITATIONS** Minimum flow guarantee for source water requires a long-term agreement with San José. Risks to available yield include drought, environmental needs/impacts, and operations. Consistent with Valley Water's WSMP 2040, assuming DPR water is first-priority supply for Penitencia WTP, blending with raw water. If assumption changes, Penitencia WTP's capacity may limit potable reuse yield. Further evaluation and coordination needed to confirm acceptability of purified water blending ratio.

**Cost estimates are rounded up to the nearest $5M for capital costs, $100k for O&M costs, and $100 for life-cycle unit costs. Capital and O&M costs assume the implementation of the most cost-effective ROC management strategy, based on the Evaluation of ROC Management Options Final Report. Unit costs reflect ROC management and potential 2040 yield ranges.*

Table 6-4. Portfolio 1c (SJ TWA, Milpitas Pipeline) Key Features and Costs

1c: SJ TWA (Milpitas Pipeline) Highlights		
24 mgd AWPF **Location:** San José **Use:** TWA (via existing Milpitas Pipeline to Piedmont Valve Yard)	**Capital Cost:** $555M* **Annual O&M Cost:** $24.1M* **Levelized Unit Costs** • 30-Year Life Cycle: $2,500/AF* • 100-Year Life Cycle: $2,100/AF* **Projected 2040 Yield:** • 24,000 AFY **Pipeline Length/Diameter** • 0.4 miles at 60" • 3.9 miles at 36" • 4.7 miles at 24"	**BENEFITS** SJ/SC RWF flows do not limit projected yield. Northern parts of Santa Clara and San José could receive TWA to supplement water supply. For other water retailers, purified water would flow south through Milpitas Pipeline, serving several upstream of Piedmont Valve Yard, before blending with other treated supplies and distributing via the East Pipeline. Existing infrastructure could support potential operational flexibility, such as delivery to LGRP or Rinconada (with additional costs for improvements needed to connect existing systems), pending regulatory approval. **LIMITATIONS** Minimum flow guarantee for source water requires a long-term agreement with San José. Risks to available yield include drought, environmental needs/impacts, and operations. Using the Milpitas Pipeline to convey purified water precludes independent use of an emergency connection to SFPUC's system, via the Milpitas Intertie (northern end of Milpitas Pipeline). Further evaluation and coordination needed to confirm acceptability of purified water blending ratio.

**Cost estimates are rounded up to the nearest $5M for capital costs, $100k for O&M costs, and $100 for life-cycle unit costs. Capital and O&M costs assume the implementation of the most cost-effective ROC management strategy, based on the Evaluation of ROC Management Options Final Report. Unit costs reflect the ROC management range as a single value due to rounding.*

Table 6-5. Portfolio 1d (SJ TWA, new pipeline) Key Features and Costs

1d: SJ TWA (new pipeline) Highlights

24 mgd AWPF

Location: San José

Use: TWA (via a new dedicated pipeline to Piedmont Valve Yard)

Capital Cost: $605M*

Annual O&M Cost: $24.1M*

Levelized Unit Costs

- 30-Year Life Cycle: $2,600/AF*
- 100-Year Life Cycle: $2,200/AF*

Projected 2040 Yield:

- 24,000 AFY

Pipeline Length/Diameter

- 0.4 miles at 60”
- 8.2 miles at 36”
- 4.7 miles at 24”

BENEFITS

SJ/SC RWF flows do not limit projected yield. Northern parts of Santa Clara and San José could receive TWA to supplement water supply. For other water retailers, purified water would flow south through a new dedicated pipeline before blending with other treated supply and distributing via the Milpitas Pipeline (flowing north) and the East Pipeline. Existing infrastructure could support potential operational flexibility such as delivery to LGRP or Rinconada (with additional costs for improvements needed to connect existing systems), pending regulatory approval.

LIMITATIONS

A minimum flow guarantee for source water requires a long-term agreement with San José. Risks to available yield include drought, environmental needs/impacts, and operations. Further evaluation and coordination needed to confirm acceptability of purified water blending ratio.

**Cost estimates are rounded up to the nearest $5M for capital costs, $100k for O&M costs, and $100 for life-cycle unit costs. Capital and O&M costs assume the implementation of the most cost-effective ROC management strategy, based on the Evaluation of ROC Management Options Final Report. Unit costs reflect ROC management range as a single value due to rounding.*

Valley Water’s ROC Management Team (Valley Water staff and a consultant team led by GHD) separately evaluated ROC management strategies and documented the findings in a report dated September 1, 2020 entitled *Evaluation of ROC Management Options Final Report* (Valley Water, 2020a), which is attached to the CoRe Plan as *Appendix G.*

The AWPF considered for each San José portfolio is estimated to generate up to 4.3 mgd of ROC depending on the production of purified water. The ROC Management Options Final Report identified two options for managing ROC from a San José AWPF:

San José ROC Strategy, Option 1: Blending and discharge at a new outfall downstream of existing effluent outfall discharge weir. This option involves constructing a ROC pump station and holding tank, 1.8 miles of 18” HDPE pipe from the AWPF to a new outfall near the existing effluent weir, and an outfall diffuser at the discharge point. Treatment processes for nutrients and CECs are also included in the ROC management cost estimate.

San José ROC Strategy, Option 2: Discharge at a new shallow outfall at Coyote Creek. This option involves constructing a ROC pump station and holding tank, 3.8 miles of 18” HDPE pipe from the AWPF to a new outfall at Coyote Creek, and an outfall diffuser at the discharge point. Treatment processes for nutrients and CECs are also included in the ROC management cost estimate.

The ROC management report includes an analysis of various strategies at the San José AWPF without recommending a single option for implementation, thus allowing flexibility for continued discussions and negotiations among Valley Water, Partner Agencies, and Regional Boards. Capital and O&M costs shown in Tables 6-2 to 6-5 assume implementation of **ROC Option 1** for San José portfolios. Capital costs could increase (an addition of up to $10M) if implementing a higher cost strategy as evaluated in the final report of ROC management options.

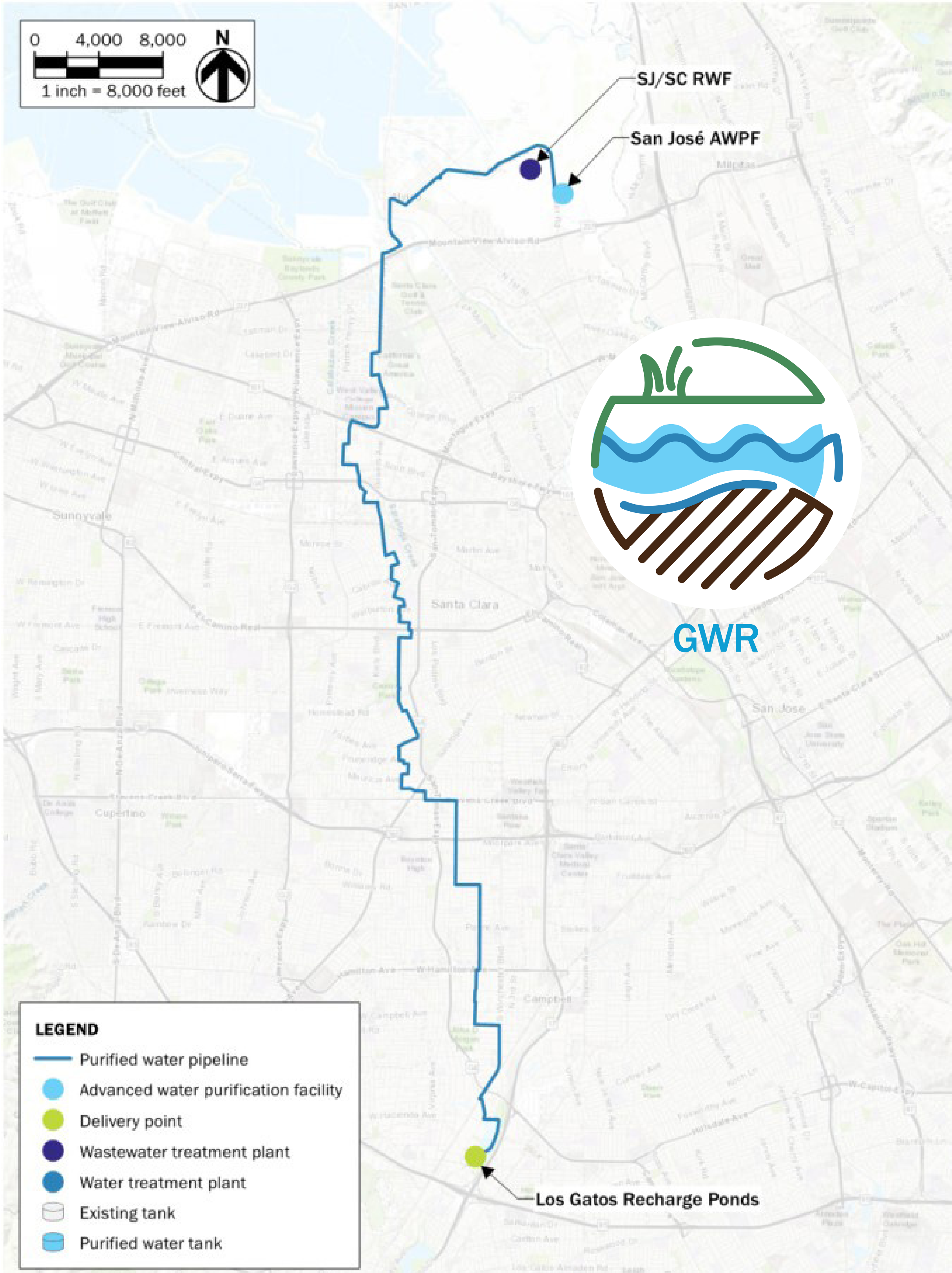


Figure 6-1. Portfolio 1a: SJ GWR facility locations and pipeline alignments

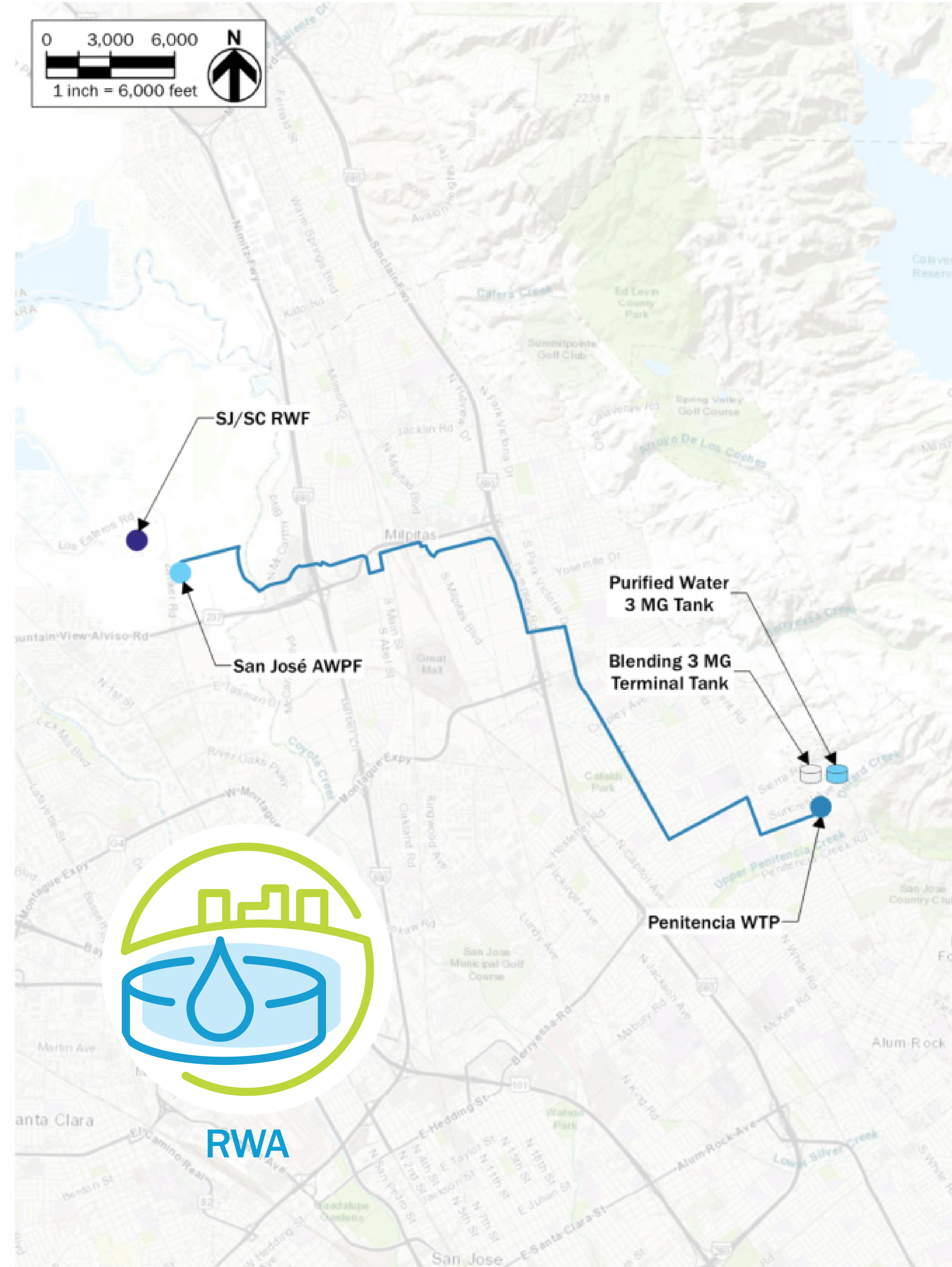


Figure 6-2. Portfolio 1b: SJ RWA facility locations and pipeline alignments

Note: The purified water pipeline alignment from the San José AWPF to Penitencia WTP may require special geotechnical considerations in the next phase of design. Class 5 cost estimates include large contingency factors.

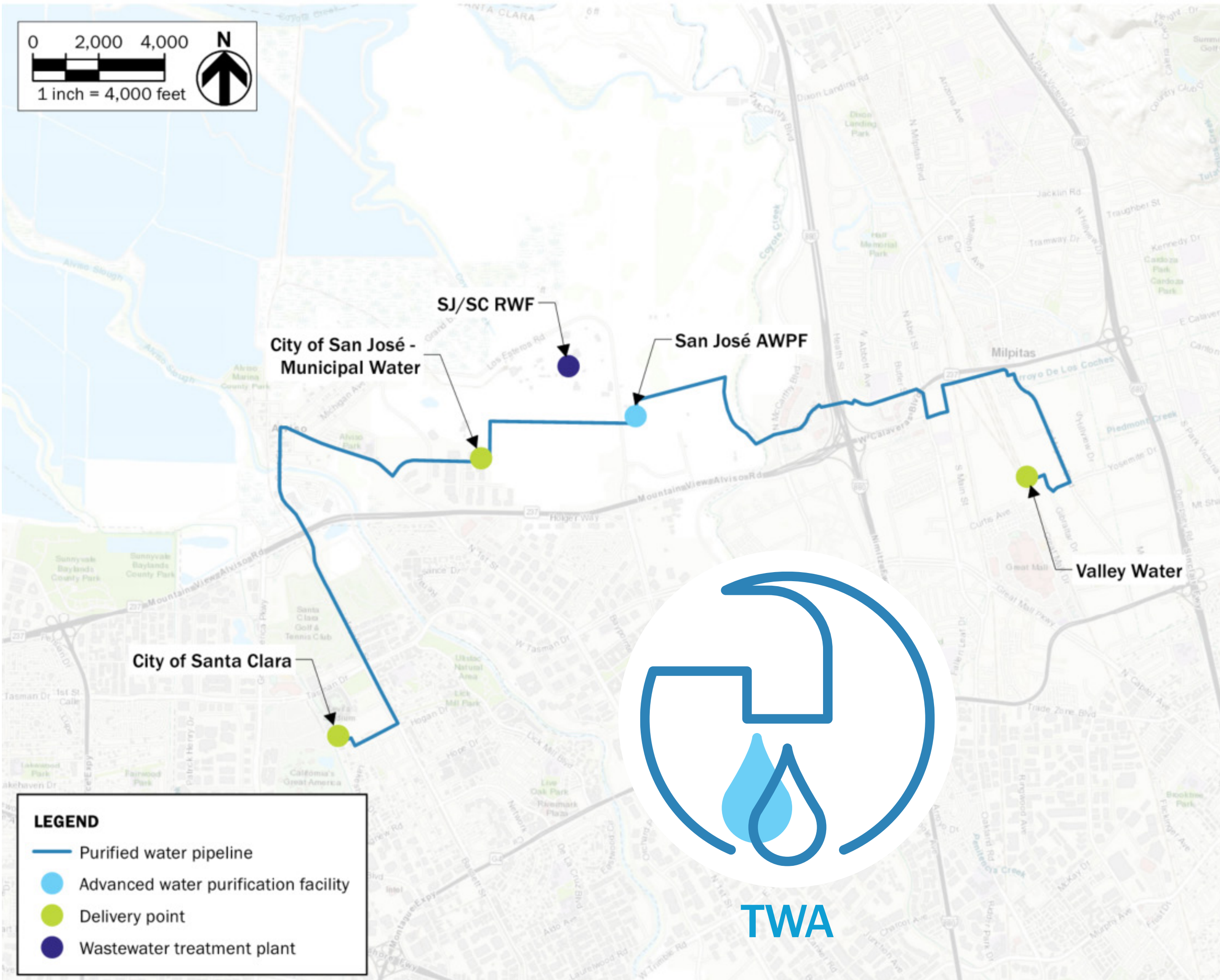


Figure 6-3. Portfolio 1c: SJ TWA (Milpitas pipeline) facility locations and pipeline alignments

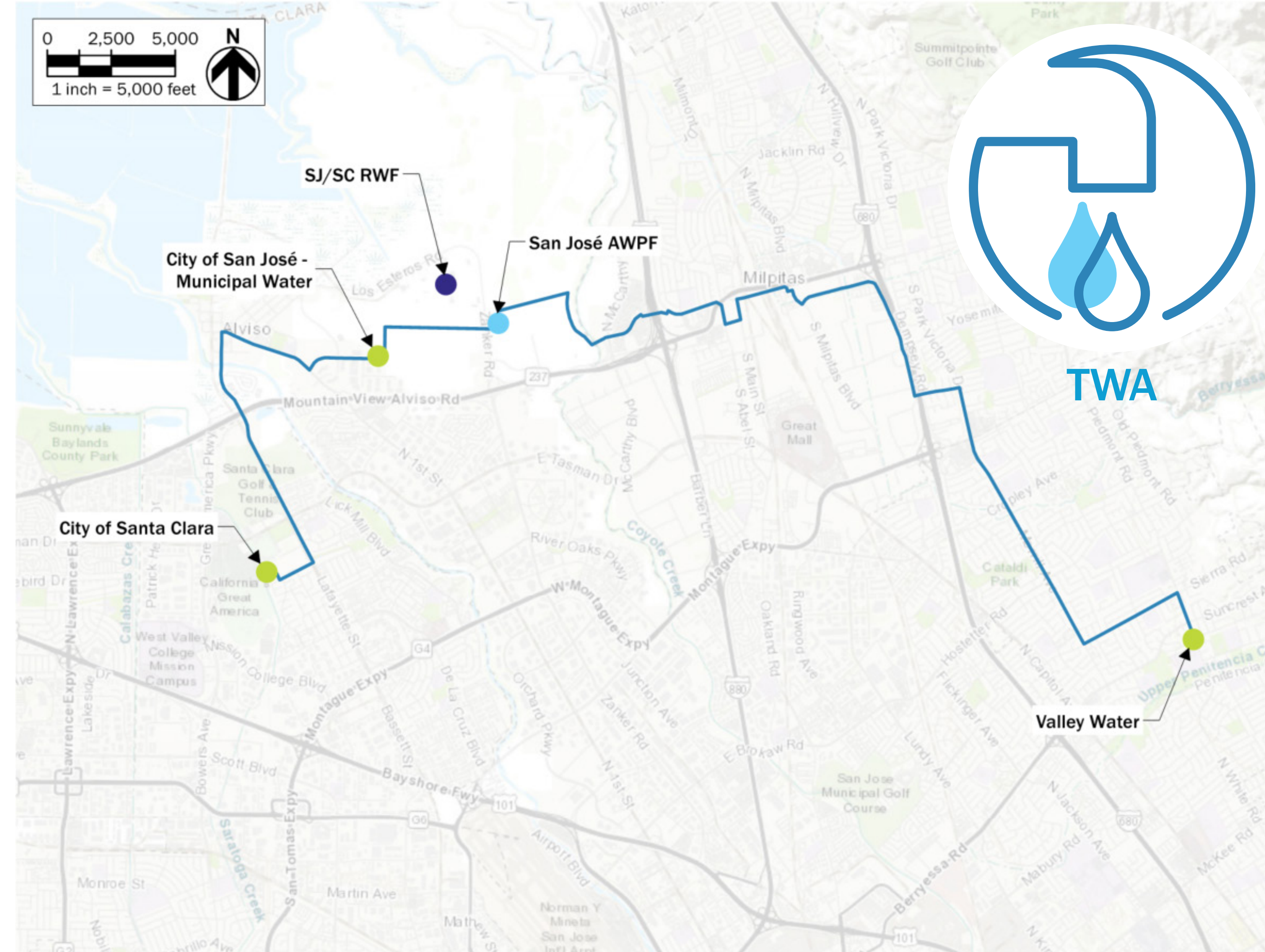


Figure 6-4. Portfolio 1d: SJ TWA (new pipeline) facility locations and pipeline alignments

Portfolios 1c and 1d explore using SJ/SC RWF source water for TWA, making Portfolio 1 an interesting and unique case study that reflects the full range of potable reuse options Valley Water is considering. Portfolios 1a (GWR) and 1b (RWA) are largely consistent with alternatives developed as part of the Purified Water Program Plan (Valley Water, 2018). Portfolios 1c and 1d represent an important first step toward testing whether TWA may yield significant costs savings compared to GWR and RWA. Insights from Portfolio 1 may help inform potential next steps related to the various TWA opportunities that exist throughout the County, as further described in Section 7.3.

6.2.2 Palo Alto and Sunnyvale Combined-Flow Regional AWPF for GWR

Two variations of Portfolio 2 consider combining available effluent from Palo Alto RWQCP and Sunnyvale WPCP for purification at one AWPF located in either Palo Alto or Sunnyvale (Portfolios 2a and 2b, respectively), providing regional benefit through GWR at LGRP. Sourcing one AWPF from two WWTPs under separate ownership and operations is not common and likely triggers unique interagency and regulatory requirements. Further, for portfolios that consider purifying effluent from Palo Alto and/or Sunnyvale WWTPs, source flow availability is a key consideration; even when combined from both sources, future WWTP influent flow may not meet Valley Water's 24,000 AFY PR goal. Portfolios 2a and 2b are each designed to deliver up to 23,000 AFY to LGRP for GWR. Key features and costs for the PA+SV GWR Portfolio variations are summarized in Tables 6-6 and 6-7, while Figures 6-5 and 6-6 show their respective facility locations and pipeline alignments.

Table 6-6. Portfolio 2a (PA [+SV] GWR) Key Features and Costs

2a: PA (+SV) GWR Highlights 24.5 mgd AWPF **Location:** Palo Alto **Use:** GWR at LGRP (24 mgd) and NPR+ in Sunnyvale (0.5 mgd)	**Capital Cost:** $800M* **Annual O&M Cost:** $22.5M* **Levelized Unit Costs** • 30-Year Life Cycle: $3,000-$4,000/AF* • 100-Year Life Cycle: $2,400-$3,100/AF* **Projected 2040 Yield:** 17,000-23,000 AFY **Pipeline Length/Diameter** • 20.3 miles at 48" • 10.3 miles at 36"	**BENEFITS** Valley Water has a long-term agreement with Palo Alto to receive flows and is negotiating similarly with Sunnyvale. **LIMITATIONS** Palo Alto RWQCP and Sunnyvale WPCP flows limit projected yield. Permitting and regulatory compliance for ROC management need to be confirmed. Costs for acquiring AWPF site are not included.

**Cost estimates are rounded up to the nearest $5M for capital costs, $100k for O&M costs, and $100 for life-cycle unit costs. Capital and O&M costs assume the implementation of the most cost-effective ROC management strategy, based on the Evaluation of ROC Management Options Final Report. Unit costs reflect ROC management and potential 2040 yield ranges.*

Table 6-7. Portfolio 2b (SV [+PA] GWR) Key Features and Costs

2b: SV (+PA) GWR Highlights 24.5 mgd AWPF **Location:** Sunnyvale **Use:** GWR at LGRP (24 mgd) and NPR+ in Sunnyvale (0.5 mgd)	**Capital Cost:** $805M* **Annual O&M Cost:** $21.6M* **Levelized Unit Costs** • 30-Year Life Cycle: $3,000-$3,900/AF* • 100-Year Life Cycle: $2,400-$3,100/AF* **Projected 2040 Yield:** 17,000-23,000 AFY **Pipeline Length/Diameter** • 17.1 miles at 48" • 10 miles at 36"	**BENEFITS** Valley Water has a long-term agreement with Palo Alto to receive flows and is in discussions with Sunnyvale. **LIMITATIONS** Palo Alto RWQCP and Sunnyvale WPCP flows limit projected yield. Technical feasibility and costs to prepare Recycle Hill (a former landfill site next to Sunnyvale WPCP) for AWPF construction remain in question. Due to lack of available land, Recycle Hill is the site assumed for preliminary design purposes; costs reflect best available for site preparation. In addition, ROC management options are limited and less feasible compared to other reuse opportunities and AWPF locations.

**Cost estimates are rounded up to the nearest $5M for capital costs, $100k for O&M costs, and $100 for life-cycle unit costs. Capital, O&M, and unit costs assume the implementation of the ROC management strategy for an AWPF located in Sunnyvale as identified in the Evaluation of ROC Management Options Final Report. Unit costs reflect potential 2040 yield ranges.*

Both variations of Portfolio 2 (a regional AWPF purifying combined flow from Palo Alto RWQCP and Sunnyvale WPCP) are estimated to produce up to 4.3 mgd of ROC, regardless of the AWPF location.

The *Evaluation of ROC Management Options Final Report* prepared by GHD (Valley Water, 2020a) identified three options for managing ROC from a regional AWPF located in Palo Alto:

- **Palo Alto ROC Strategy, Option 1:** Blending and discharge at the existing RWQCP outfall. This option involves constructing a ROC pump station and holding tank and 2.1 miles of 18" HDPE pipe from the AWPF to the existing outfall. Treatment processes for nutrients and CECs are also included in the ROC management cost estimate.
- **Palo Alto ROC Strategy, Option 2:** Discharge at a new shallow outfall in San Francisco Bay. This option involves constructing a ROC pump station and holding tank, 2.8 miles of 18" HDPE pipe from the AWPF to the existing outfall, and 0.2 miles of 18inch HDPE pipe from the existing outfall to a location under San Francisco Bay. Treatment processes for nutrients and CECs are also included in the ROC management cost estimate.
- **Palo Alto ROC Strategy, Option 3:** Discharge at a deep-water outfall north of Dumbarton Bridge. This option involves constructing a ROC pump station and holding tank and 13.3 miles of 20" HDPE pipe from the AWPF to an existing deep-water outfall in Redwood City. Treatment processes for nutrients and CECs are also included in the ROC management cost estimate.

The ROC management report provides an analysis of various strategies at the Palo Alto AWPF without identifying a recommended option for implementation, thus allowing flexibility for continued discussions and negotiations among Valley Water, Partner Agencies, and Regional Boards. Capital and O&M costs shown in Table 6-6 assume implementation of **ROC Option 1** for the regional AWPF in Palo Alto. Capital costs could increase (by as much as $60M) if implementing a higher cost strategy as evaluated in the final report of ROC management options.

The *Evaluation of ROC Management Options Final Report* prepared by GHD (Valley Water, 2020a) identified a single option for managing ROC from a regional AWPF located in Sunnyvale:

- **Sunnyvale ROC Strategy:** Discharge at a new shallow outfall at Guadalupe Slough. Involves constructing a ROC pump station, holding tank, and 6.2 miles of 18" HDPE pipe from the AWPF to a new outfall discharge at Guadalupe Slough. ROC management cost estimate includes treatment processes for nutrients and CECs.

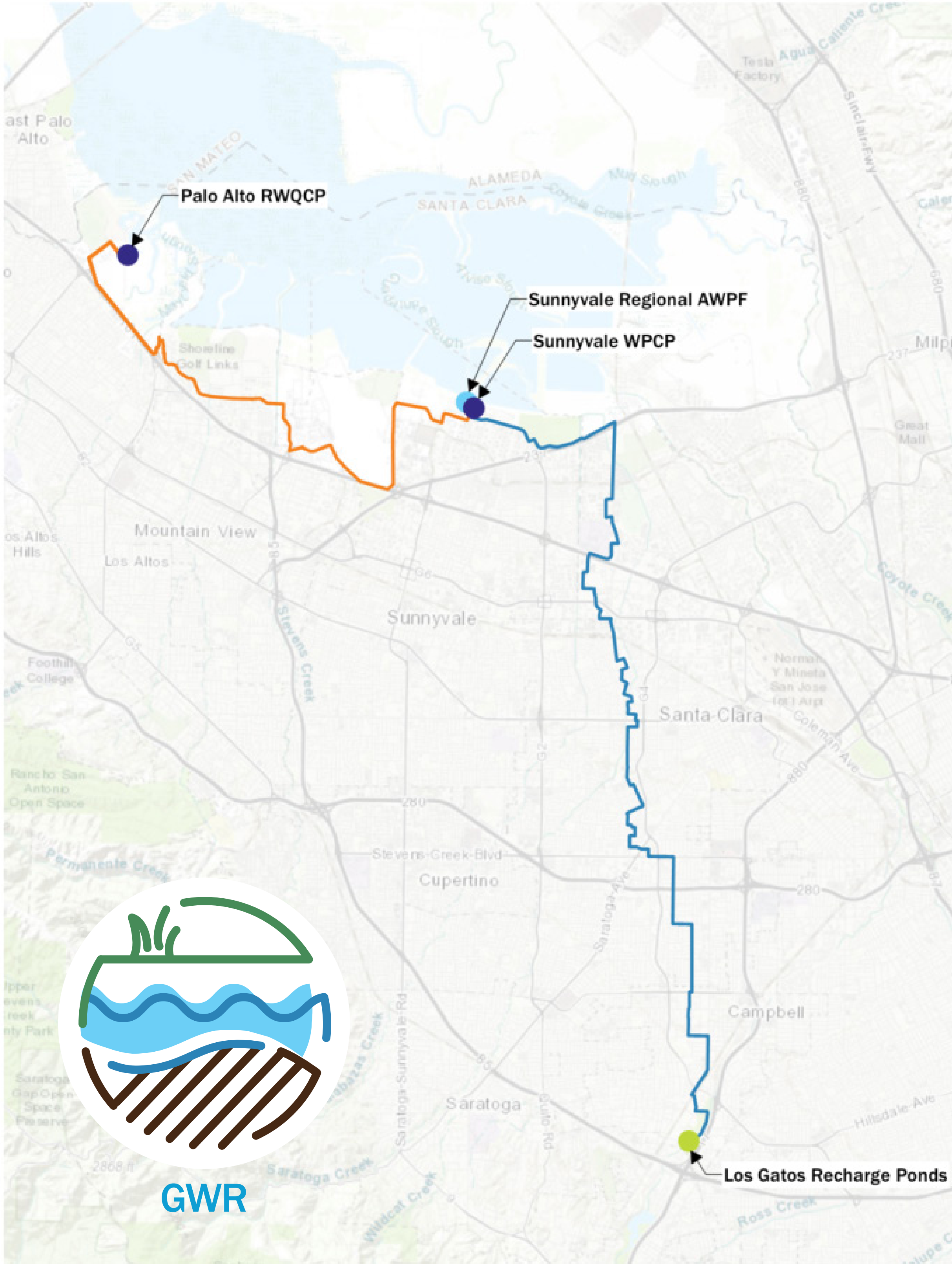


Figure 6-5. Portfolio 2a: PA (+SV) GWR facility locations and pipeline alignments

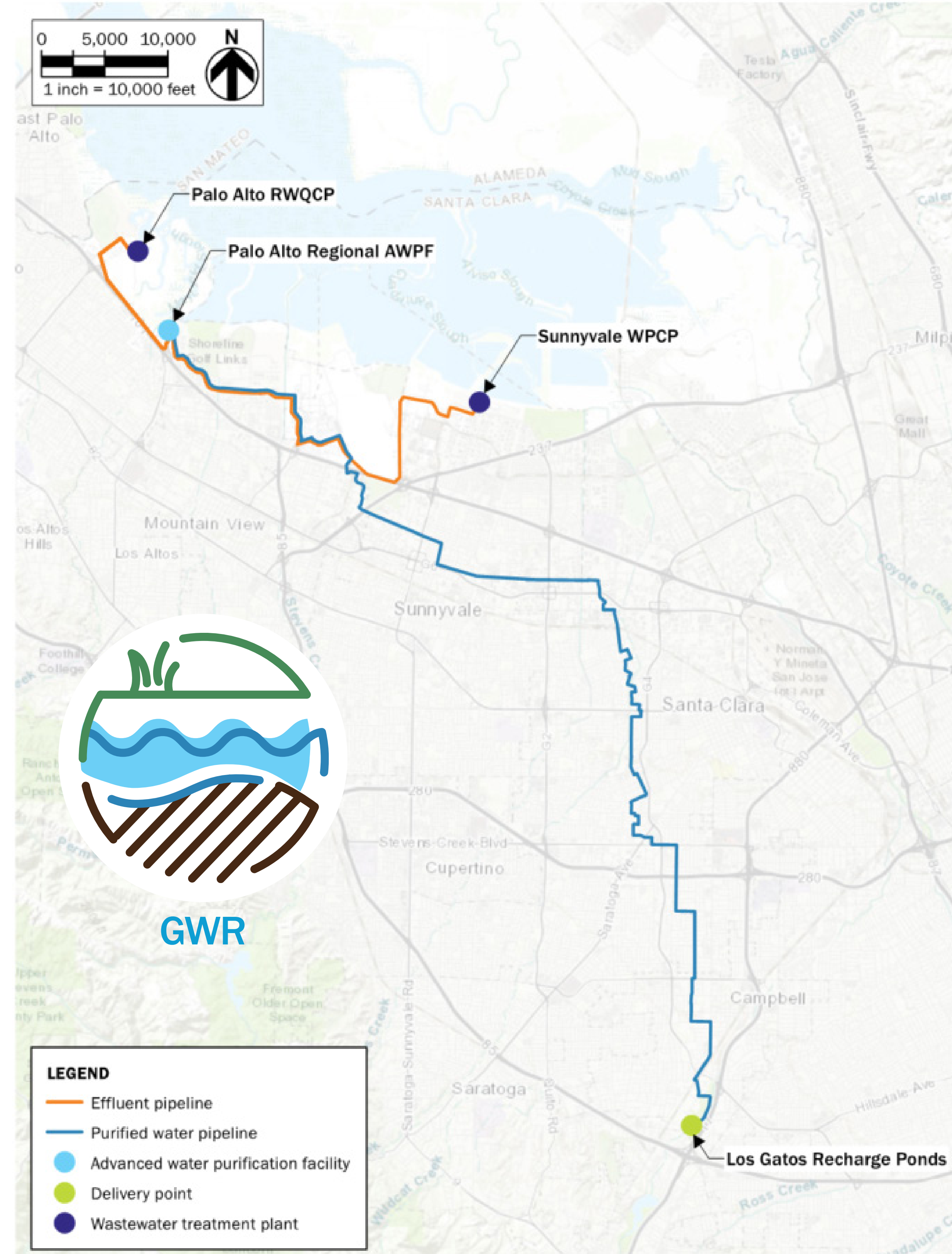


Figure 6-6. Portfolio 2b: SV (+PA) GWR facility locations and pipeline alignments

6.2.3 Palo Alto/Sunnyvale (PA/SV) Two Separate AWPFs for GWR

Portfolio 4 (PA/SV GWR) considers purifying available effluent from the Palo Alto RWQCP and the Sunnyvale WPCP at two separate AWPFs and conveying to LGRP for GWR. The Palo Alto facility would be located on the former Los Altos Treatment Plant site located in Palo Alto; the Sunnyvale AWPF would be located on Recycle Hill. Key features and costs are summarized in Table 6-8, while Figure 6-7 shows respective facility locations and pipeline alignments.

Table 6-8. Portfolio 4 (PA/SV GWR) Key Features and Costs

4: PA/SV GWR Highlights: **2 AWPFs:** 14 mgd in Palo Alto, 10.5 mgd in Sunnyvale **Use:** GWR at LGRP	**Capital Cost:** $850M* **Annual O&M Cost:** $23.0M* **Levelized Unit Costs** • 30-Year Life Cycle: $3,200-$4,300/AF* • 100-Year Life Cycle: $2,500-$3,300/AF* **Reuse Type & Delivery Point:** GWR at LGRP **Projected 2040 Combined Yield:** 17,000-23,000 AFY **Pipeline Length/Diameter** • 13.7 miles at 48" • 11.6 miles at 36"	**BENEFITS** Valley Water has a long-term agreement with Palo Alto. Having two AWPFs allows Valley Water to build one facility first and the other when needed. **LIMITATIONS** Palo Alto RWQCP and Sunnyvale WPCP flows limit projected yield. Constructing and operating two separate AWPFs is costly. Costs for acquiring the proposed AWPF site in Palo Alto are not included. Though Sunnyvale owns the proposed AWPF site (Recycle Hill), technical feasibility of the location remains uncertain and requires further geotechnical and geo-environmental studies. The best available estimate for site preparation cost is included. ROC management options are limited at Sunnyvale.

**Cost estimates are rounded up to the nearest $5M for capital costs, $100k for O&M costs, and $100 for life-cycle unit costs. Capital and O&M costs assume the implementation of the most cost-effective ROC management strategy at the Palo Alto AWPF, based on the Evaluation of ROC Management Options Final Report (Valley Water, 2020a). Unit costs reflect ROC management and potential 2040 yield ranges.*

Portfolio 4 (Palo Alto AWPF). The single-source water variation of an AWPF in Palo Alto would produce up to 2.5 mgd of ROC. The same three ROC management options identified in Portfolio 2a (a combined regional Palo Alto facility) also apply to this portfolio, though sizing is different due to smaller capacity of treating flow from the Palo Alto RWQCP. Key differences are summarized below.

- **Palo Alto ROC Strategy, Options 1 and 2:** Similar to ROC Options 1 and 2 for Portfolio 2a (one regional AWPF in Palo Alto, except a smaller 14" (vs. 18") HDPE pipe from the AWPF to the existing outfall.
- **Palo Alto ROC Strategy, Option 3:** Similar to ROC Option 3 for Portfolio 2a, except a smaller 14" (vs. 20") HDPE pipe from the AWPF to an existing deep-water outfall in Redwood City.

The *Evaluation of ROC Management Options Final Report* prepared by GHD (Valley Water, 2020a) provides an analysis of various strategies at the Palo Alto AWPF without recommending a single option for implementation, thus allowing flexibility for continued discussions and negotiations among Valley Water, Partner Agencies, and Regional Boards. Capital and O&M costs shown in Table 6-8 assume implementation of **ROC Option 1** for Portfolio 4 (PA/SV GWR). Capital costs could increase (an addition of up to $40M) if implementing a higher cost strategy as evaluated in the final report of ROC management options.

Portfolio 4 (Sunnyvale AWPF): The single-source water variation of an AWPF in Sunnyvale would produce up to 1.8 mgd of ROC. Similar to Portfolio 2b (a combined regional AWPF in Sunnyvale), only one ROC management option was identified this facility:

- **SUNNYVALE ROC STRATEGY:** Same as the ROC option for one regional AWPF in Sunnyvale, except a smaller 12" (vs. 18") HDPE pipe from the AWPF to a new outfall discharge point at Guadalupe Slough.

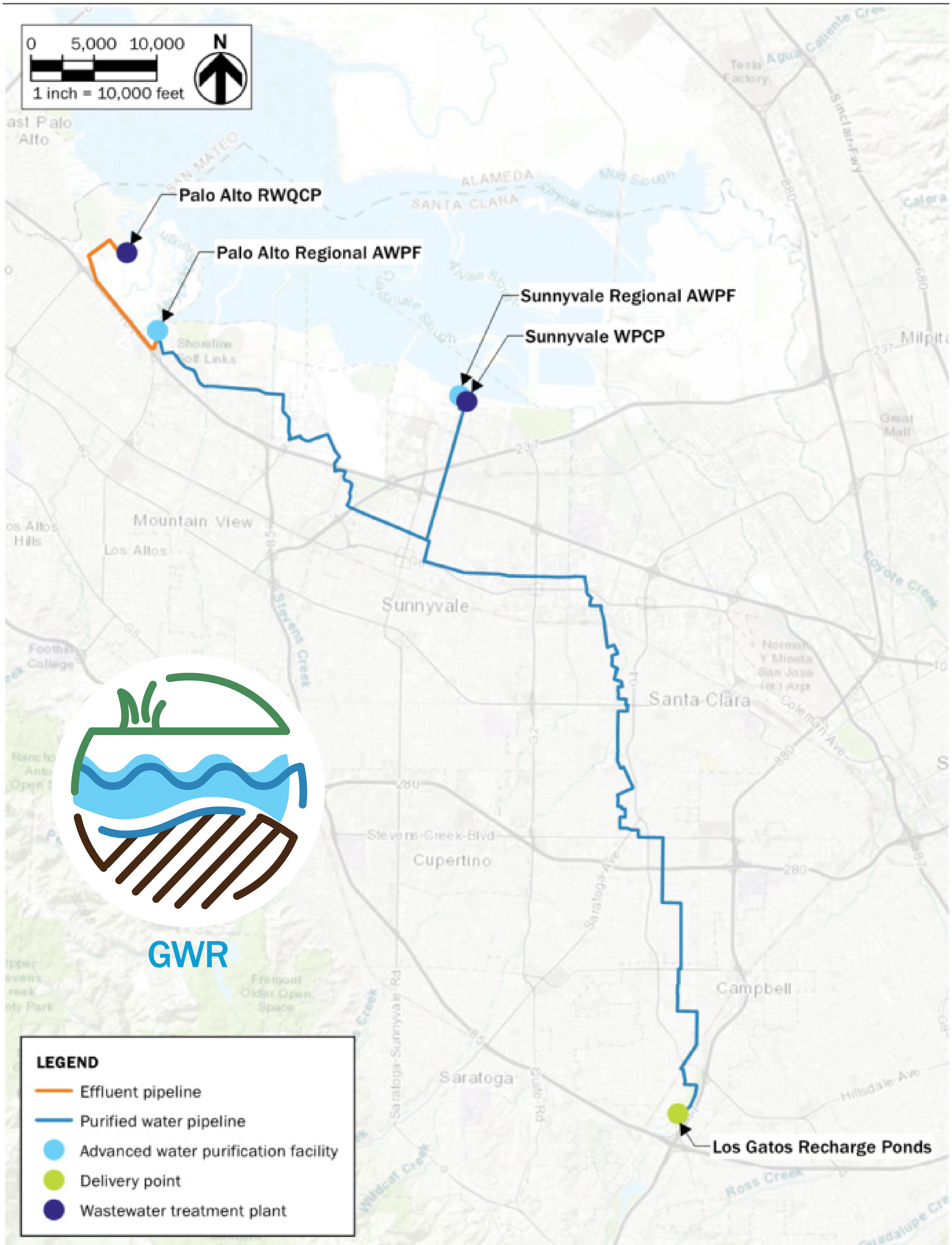


Figure 6-7. Portfolio 4: PA/SV GWR facility locations and pipeline alignments

6.3 South County Reuse Options

To explore solutions for augmenting water supply in South County, the Project Team reviewed previous reuse studies and plans before developing new conceptual alternatives for consideration. Though the 2015 South County Recycled Water Master Plan (RWMP) (SCRWA, 2016) evaluated reuse alternatives in both Gilroy and Morgan Hill, the recommendations focused on expanding NPR distribution in Gilroy, since the substantial energy and infrastructure required to convey recycled water north from the SCRWA WWTP to Morgan Hill would be less cost-effective. Recycled water service at the SCRWA facility is already challenged in meeting existing maximum day NPR demand in Gilroy (5.2 mgd in 2014), using most of the average dry weather influent flow (6.0 mgd in 2014); storage and pumping are needed to manage daily and diurnal variations in flow to meet NPR demand.

SCRWA, Morgan Hill, Gilroy, Valley Water, and the Project Team met (in person and via phone) to explore South County reuse project concepts and collaboratively developed a list of potential opportunities, as summarized in Table 6-9. From this list, SCRWA, Morgan Hill, and Gilroy staff agreed to focus the CoRe Plan efforts for South County on improving overall water supply reliability in Morgan Hill and selected three opportunities, referred to as Morgan Hill (MH) Options 1 (MH-1: NPR+), 2 (MH-2: GWR), and 3 (MH-3: SWA).

Table 6-9. Potential Future South County Reuse Opportunities

Reuse Type	Source Flow	Delivery Point	Summary	Capital Cost ($2019)
NPR	SCRWA	New Morgan Hill NPR distribution system	Per the 2015 South County RWMP, extend pipeline parallel to existing joint sewer trunk line to convey recycled water from SCRWA in Gilroy to Morgan Hill	$60M [a]
NPR+	SBWR	New Morgan Hill NPR distribution system	Extend Silver Creek Pipeline from Metcalf Energy Center to customers in Morgan Hill; includes a 6-mile pipeline extension and serving peak demands up to 5 mgd for an estimated annualized NPR demand of 2,900 AFY **Referred to as Morgan Hill OPTION 1 (MH-1: NPR+)**	$70M [b]
GWR	Morgan Hill satellite WWTP and AWPF	San Pedro Ponds (assumed location for design and costs)	Recharge Llagas Subbasin using purified water from a satellite WWTP and AWPF in Morgan Hill (flow diverted from the SCRWA trunk line) **Referred to as Morgan Hill OPTION 2 (MH-2: GWR)**	$125M [b]
SWA	Morgan Hill satellite WWTP and AWPF	Anderson Reservoir	Augment Anderson Reservoir using purified water from a satellite WWTP and AWPF in Morgan Hill, pumping to the reservoir for blending and dilution, and subsequent treating at Santa Teresa and/or Rinconada WTPs. In exchange, Valley Water would recharge Llagas Subbasin with equal volume of raw water from Santa Clara Conduit **Referred to as Morgan Hill OPTION 3 (MH-3: SWA)**	$145M [b]
SWA	SCRWA and Gilroy AWPF	Coyote Reservoir	Augment Coyote Reservoir using purified water from an AWPF at SCRWA (Gilroy), pumping to the reservoir for blending and dilution, and subsequent treating at Santa Teresa and/or Rinconada WTPs. In exchange, Valley Water would recharge Llagas Subbasin with equal volume of raw water from Santa Clara Conduit	-- [c]
RWA	SCRWA and Gilroy AWPF	Pacheco Conduit	Pump purified water from an AWPF at SCRWA (Gilroy) to Pacheco Conduit for RWA at Santa Teresa and/or Rinconada WTPs. In exchange, Valley Water would recharge Llagas Subbasin with equal volume of raw water from Santa Clara Conduit	-- [c]
TWA	Morgan Hill satellite WWTP and AWPF	Morgan Hill potable distribution system	Deliver purified water from a satellite WWTP and AWPF in Morgan Hill to engineered storage, then into Morgan Hill's potable water distribution system	-- [c]
TWA	SCRWA and Gilroy AWPF	Gilroy potable distribution system	Deliver purified water from an AWPF at SCRWA to engineered storage, then into Gilroy's potable water distribution system	-- [c]

[a] Costs from SCRWA (2016) escalated to 2019 dollars.
[b] See Appendix A-6: Cost Estimates for cost details.
[c] Not available

Morgan Hill reuse options were developed to the same level of detail as North County portfolios, including preliminary designs and AACE Class 5 cost estimates, as summarized in Tables 6-10 to 6-12. Valley Water's ROC Management Project Team reported the only option available for managing ROC from a Morgan Hill or Gilroy-based AWPF is construction of lined evaporation ponds of about 80 to 100 acres in size at a location not yet identified but assumed to be near the SCRWA WWTP for the purpose of preliminary design and costs.

Table 6-10. MH-1 (NPR+) Key Features and Costs

MH-1: NPR+ Highlights: 6-mile Silver Creek Pipeline extension (at 16", 5 mgd capacity) **Location:** SBWR system connection (to north) and new recycled water system in Morgan Hill (to south) **Use:** NPR+	**Capital Cost:** $70M* **Annual O&M Cost:** $2.6M* **Levelized Unit Costs** • 30-Year Life Cycle: $2,200/AF* • 100-Year Life Cycle: $1,700/AF* **Projected 2040 Yield:** 2,900 AFY **Conveyance Pipeline:** 6 miles at 16" **Distribution Pipelines:** 16.4 miles at various diameters	**BENEFITS** MH1: NPR+ improves water supply reliability for Morgan Hill by importing NPR+ supply from SBWR to serve non-potable demands in lieu of groundwater, which is currently Morgan Hill's sole source. MH-1 (NPR+) could be combined with MH-2 (GWR), MH-3 (SWA), or Portfolios 2 or 4 (PA/SV GWR). **LIMITATIONS** An agreement to establish terms of exporting SBWR NPR+ supply from San José and neighboring areas to Morgan Hill would be needed, as the existing Silver Creek Agreement between Valley Water and San José expires in 2027. Long-term supply reliability is unconfirmed. Operational impacts to the SBWR system have not been evaluated, and a new reservoir may be needed to supply reliable summertime flows. Further evaluation is needed to confirm feasibility of implementing MH-1 (NPR+) and variations of Portfolio 1 (San José AWPF), as they rely on the same source. Valley Water may need to revisit and update the Salt and Nutrient Management Plan to reassess potential impacts of recycled water on the Llagas Subbasin prior to moving forward. Given shifting development trends in Morgan Hill, an update NPR market assessment is needed.

**Cost estimates are rounded up to the nearest $5M for capital costs, $100k for O&M costs, and $100 for life-cycle unit costs. The estimated cost of a new recycled water distribution system for Morgan Hill is included.*

Table 6-11. MH-2 (GWR) Key Features and Costs

MH-2: GWR Highlights: 2.5 mgd satellite WWTP and 2.1 mgd AWPF **Location:** Morgan Hill **Use:** GWR (delivery point to be confirmed; San Pedro Ponds assumed for preliminary design)	**Capital Cost:** $125M* **Annual O&M Cost:** $6.9M* **Levelized Unit Costs** • 30-Year Life Cycle: $7,200/AF* • 100-Year Life Cycle: $6,100/AF* **Projected 2040 Yield:** 1,900 AFY • **Conveyance Pipeline:** 2.8 miles at 16"	**BENEFITS** MH-2: GWR would improve water supply reliability and drought resilience for Morgan Hill by recharging the Llagas Subbasin with purified water. MH-2 (GWR) could be combined with MH-1 (NPR+) or Portfolios 1 (SJ GWR, RWA, or TWA), 2 (PA+SV GWR), or 4 (PA/SV GWR). **LIMITATIONS** High unit costs with uncertain value to improving South County water supply reliability. Limited wastewater available for satellite treatment in Morgan Hill and relied upon for meeting existing South County RWS demands. Morgan Hill satellite facility would increase solids loads to SCRWA, posing operational issues that may be substantial. If implemented in Morgan Hill, solids handling requires further study and may increase costs significantly. Density and proximity of active private wells limit GWR locations in South County. San Pedro Ponds is assumed delivery point; further evaluation needed to confirm viability. Conditions and reliability of increasing raw water delivery to Llagas Subbasin and specific recharge facility need to be confirmed. Evaporation pond for ROC management may face permitting challenges; also, assumed location in Gilroy gets inundated with stormwater (unsuitable for evaporation pond). MH-2 (GWR) and MH-3 (SWA) are mutually exclusive, as they rely on the same supply source.

**Cost estimates are rounded up to the nearest $5M for capital costs, $100k for O&M costs, and $100 for life-cycle unit costs. All costs shown here assume the implementation of the sole ROC management strategy identified for a Morgan Hill AWPF in the Evaluation of ROC Management Options Final Report prepared by GHD (Valley Water, 2020a).*

Table 6-12. MH-3 (SWA) Key Features and Costs

MH-3: SWA Highlights:		
2.5 mgd satellite WWTP and 2.1 mgd AWPF **Location:** Morgan Hill **Use:** SWA at Anderson Reservoir	**Capital Cost:** $145M* **Annual O&M Cost:** $7.2M* **Levelized Unit Costs** • 30-Year Life Cycle: $8,000/AF* • 100-Year Life Cycle: $6,600/AF* **Projected 2040 Yield:** 1,900 AFY **Conveyance Pipeline:** 5.6 miles at 16”	**BENEFITS** This option would improve water supply reliability and drought resilience for Morgan Hill by recharging the Llagas Subbasin with raw water supplied from Valley Water via the Santa Clara Conduit in exchange for an equivalent amount of purified water delivered to Anderson Reservoir for SWA. MH-3 (SWA) could be combined with either MH-1 (NPR+) or Portfolios 1 (SJ GWR, RWA, or TWA), 2 (PA+SV GWR), or 4 (PA/SV GWR). **LIMITATIONS** High unit costs with uncertain value to improving South County water supply reliability. Limited wastewater available for satellite treatment in Morgan Hill and relied upon for meeting existing South County RWS demands. Morgan Hill satellite facility would increase solids loads to SCRWA, posing operational issues that may be substantial. If implemented in Morgan Hill, solids handling requires further study and may increase costs significantly. New permits from Regional Board(s) and/or DDW needed for discharging purified water to Anderson Reservoir. Conditions and reliability of increasing raw water delivery to Llagas Subbasin and specific recharge facility need to be confirmed. Evaporation pond for ROC management may face permitting challenges; also, assumed location in Gilroy gets inundated with stormwater (unsuitable for evaporation pond). MH-2 (GWR) and MH-3 (SWA) are mutually exclusive, as they rely on the same supply source.

**Cost estimates are rounded up to the nearest $5M for capital costs, $100k for O&M costs, and $100 for life-cycle unit costs. All costs shown here assume the implementation of the sole ROC management strategy identified for a Morgan Hill AWPF in the Evaluation of ROC Management Options Final Report prepared by GHD (Valley Water, 2020a).*

The Morgan Hill satellite AWPF is estimated to produce up to 0.4 mgd of ROC. The *Evaluation of ROC Management Options Final Report* prepared by GHD (Valley Water, 2020a) identified one option for managing ROC from this facility:

- **Morgan Hill ROC Strategy:** Discharge to a lined evaporation pond of about 80 to 100 acres. Due to the area of land required for this approach and lack of adequately sized plots in Morgan Hill, Valley Water’s ROC Management Team assumed this approach would require pumping ROC and conveying through 11.1 miles of HDPE pipeline at 8” diameter to a SCRWA-owned plot of land near the WWTP in Gilroy.

Though the CoRe Plan uses this ROC management approach for the preliminary design and cost estimate related to a potential Morgan Hill satellite AWPF, the viability of the assumed location for the evaporation pond remains in question.

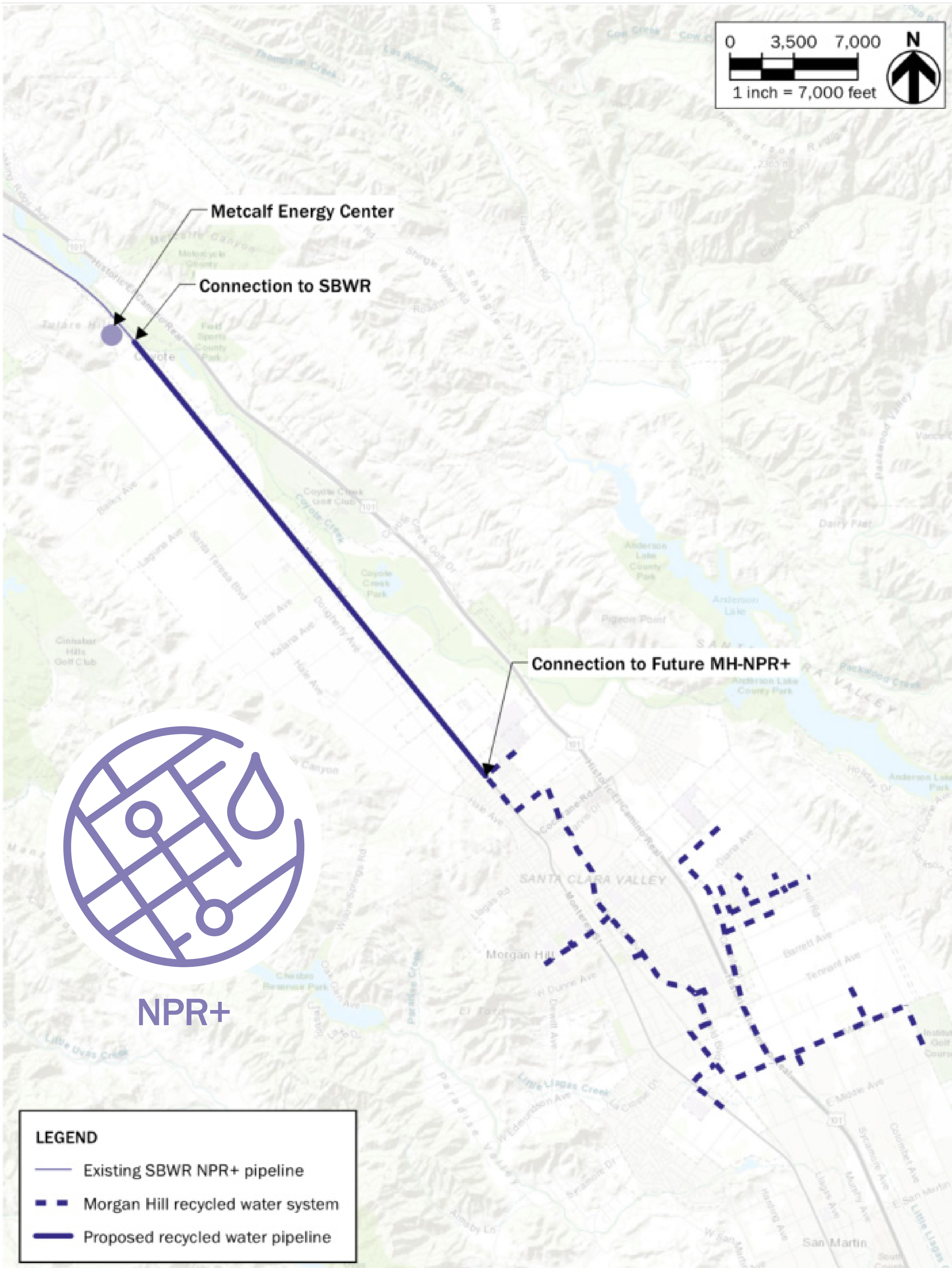


Figure 6-8. MH-1 (NPR+) facility locations and pipeline alignments

Figure 6-9. MH-2 (GWR) facility locations and pipeline alignments

Note: The San Pedro Ponds delivery point is assumed for preliminary design; further evaluation is needed to determine feasibility.

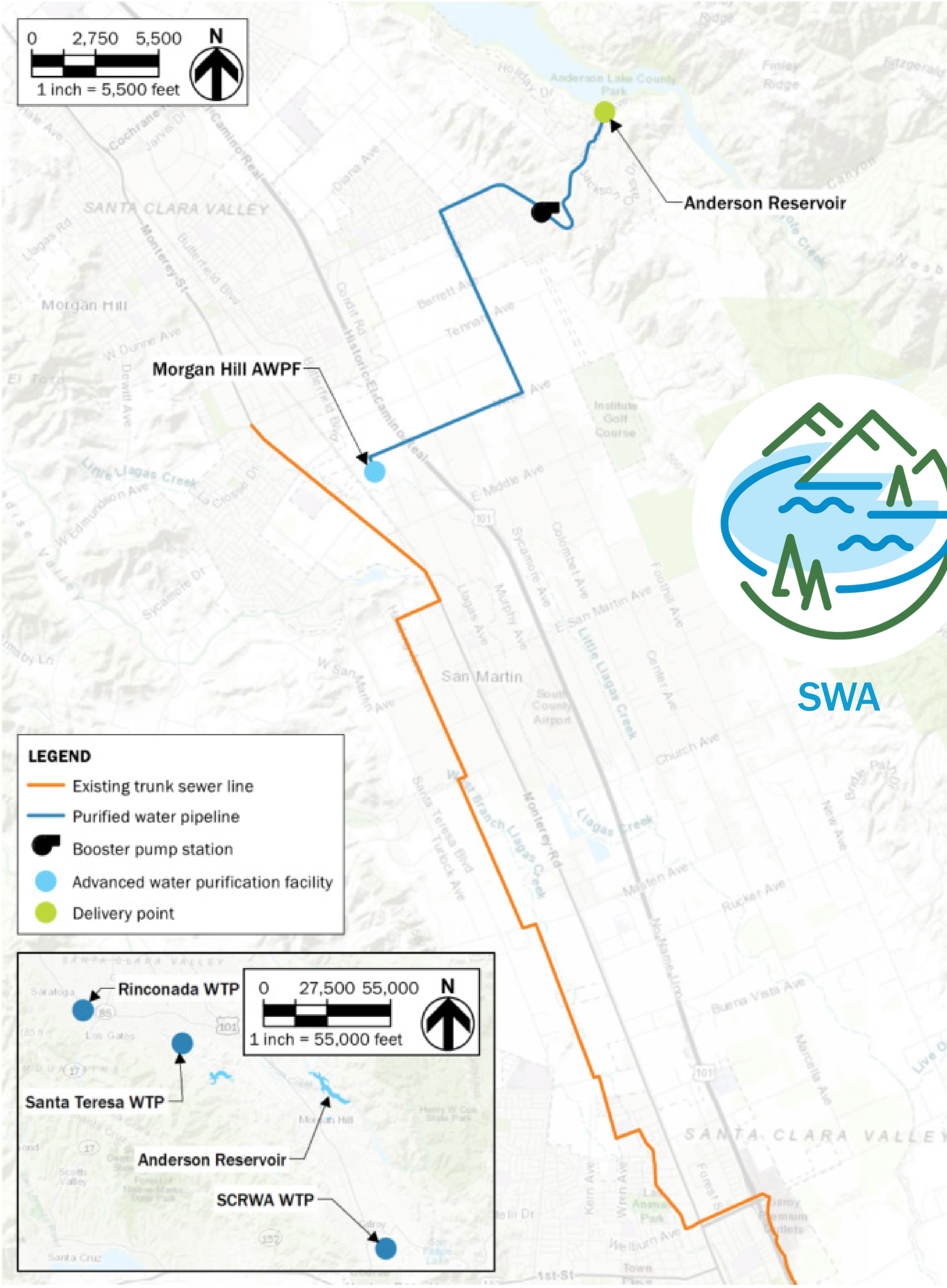


Figure 6-10. MH-3 (SWA) facility locations and pipeline alignments

6.4 At-a-Glance Comparison of Portfolios/Options and Cost Estimates

To compare North County portfolios and South County options, Figures 6-11 to 6-13 visually depict the range of estimated costs in terms of capital, operations and maintenance (O&M), and unit costs (levelized for annual yield and based on 30-year and 100-year life cycles), and Table 6-13 summarizes the estimated values. Cost ranges reflect the following factors.

1. **Source water availability,** which influences the design capacity (production) and efficiency of an AWPF and annual yield of purified water for potable reuse (the latter affects unit costs)
2. **ROC management strategies** for an AWPF in San José or Palo Alto (where Valley Water's ROC Management Team identified multiple options)
3. **Level of accuracy** for planning-level, AACE Class 5 cost estimates (from -50% to +100%)

As summarized further in Sections 7 and 8 and described with greater detail in ***Appendix A***, many opportunities exist for flexibility in implementing some of the projects described and evaluated within this CoRe Plan, such as:

- Phase implementation (such as flexible implementation scenarios in Section 9)
- Repackage projects, blending aspects of the portfolios with one another; add or remove some project element(s)
- Select an alternative alignment
- Optimize (or "right-size") design capacity of treatment facilities and conveyance infrastructure to reflect Board directives and current status of driving forces, such as: near-term policy updates changing Valley Water's potable reuse goals (production or yield); updated demand projections; or partner agreements

Implementing these opportunities could affect costs, with some actions resulting in cost increases and others resulting in cost reductions. Further, estimated costs do not consider impacts of external funding and, thus, do not necessarily represent the costs to Valley Water. As a result, comparison of unit costs as included in this CoRe Plan to others (different supplies, projects, or programs) may be misleading at this stage.

When comparing the planning-level estimated costs across the CoRe Plan portfolios/options, several observed trends lead to the following conclusions.

North County

- For similar production capacities, **capital costs** are estimated to be **lower for DPR versus GWR** (Figure 6-11).
- All four variations of Portfolio 1 (San José AWPF) are estimated at lower capital costs than Portfolios 2 and 4 (Palo Alto and/or Sunnyvale AWPFs).
- Of the four Portfolio 1 (San José AWPF) variations, estimated capital costs are lowest for TWA options (Portfolios 1c and 1d; RWA and GWR are similar, though RWA appears less costly in comparison.
- Both variations of Portfolio 2 (combined Palo Alto/Sunnyvale regional AWPF) have lower estimated capital costs compared to two separate AWPFs in Palo Alto and Sunnyvale (Portfolio 4).
- **Annual O&M costs** are estimated to be **lower for GWR versus DPR** (Figure 6-12).

South County

- For Morgan Hill options, estimated costs are **lowest for MH-1: NPR+** and **similar between MH-2: GWR and MH-3: SWA**. Levelized **unit costs** for **MH-2: GWR and MH-3: SWA** are about **twice as high** as potable reuse unit costs in North County (Figure 6-13).

Estimated Ranges of **Capital Costs**

Consistent with AACE International Class 5 level of project definition, the cost estimating accuracy ranges from -50% to +100%, as shown in Figure 6-11 for capital costs.

Any modifications or optimizations of these estimated life-cycle costs can either increase or reduce costs. Therefore, these cost estimates are susceptible to change.

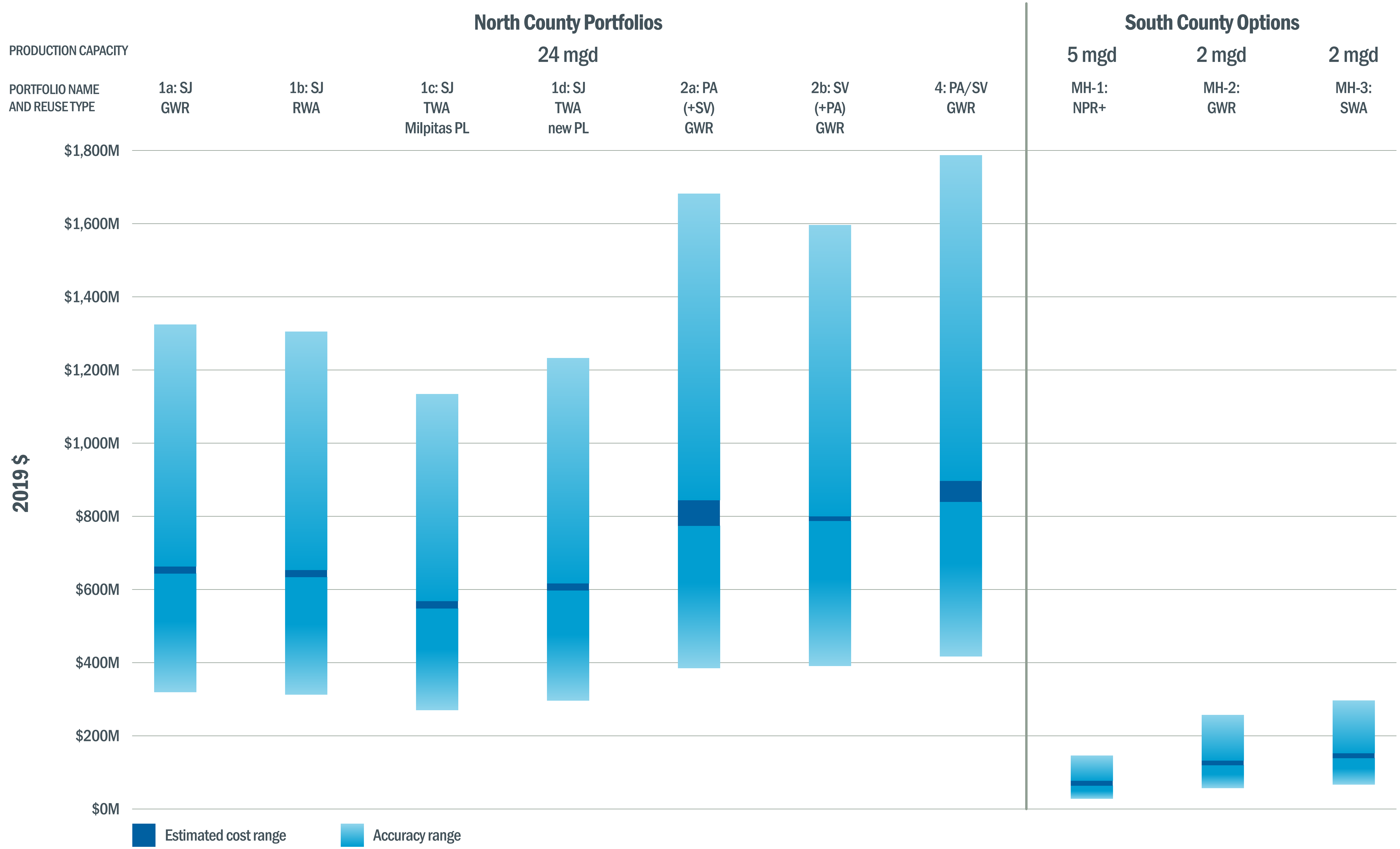


Figure 6-11. Ranges of estimated capital costs with AACE Class 5 level of accuracy

Notes: 1. As presented, capital costs do not reflect potential external funding and are not necessarily the costs to Valley Water.
2. Cost estimates reflect AACE International Class 5 criteria. Class 5 estimates have an expected accuracy range of -50% to +100%.

Estimated Ranges of **Annual O&M Costs**

Consistent with AACE International Class 5 level of project definition, the cost estimating accuracy ranges from -50% to +100%, as shown in Figure 6-12 for O&M costs.

Any modifications or optimizations of these estimated life-cycle costs can either increase or reduce costs. Therefore, these cost estimates are susceptible to change.

Figure 6-12. Ranges of estimated annual O&M costs with AACE Class 5 level of accuracy

Notes: 1. As presented, O&M costs do not reflect potential external funding and are not necessarily the costs to Valley Water.
2. Cost estimates reflect AACE International Class 5 criteria. Class 5 estimates have an expected accuracy range of -50% to +100%.

Estimated Ranges of **Unit Costs**

Consistent with AACE International Class 5 level of project definition, the cost estimating accuracy ranges from -50% to +100%, as shown in Figure 6-13 for 30-year and 100-year life cycles.

Any modifications or optimizations of these estimated life-cycle costs can either increase or reduce costs. Therefore, these cost estimates are susceptible to change.

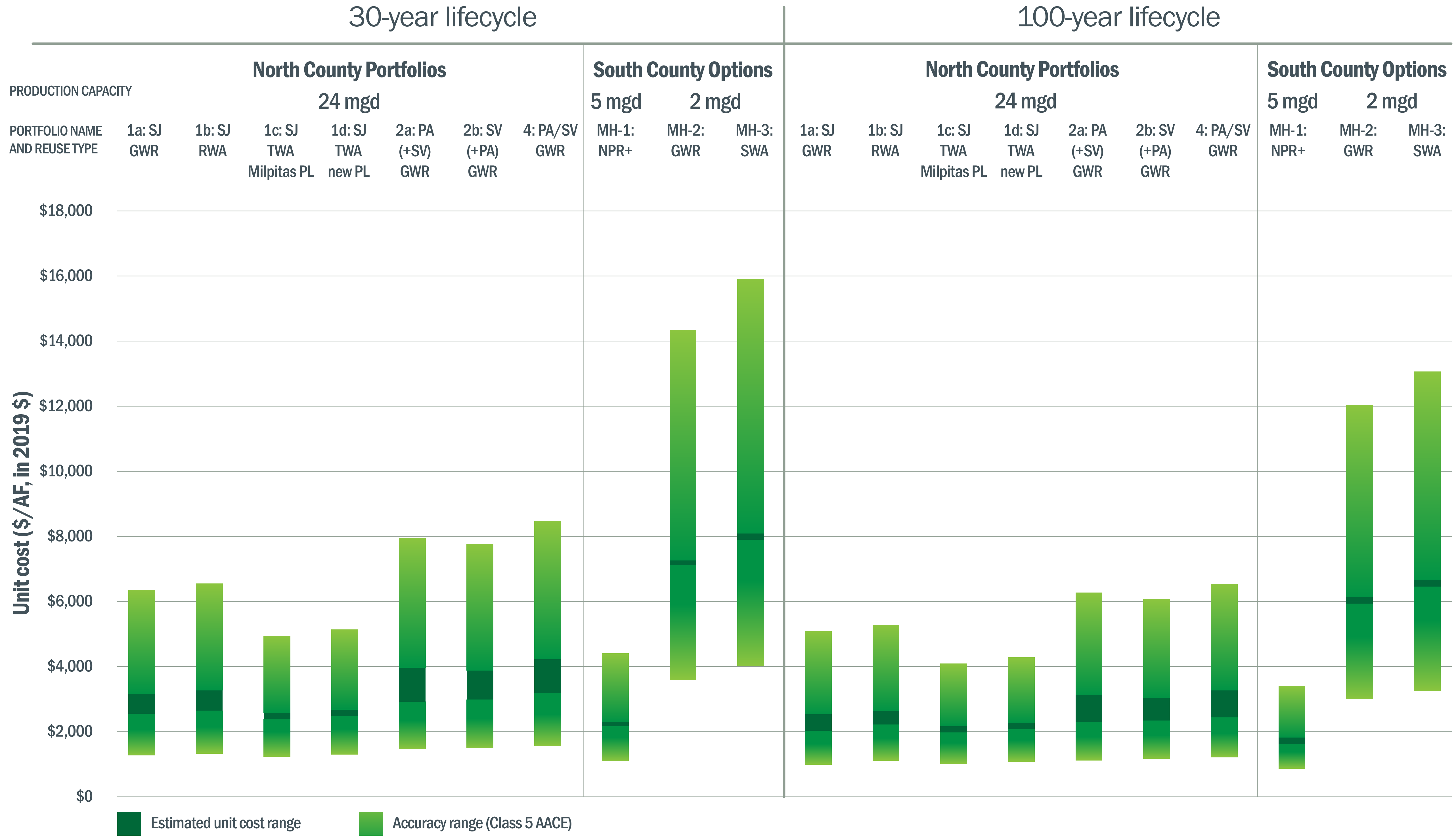


Figure 6-13. Levelized unit costs with AACE Class 5 level of accuracy (30-year and 100-year life cycles)

Notes: 1. Unit costs as presented do not consider potential external funding and are not necessarily the costs to Valley Water. Thus, comparison of these unit costs to other supplies may be misleading at this stage.
2. Cost estimates reflect AACE International Class 5 criteria. Class 5 estimates have an expected accuracy range of -50% to +100%.

Table 6-13. Estimated Portfolio Costs and ROC Management Options

Portfolio			ROC Management Strategy (*Option used to estimate capital and O&M costs)	Estimated Cost ($M) [a]		Levelized Unit Cost [a] ($/AF)	
				Capital	Annual O&M	30-year Life Cycle	100-year Life Cycle
Portfolio 1 Purifies effluent from SJ/SC RWF at a 24-mgd AWPF located in San José	1a: SJ GWR	Delivers 19,000-24,000 AFY to LGRP for GWR	Option 1*: ROC with residual final effluent and discharge at a new outfall downstream of existing effluent outfall discharge weir though an outfall diffuser Option 2: Discharge at a new shallow outfall at Coyote Creek through an outfall diffuser	$655	$21.4	$2,600-$3,200	$2,100-$2,600
	1b: SJ RWA	Delivers 19,800-24,000 AFY to the SBA terminal tank upstream of Penitencia WTP for RWA		$650	$24.5	$2,700-$3,300	$2,300-$2,700
	1c: SJ TWA, Milpitas Pipeline	Delivers 24,000 AFY total for TWA, including: up to 4 mgd directly to Santa Clara and San José (north of Highway 101), and up to 20 mgd to Valley Water's retailers Serves purified water to several turnouts as the water flows south through the existing Milpitas Pipeline before reaching Piedmont Valve Yard (i.e., blending location near Penitencia WTP) and delivery via East Pipeline		$555	$24.1	$2,500	$2,100
	1d: SJ TWA, new pipeline	Delivers 24,000 AFY total for TWA, including: up to 4 mgd directly to Santa Clara and San José (north of Highway 101), and up to 20 mgd to Valley Water's retailers Serves Valley Water retailers through a dedicated purified water pipeline to Piedmont Valve Yard (i.e., blending location near Penitencia WTP) for delivery via Milpitas Pipeline and East Pipeline		$605	$24.1	$2,600	$2,200
Portfolio 2 Combines effluent from Palo Alto RWQCP and Sunnyvale WPCP and purifies at a 24.5-mgd regional AWPF located in Palo Alto (2a) or Sunnyvale (2b)	2a: PA (+SV) GWR	Delivers 17,000-23,000 AFY to LGRP for GWR	Option 1*: Blend ROC with residual final effluent and discharge at existing outfall Option 2: Discharge at a new shallow outfall in San Francisco Bay Option 3: Discharge at a deep-water outfall north of Dumbarton Bridge	$800	$22.5	$3,000-$4,000	$2,400-$3,100
	2b: SV (+PA) GWR	Delivers 17,000-23,000 AFY to LGRP for GWR	Sole Option: Discharge ROC at a new shallow-water outfall at Guadalupe Slough for enhanced mixing	$805	$21.6	$3,000-$3,900	$2,400-$3,100
Portfolio 4 Purifies effluent from Palo Alto RWQCP and Sunnyvale WPCP at separate regional facilities, including: 14-mgd Palo Alto AWPF and 10.5-mgd Sunnyvale AWPF	4: PA/SV GWR	Delivers a combined 17,000-23,000 AFY to LGRP for GWR	Option 1*: Blend ROC with residual final effluent and discharge at existing outfall Option 2: Discharge at a new shallow outfall in San Francisco Bay Option 3: Discharge at a deep-water outfall north of Dumbarton Bridge Sole Option: Discharge ROC at a new shallow-water outfall at Guadalupe Slough for enhanced mixing	$850	$23.0	$3,200-$4,300	$2,500-$3,300
Morgan Hill Options	MH-1: NPR+	Delivers 2,900 AFY of NPR+ from SBWR to a new Morgan Hill recycled water system [b]	Not applicable	$70	$2.6	$2,200	$1,700
	MH-2: GWR	Delivers 1,900 AFY from a Morgan Hill 2.5-mgd satellite WWTP and 2.1-mgd AWPF to a recharge facility [c] in Morgan Hill for GWR	Sole Option: Lined evaporation pond in Gilroy	$125	$6.9	$7,200	$6,100
	MH-3: SWA	Delivers 1,900 AFY from a Morgan Hill 2.5-mgd satellite WWTP and 2.1-mgd AWPF to Anderson Reservoir for SWA		$145	$7.2	$8,000	$6,600

[a] *Cost estimates are rounded up to the nearest $5M for capital costs, $100k for O&M costs, and $100 for life-cycle unit costs.*
[b] *MH-1: NPR+ cost estimate includes new recycled water distribution system cost from the 2015 South County Recycled Water Master Plan Update, projected to 2019 dollars (SCRWA, 2016).*
[c] *Delivery point requires further evaluation; preliminary design assumes San Pedro Ponds.*

6.5 Evaluation and Risk

The Project Team created two tools to compare portfolios: an evaluation tool and a risk tool. The evaluation tool compares portfolios relative to one another based on prioritization criteria identified by Valley Water and its Partner Agencies. The risk tool supports assessment of each portfolio separate from the overall evaluation focusing on aspects that may disrupt, delay, or halt projects and considering the likelihood and consequence of risks. The tool returns a calculated composite risk score for each portfolio. ***Appendix A-7*** (Evaluation and Risk Tools) provides detailed descriptions of the approaches for developing and using the tools to compare portfolios, and brief summaries follow in this section.

6.5.1 Evaluation Tool

In October 2018, Valley Water and its Partner Agencies reached collective agreement on five evaluation criteria representing program goals. A collective 19 sub-criteria further define the 5 criteria and help differentiate portfolios in scoring (Table 6-14). Several program goals important to Valley Water and its Partner Agencies are not reflected in the criteria or sub-criteria because the evaluation tool focuses aspects that distinguish portfolios from one another. An example of a project goal not reflected in the criteria (i.e., does not set apart portfolios) is that all portfolios protect groundwater and surface water quality, as required by Valley Water.

As conditions change and new information becomes available, portfolios will perform differently with respect to the criteria and sub-criteria, and results of the evaluation tool will change.

Table 6-14. Criteria and Sub-criteria Built into the CoRe Evaluation Tool

Criteria	Sub-Criteria (used to further define and score criteria)
Economics	Estimated life-cycle costs: 30-year
Countywide (regional) supply reliability	• Projected 2040 PR annual purified water production • Purified water delivery point utilization • Local reuse benefit – retains reuse supply in same sewer service area
Environmental impacts/ benefits and sustainability	• Minimizing carbon footprint (evaluated using energy use as a surrogate for carbon emissions) • Environmental and social justice • Equity in supply benefits (with respect to water rights)
Ease of implementation and regulatory compliance	• Partnerships/collaboration • Public health regulatory considerations • Environmental compliance regulatory considerations • Design readiness • Anticipated permit requirements • Public acceptance/support
Engineering feasibility	• Need for pilot study (treatment technology proven at full scale) • Pipeline construction • Land acquisition / ownership • Site preparation requirements • Ease of operation

To demonstrate functionality, the Project Team used a variety of weighting scenarios in the evaluation tool to change the relative importance of criteria and sub-criteria in scoring the North County portfolios and South County options. ***Appendix A-7*** includes scenario outcomes. For all four weighting scenarios explored by the Project Team, Portfolio 1a (SJ GWR) outperforms other North County portfolios. For South County options, MH-1 (NPR+) outperforms Morgan Hill NPR from SCRWA, and MH-2 (GWR) outperforms MH-3 (SWA).

6.5.2 Risk Tool

The Project Team identified risks in seven categories with input from reuse subject matter experts, water industry guidance (such as Water Research Foundation's Reference Manual 4715; Water Research Foundation, 2019), Valley Water staff, and Partner Agencies. The Project Team qualitatively analyzed risks of each portfolio/option considering likelihood and consequence(s) of a particular risk occurring and mitigation strategies that could eliminate the risk or reduce its impact.

Example results from the risk assessment tool for North County portfolios and South County options are presented in Figure 6-14 and ***Appendix A-7.*** In this example, Portfolios 1a (SJ GWR) and 2a (PA [+SV] GWR) return the lowest composite risk scores based on the Project Team's input for each of seven risk categories.

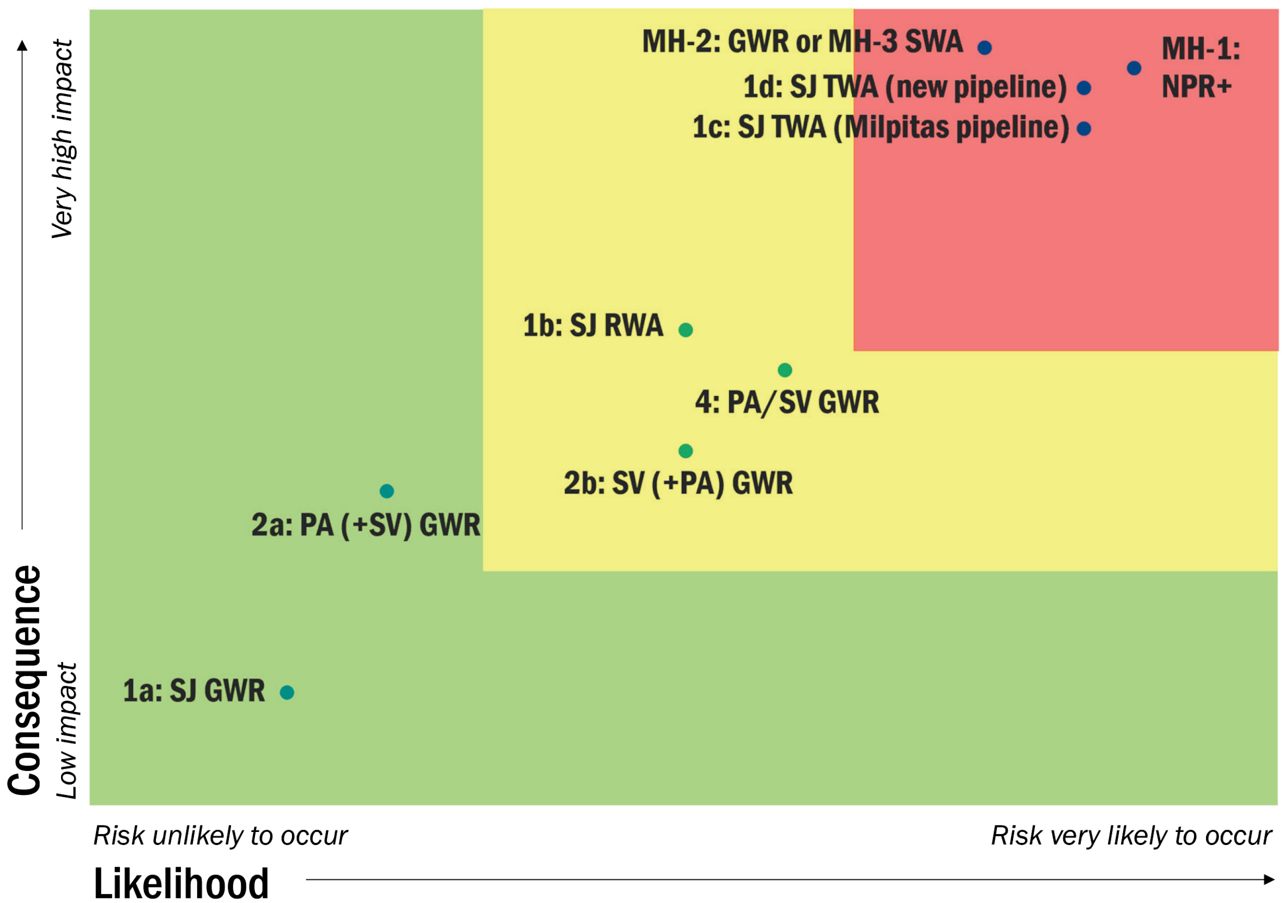


Figure 6-14. Example of risk assessment tool results to compare CoRe portfolios and options

Note: Risk of Portfolios 1c (SJ TWA, Milpitas Pipeline) and 1d (SJ TWA, new pipeline) may drop following the state's adoption of DPR regulations, anticipated as soon as 2023.

6.5.3 ROC Management Strategies Evaluation

Under a separate but related project, Valley Water and its ROC Management Strategies project consultant (GHD) evaluated various options for managing the ROC waste stream considering anticipated compliance with the SF Bay Basin Plan, NPDES permits, and WDR. The results of the ROC strategies evaluation are documented in detail in the *Evaluation of ROC Management Options Final Report* (Valley Water, 2020a), attached as ***Appendix G***. To distill the evaluation results, Table 6-15 summarizes benefits and challenges of the individual strategies GHD evaluated and includes recommended next steps for Valley Water to consider during future phases of project selection and implementation.

Table 6-15. Overview of ROC Management Strategies Evaluation Prepared by GHD (Valley Water, 2020a)

ROC Management Strategy	Applicable AWPF Locations	Benefits	Challenges	Recommended Next Steps
1. Existing Outfall Use existing outfall and rely on blending with current discharge	**San José Portfolios:** 1a, SJ GWR 1b: SJ RWA 1c: TWA, Milpitas Pipeline 1d: SJ TWA, new pipeline	• Anticipated compliance with applicable discharge requirements, based on GHD's analysis • Anticipated to meet target AWPF production capacity, based on GHD's analysis • Likely feasible to permit by 2028 due to avoidance of developing a new outfall	• Involves securing a new permit that requires coordination between Valley Water and San José • Requires inter-agency agreements to commingle discharge flows	• Further discuss regulatory approach with Regional Board and other agencies with jurisdiction • Obtain inter-agency agreements to define roles and responsibilities for permit compliance

	Palo Alto Portfolios:
	2a: PA (+SV) GWR
	4: PA/SV GWR
	Sunnyvale Portfolios:
	2b: SV (+PA) GWR
	4: PA/SV GWR
		• Anticipated compliance with applicable discharge requirements, based on GHD's analysis, so long as AWPF production rate is lowered to ensure sufficient blending
		• Likely feasible to permit by 2028 due to avoidance of developing a new outfall
			• Uncertainty regarding the willingness of the Regional Board to consider alternative compliance assessments such as mass-loading based objectives
			• Limited recycled water capacity due to minimum discharge needed for dilution; capacity ranges depending on assumptions, shown below as a percent of target capacity
			  • Palo Alto AWPF: Portfolio 2a (PA [+SV] GWR): 46-82% and Portfolio 4 (PA/SV GWR): 27-68%
			  • Sunnyvale AWPF: Portfolio 2b (SV [+PA] GWR): 3-51% and Portfolio 4 (PA/SV GWR): 52-88%
			• Involves securing a new permit that requires coordination between Valley Water and Palo Alto and/or Sunnyvale
			• Requires inter-agency agreements to commingle discharge flows
				• Further discuss regulatory approach with Regional Board and other agencies with jurisdiction and determine whether alternative limits such as mass-based requirements could be applied
				• Obtain inter-agency agreements to define roles and responsibilities for permit compliance

2. New Outfall Blend at a new outfall near an existing outfall	**San José Portfolios:** 1a, SJ GWR 1b: SJ RWA 1c: TWA, Milpitas Pipeline 1d: SJ TWA, new pipeline	• Anticipated compliance with applicable discharge requirements, based on GHD's assumptions • Anticipated to meet target AWPF production capacity, based on GHD's analysis	• Dilution with San José discharge in the environment (rather than prior to discharge) may limit ability to receive dilution credit • Uncertainty in feasibility of implementing by 2028, given a new outfall is subject to environmental regulatory requirements (endangered species present) • Involves securing a new permit that requires coordination between Valley Water and San José	• Further discuss regulatory approach with Regional Board and other agencies with jurisdiction • Evaluate schedule requirements for implementing a new outfall • Obtain inter-agency agreements to define roles and responsibilities for permit compliance
3. New Outfall with Enhanced Mixing Discharge at a new enhanced mixing outfall	**San José Portfolios:** 1a, SJ GWR 1b: SJ RWA 1c: TWA, Milpitas Pipeline 1d: SJ TWA, new pipeline **Palo Alto Portfolios:** 2a: PA (+SV) GWR 4: PA/SV GWR) **Sunnyvale Portfolios:** 2b: SV (+PA) GWR 4: PA/SV GWR	• Offers potential for more dilution credit compared to using the existing outfall or a new shallow outfall • Anticipated to meet target AWPF production capacity, based on GHD's analysis • May not require coordination with the Project Partner to obtain an NPDES permit	• Uncertainty in feasibility of implementing by 2028, given a new outfall is subject to environmental regulatory requirements (endangered species present) • Unconfirmed (and not guaranteed) amount of dilution achieved by a new outfall • Permitting uncertainty, considering development of an outfall extension at Palo Alto was not permitted in the 1980s	• Continue to assess potential dilution credit that could be achieved depending on outfall design • Further discuss regulatory approach with Regional Board and other agencies with jurisdiction • Evaluate schedule requirements for implementing a new outfall
4. Deep Water Discharge Outfall Discharge at an existing deep-water outfall (Silicon Valley Clean Water)	**Palo Alto Portfolios:** 2a: PA (+SV) GWR 4: PA/SV GWR)	• Offers potential for more dilution credit compared to using an existing outfall • Based on GHD's analysis, meets target AWPF production capacity	• Unknown capacity of the outfall requires verification • Involves securing a new permit that requires coordination between Valley Water, Silicon Valley Clean Water, and Palo Alto	• Verify capacity and dilution of the existing deep-water outfall • Evaluate schedule requirements for connecting to the existing outfall • Obtain inter-agency agreements to define roles and responsibilities for permit compliance
5. Evaporation Pond Discharge into a lined evaporation pond (in Gilroy)	**Morgan Hill Options:** MH-2: GWR MH-3: SWA	• Provides a potential option for disposing ROC produced in Morgan Hill (far from SF Bay) • Other site-specific benefits may arise after identifying a feasible location	• Requires Valley Water to acquire a significant amount of land • Other site-specific challenges may arise after identifying a suitable location	• Identify a suitable location for the evaporation ponds • Further discuss regulatory approach with Regional Board and other agencies with jurisdiction • Evaluate schedule requirements for connecting to the existing outfall

Section 7:
Potential Future Opportunities and Alternative Elements

Through the CoRe Plan's development, Valley Water and its Partner Agencies considered a wide range of reuse scenarios, including reuse projects identified in the North County portfolios and South County options described in Section 6. In addition, Valley Water and its Partner Agencies also considered opportunities that may be further explored in the future and alternative elements that could replace aspects of the portfolios/options.

7.1 NPR/NPR+ Expansion (featured in all portfolios)

Several Partner Agencies are evaluating potential projects to expand existing recycled water systems. Figure 7-1 shows locations of NPR and NPR+ expansion projects as identified in Partner Agencies' existing recycled water master plans[7]. Projects identified in the figure do not necessarily reflect full potential buildout conditions for each Partner Agency.

As described in more detail in Section 2.3 of ***Appendix A-1***, the Project Team compiled and summarized market potential for future NPR/NPR+ expansion on a Countywide basis and related capital costs as previously studied by Partner Agencies and documented in their respective recycled water master plans. Compared to NPR/NPR+ demands summarized in 2015 UWMPs, recycled water projections in existing recycled water master plans are significantly higher. Key factors contributing to this discrepancy are that projects identified in recycled water master plans are: (a) not necessarily confirmed to be feasible or cost-effective, and (b) not consistently reflective of full costs, such as retrofits and treatment to improve NPR quality.

Depending on site- and case-specific circumstances, use of recycled water for NPR can be a logical, cost-effective water management strategy. Many variables play a role in that determination, including the need for supplemental water supply of a certain quality, within an established timeframe, and during specific conditions.

[7] Sunnyvale is not currently funding expansion of its recycled water system. Potential NPR/NPR+ expansion projects listed in this report are based on the City of Sunnyvale's 2013 Feasibility Study for Recycled Water Expansion.

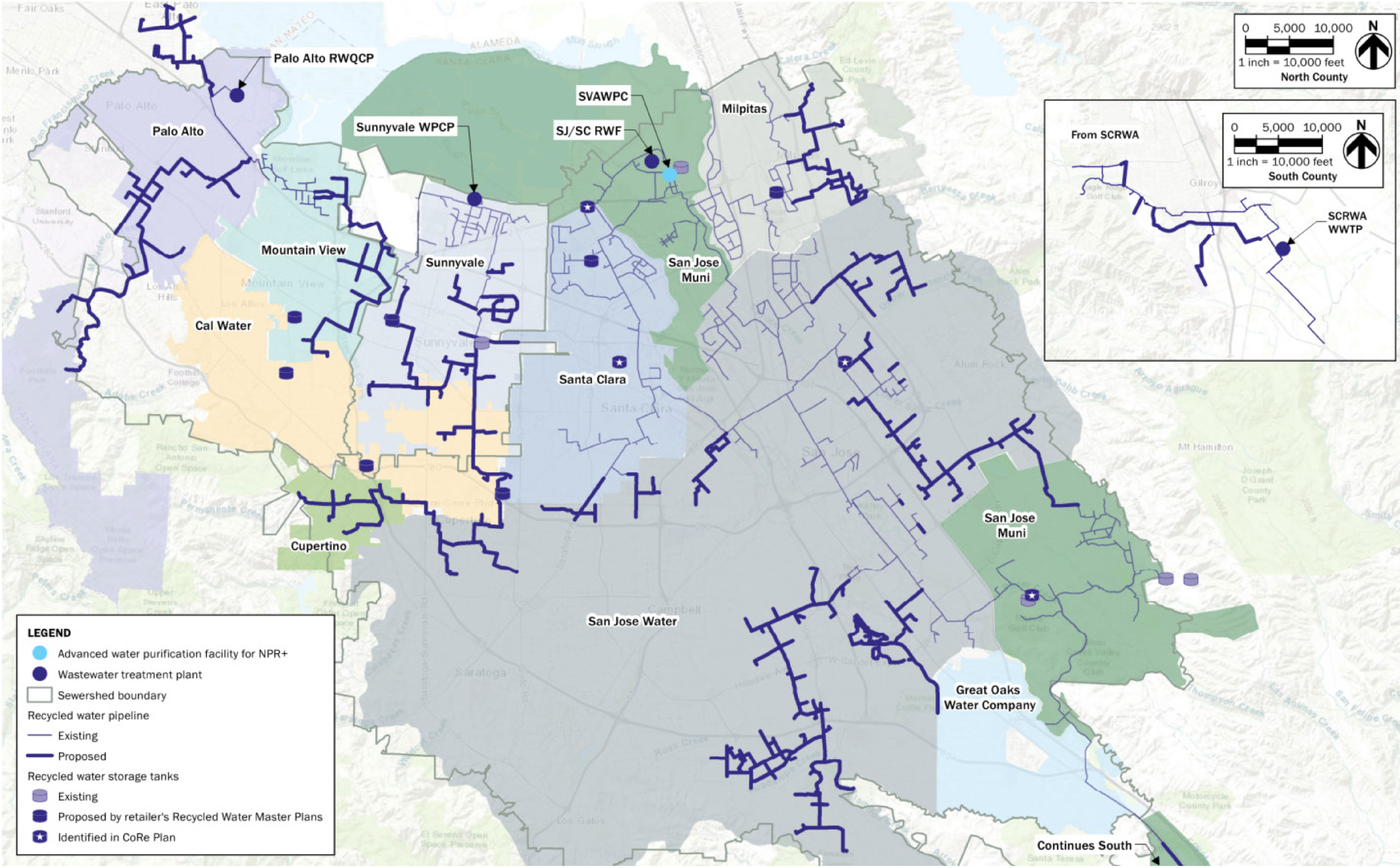


Figure 7-1. Potential future recycled water distribution system expansions throughout Santa Clara County and water retailer service areas

Note: Recycled water infrastructure improvements reflect NPR retailers' recycled water master plans and are currently undefined for City of Santa Clara and San José Municipal Water service areas.

7.2 Interties between Recycled Water Systems

Physically interconnecting recycled water systems serves several potential functions, including:

Reliability: If an outage occurs in one system, available capacity from an adjoining system could be used. Supply from an adjoining system could also support pipeline maintenance activities, such as shutdowns of transmission mains.

Peak demand supply mitigation: Peak day and peak hour demands are a challenge in some systems, and available supply from an adjoining system could be leveraged to meet demands.

Freeing up effluent for PR: By meeting NPR demands of adjacent systems, the amount of supply offset could provide more flow for PR or ROC dilution. For example, if Sunnyvale's NPR demand were met by SBWR, Sunnyvale could provide more supply for PR or ROC dilution. Vice versa, if SBWR's NPR+ expansion was met using effluent from Sunnyvale, SBWR would be able to confidently meet NPR+ demands even during dry years, allowing for supply for PR.

In addition to pipelines, interties may require pump stations, pressure-reducing valves, metering, or other facilities depending on intended function and planned operations. Further, interties between some recycled water distribution systems may require treatment improvements (i.e., an AWPF for NPR+) to avoid negatively impacting an adjoining system's water quality. Over the past decade, Valley Water and Partner Agencies studied pipeline alignments for several intertie opportunities in North County, including the following.

- **Sunnyvale-SBWR interties.** Three intertie options were considered to connect Sunnyvale and SBWR, including: one effluent intertie to convey secondary effluent from Sunnyvale WPCP to the SJ/SC RWF or SVAWPC, and two recycled water intertie alignments (one northern and one southern connector).
- **Sunnyvale-Palo Alto/Mountain View intertie.** An intertie could connect an existing 16-inch pipeline on Enterprise Way in Sunnyvale to a new 16-inch recycled water pipeline located in Moffett Field.

Table 7-1 briefly describes these interties and shows estimated capital costs, as identified in various past studies. For the two Sunnyvale-SBWR recycled water intertie alignments, capital cost estimates vary based on conditions and assumptions used in past studies. Figure 7-2 identifies alignments considered. A more detailed discussion of cost and design assumptions is included in Section 2.3 of ***Appendix A-1.***

Table 7-1. Summary of Potential Recycled Water System Interties

Intertie	Description	Length/ Diameter	Capital Cost ($M)
Sunnyvale – SBWR interties			
1. Effluent intertie	30" pipeline to convey up to 10 mgd of secondary effluent from the Sunnyvale WPCP to the SJ/SC RWF or SVAWPC. Involves tunneling through Bay soils and high groundwater areas.	32,000 LF at 30"	$86
2. Recycled water intertie, northern connector	24" or 30" pipeline connecting an existing 30" SBWR pipeline (at Lafayette Drive and Tasman Road) to an existing 24" Sunnyvale pipeline (at Sunnyvale East Channel and Persian Drive). Hydraulically modeled for peak recycled water demand of 2.7 mgd from SBWR to Sunnyvale.	16,000 LF at 24"	$15
		15,000 LF at 30"	$24 [a] - $51
3. Recycled water intertie, southern connector	16" or 30" pipeline connecting an existing 16" SBWR pipeline (at Homestead Road and Las Palmas Drive) to existing Wolfe Road pipeline. Hydraulically modeled for peak recycled water demand of 2.7 mgd from SBWR to Sunnyvale	12,000 LF at 16"	$7
		12,000 LF at 30"	N/A
Sunnyvale-Palo Alto/ Mountain View intertie			
4. Recycled water intertie	16" pipeline connecting to two other 16" pipelines: one existing (on Enterprise Way in Sunnyvale) and one new (located in Moffett Field, part of a potential Mountain View NPR system expansion)	18,600 LF at 16"	$16 [a]

[a] *For more detail, refer to Appendix A-1, Section 2.3 and Appendix A-6 (cost tables).*

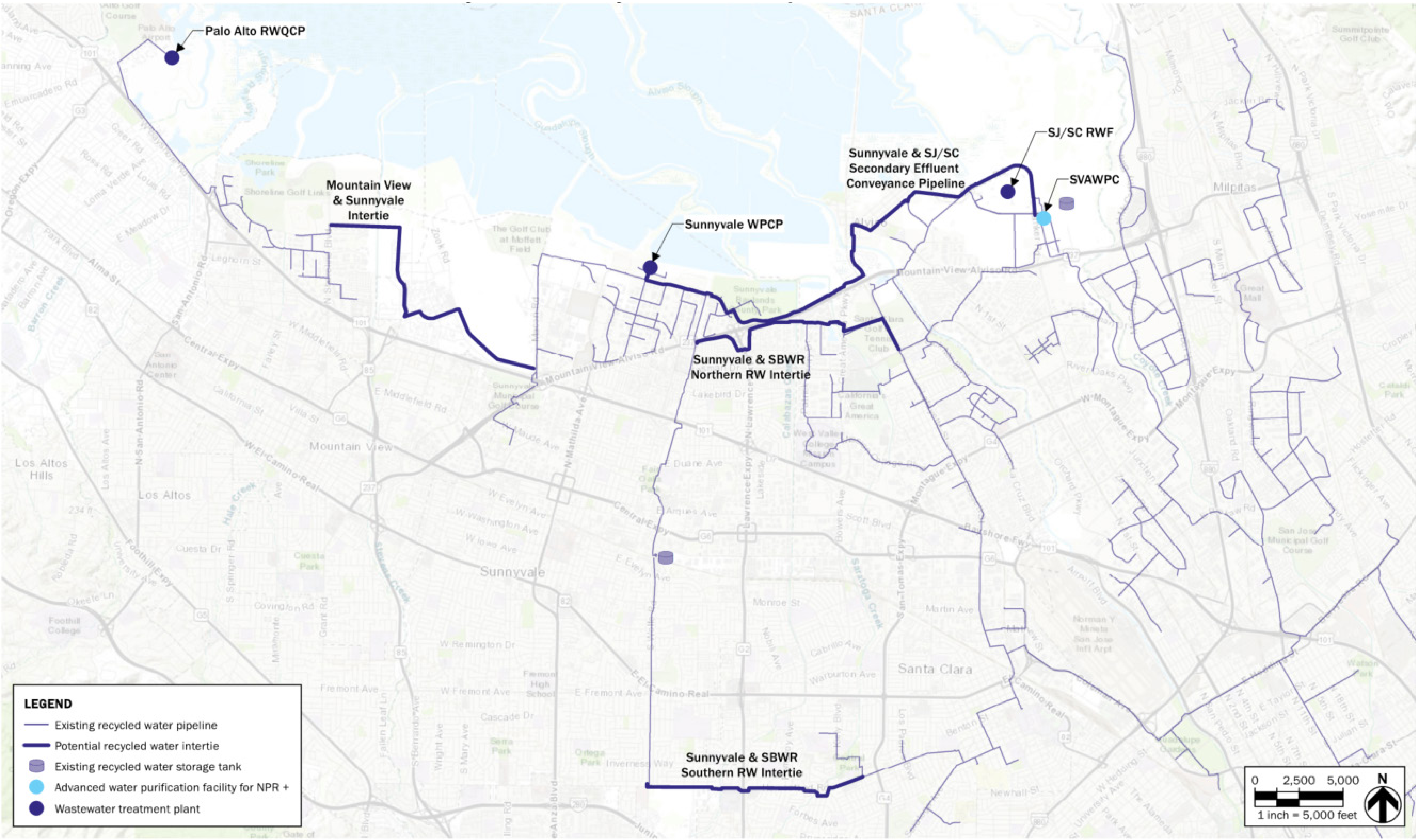


Figure 7-2. Potential interties between recycled water systems

7.3 Potential Future Reuse Opportunities, Design Variations, and Alternative Elements

Valley Water and its Partner Agencies may consider adapting the portfolios and options summarized in Section 6 to further increase benefits, such as operational flexibility. Some potential future reuse opportunities are summarized below, along with alternative project elements that are not incorporated into baseline components of any portfolio but may be considered through either a substitution (e.g., an alternate pipeline alignment) or "add-on" (e.g., new interties between NPR+ systems).

Resized design capacity of AWPFs and/or phased implementation

Several conditions may warrant revisiting and revising the design capacity of AWPFs considered to date to "right-size" projects. For example, Valley Water may consider impacts of source water availability—that is, long-term agreements with Partner Agencies guaranteeing a minimum flow to support potable reuse—along with any potential refinements to supply planning that change Valley Water's defined target for potable reuse (currently 24,000 AFY) or effluent flow needed for ROC management strategies that involve blended discharge.

Phased implementation would allow for incrementally increasing the capacity of an AWPF through strategies like modular construction. However, it is critical to consider the anticipated buildout details from the outset, such that design of conveyance capacity and intended reuse type(s) to be delivered support the envisioned buildout.

Optimized/resized design of conveyance capacity

The Project Team developed preliminary design of conveyance infrastructure using pipeline diameters consistent with those considered under the Final Expedited Purified Water Program Plan (Valley Water, 2018). However, Valley Water purposefully sized the 48-inch diameter pipelines in the Expedited Purified Water Program Plan to be larger than needed, such that the system would allow for increased flow if Valley Water secured additional source water. Based on a high-level estimate, reducing the Portfolio 1a (SJ GWR) 48-inch pipeline of about 18.1 miles from San José to LGRP to 42-inch or 36-inch diameter would reduce capital costs by an amount on the order of $45M (15%) and $90M (30%), respectively. Design refinement would be needed to confirm the costs savings, as O&M implications have not been assessed.

Pipeline extension from LGRP to Rinconada WTP for RWA

To increase operational flexibility of portfolios involving GWR at LGRP, a pipeline extension and pump station would allow the opportunity to send purified water to Rinconada WTP for RWA. This RWA variation would improve potable reuse supply yield at times when the groundwater basin reaches capacity and recharge is not possible. Before this pipeline scenario is implemented, AWPFs configured for GWR would require treatment upgrades to align with anticipated regulatory requirements for RWA. Operational analysis is needed to determine how purified water would be blended with existing sources of raw water and how resulting water quality would change.

Operational flexibility for DPR portfolios (San José AWPF to Penitencia WTP) via Central Pipeline

Portfolios 1b (SJ RWA), 1c (SJ TWA, Milpitas Pipeline), and 1d (SJ TWA, new pipeline) consider DPR from a San José AWPF, and each features a delivery point proximate to Penitencia WTP, thus allowing an access point to the Central Pipeline—an existing raw water conveyance system originating from the SBA Terminal Tank at the Penitencia WTP leading to LGRP and Rinconada WTP—and providing increased operational flexibility. This scenario could allow Valley Water to send purified water from a San José AWPF and route around Penitencia WTP to flow to LGRP for GWR in the interim timeframe, and once DDW has finalized DPR regulations, RWA via Penitencia or TWA may be possible. Operational analysis is needed to determine whether and/or how Rinconada WTP would blend purified water with existing sources of raw water.

Alternate alignments from Palo Alto to LGRP

Portfolios 2a (PA [+SV] GWR) and 4 (PA/SV GWR) include conveyance of purified water from an AWPF in Palo Alto south to LGRP. Four possible route variations were considered, though one default alignment was selected for the purpose of determining costs and relative pipe lengths across portfolios. By default, Portfolios 2a (PA [+SV] GWR) and 4 (PA/SV GWR) both use an eastern route that bypasses Sunnyvale. Alternate routes, shown as dashed lines on the Portfolios 2a (PA [+SV] GWR) and 4 (PA/SV GWR) figures in ***Appendix A-1***, include a western route that bypasses Sunnyvale, and two routes (eastern and western) that travel through Sunnyvale. Routes that bypass Sunnyvale are substantially shorter and therefore save pipeline and pumping costs; whereas routes that travel through Sunnyvale allow PR flow to be diverted to the Sunnyvale WPCP for blending with recycled water to produce NPR+.

Alternate alignment from Sunnyvale to LGRP

By default, Portfolio 2b (SV [+PA] GWR) includes the eastern alignment to convey purified water from a Sunnyvale AWPF to LGRP, though there is also a western alignment option shown as a dashed line on the Portfolio 2b (SV [+PA] GWR) figure in ***Appendix A-1***.

West County TWA

Portfolios 1c (SJ TWA [Milpitas Pipeline]) and 1d (SJ TWA [new pipeline]) explore using SJ/SC RWF source water for TWA because that allows for a case study that presents the full range of potable reuse options for comparison against one another. However, other TWA opportunities exist throughout the County.

One potential future TWA opportunity, West County TWA, builds on a concept Valley Water is already considering and relies on a Palo Alto AWPF. This option involves extending Valley Water's existing treated water pipeline, the West Pipeline, from its current end point near Foothill Expressway in Los Altos to a location near Page Mill Road in Palo Alto. The West County TWA scenario would deliver up to 24,000 AFY of purified water from a Palo Alto regional AWPF to the extended West Pipeline for purified water delivery throughout the County. Like Portfolio 2a (PA [+SV] GWR), effluent would be conveyed from the Palo Alto RWQCP and Sunnyvale WPCP to a 24-mgd AWPF that would be constructed at the former Los Altos Treatment Plant site. Though this scenario was not carried forward to portfolios reflected in this CoRe Plan, preliminary design details are included in ***Appendix A-1*** and ***Appendix A-8***[8], and related costs are shown in ***Appendix A-6***.

South County TWA

Two potential South County TWA options have been discussed with staff from Morgan Hill and Gilroy. One option involves a satellite WWTP and AWPF in Morgan Hill before adding the purified product water to the Morgan Hill drinking water distribution system. This option would likely have a high life-cycle unit cost given the high level of treatment, lack of ROC management options, and limited yield. A second TWA option would use water treated at a new AWPF adjacent to SCRWA in Gilroy and deliver purified water to the Gilroy drinking water distribution system. This option would likely have similar limitations as the first South County TWA option and limit supply available for NPR use in Gilroy.

AWPF for NPR+ in Sunnyvale

Sunnyvale does not have a need for NPR+ in its service area but would need to provide water quality consistent with SBWR or PA/MV NPR+ if interconnecting recycled water systems. Portfolios 2b (SV [+PA] GWR) and 4 (PA/SV GWR) consider an AWPF located in Sunnyvale that assumes an additional 0.5 mgd of design capacity to produce purified water for blending with recycled water for NPR+ in Sunnyvale. Portfolio 2a (PA [+SV] GWR) includes a 2,000-foot, 12-inch pipeline that carries 0.5 mgd of purified water from the 48-inch Palo Alto AWPF to the LGRP pipeline south to the Sunnyvale's San Lucar NPR storage tank. Purified water added to San Lucar would produce NPR+ for distribution throughout Sunnyvale's RWS.

Additional AWPF in San José for NPR+

Referred to as an "SVAWPC expansion" in some past studies, an additional AWPF may be considered in San José to increase purified water production to meet increasing demands for NPR+ while maintaining a TDS level of 500-550 mg/L year-round.

[8] ***Appendix A-8*** refers to this concept as Portfolio 7a: PA (+SV) TWA.

Section 8: Implementation Planning

Given the wide range of reuse scenarios considered in this CoRe Plan, implementation planning needs to incorporate flexibility and support future decision-making.

8.1 Regulatory Compliance Considerations

Assessing reuse opportunities in terms of regulatory compliance helps identify issues that may impact implementation feasibility or future permitting. While this section summarizes the strategy for regulatory compliance, ***Appendix B-1*** (Regulatory Compliance Strategy TM) addresses the topic in substantially more detail.

The regulatory analysis identifies the following:

1. **Key regulatory considerations applicable to reuse opportunities that may impact public health or environmental compliance**
2. **Differences between reuse opportunities in terms of potential regulatory and permitting challenges**
3. **Future actions that are required or may assist with regulatory and permitting efforts**

Opportunities featured and evaluated in the CoRe Plan include potable reuse portfolios in North County that consider GWR, RWA, and TWA and non-potable and potable reuse options in South County that consider NPR+, GWR, and SWA. Figure 8-1 summarizes relevant regulations, permits, and required documentation for each reuse type evaluated in the CoRe Plan.

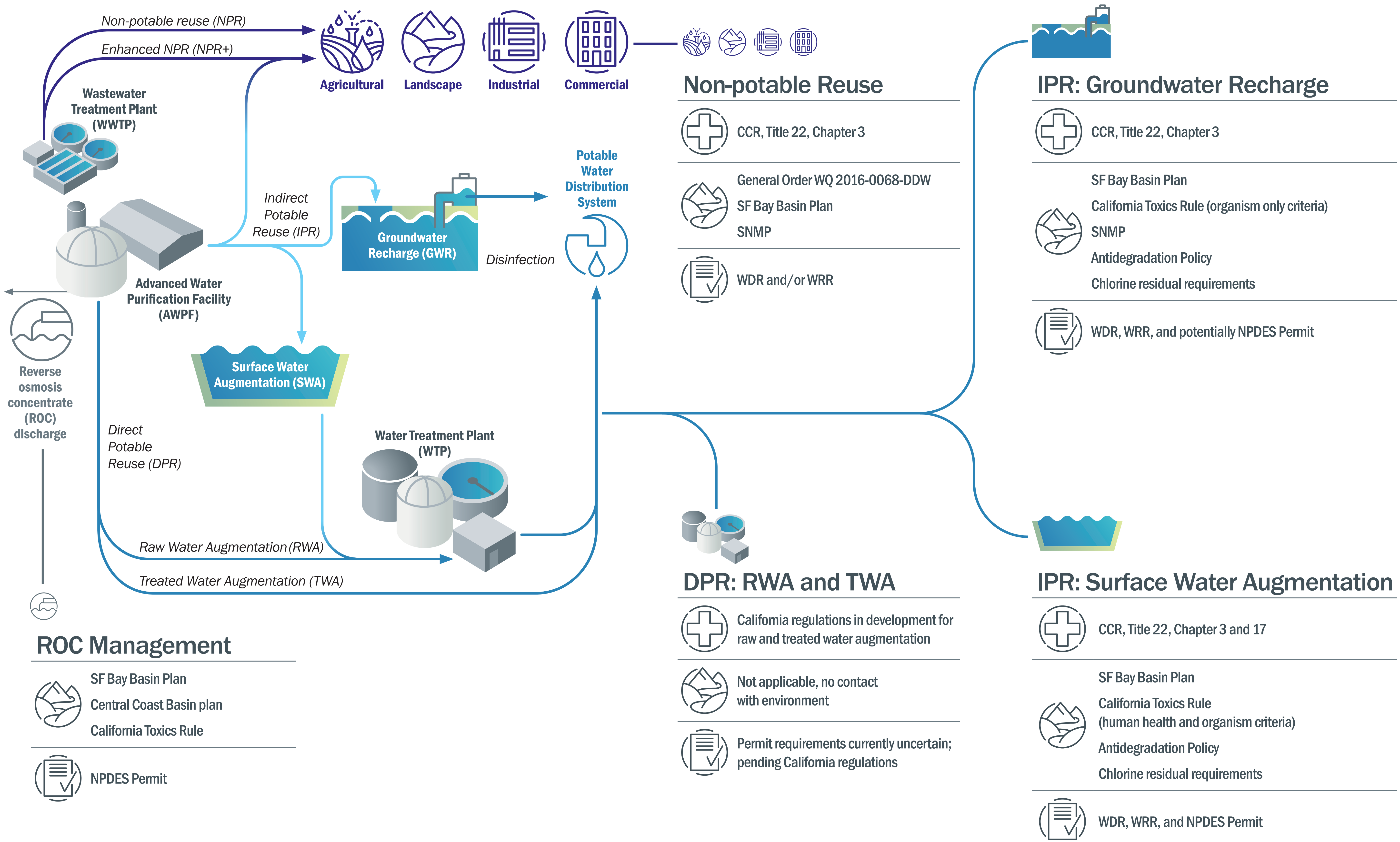


Figure 8-1. Summary of relevant regulations, permits, and required documentation for non-potable and potable reuse

8.1.1 Regulatory Compliance Evaluation

A rubric was developed for each potable reuse type to assess the relative difficulty or ease of complying with associated regulations and permitting requirements.

Existing regulations for GWR and SWA informed a set of six criteria for evaluating potable reuse opportunities.

- Pathogen removal
- Chemical removal
- Source control
- Monitoring and controls
- Retention and response time
- Technical, managerial, and financial (TMF) capacity

The same six criteria applied to evaluations of RWA and TWA portfolios, though ranking DPR opportunities required assumptions since DDW has not yet developed applicable regulations. For comparison, Table 8-1 shows the rankings as unfilled circles (less complex) to filled circles (more complex) in terms of regulatory compliance.

Table 8-1. Regulatory Complexity related to Public Health Considerations in the Potable Reuse Portfolios

Reuse type	GWR	SWA	RWA	TWA	
Portfolio / Option	1a: SJ GWR 2a: PA (+SV) GWR 2b: SV (+PA) GWR 4: PA/SV GWR MH-2: GWR	MH-3: SWA	1b: SJ RWA	1c: SJ TWA, Milpitas Pipeline	1d: SJ TWA, new pipeline
Pathogen removal	○	○	○	○	
Chemical removal	○	○	○	◒	
Source control	○	○	◒	◒	
Monitoring and control	○	○	◒	●	◒
Retention and response time	○	○	◒	◒	
TMF capacity	◒	◒	●	●	

○ *low complexity* ◒ *medium complexity* ● *high complexity*

The results span from straightforward compliance for GWR portfolios to increasingly complex for RWA and TWA. Increasing the level of certainty around criteria such as specific regulatory considerations and multi-agency coordination could reduce complexity of some portfolios. Future actions that may increase regulators' comfort with these issues could involve demonstrating public health protectiveness of a candidate treatment train or proper functioning of an enhanced monitoring and control system.

The portfolios must also demonstrate compliance with environmental discharge considerations by presenting a plan to address ROC waste streams and—in all but the DPR portfolios—purified water releases to the environment. Table 8-2 summarizes the portfolios' rankings in terms of environmental considerations and associated regulatory compliance.

Table 8-2. Regulatory Complexity related to Discharge of Purified Water to the Environment in the Potable Reuse Portfolios

Reuse type	GWR	SWA	RWA/TWA
Portfolio / Option	1a: SJ GWR 2a: PA (+SV) GWR 2b: SV (+PA) GWR 4: PA/SV GWR MH-2: GWR	MH-3: SWA	1b: SJ RWA 1c: SJ TWA, Milpitas pipeline 1d: SJ TWA, new pipeline
SF Basin Plan	○	○	N/A
California Toxics Rule	○	◒	N/A
SNMP	○	N/A	N/A
Anti-degradation	○	○	N/A
Chlorine residual	○	○	N/A

○ *low complexity* ◒ *medium complexity* ● *high complexity*
N/A indicates options that do not involve discharges to the environment

8.1.2 Recommended Next Steps for Regulatory Compliance

Several factors can influence the initial snapshot of these rankings, such as: (a) regulators' engagement and feedback on the portfolios, (b) greater clarity regarding future regulatory requirements for DPR, and (c) additional efforts by Valley Water and its partners to address or resolve the issues ranked as medium or high complexity.

Strategies to overcome some of these issues and uncertainties include the following.

- Continued partner engagement on interagency agreements
- Demonstration testing of potable reuse treatment systems
- Evaluation of enhanced monitoring and control systems
- Pathogen monitoring campaigns to support higher WWTP log reduction value (LRV) credits
- Evaluation of WTP performance and crediting in RWA scenarios
- Further coordination with the SF Bay Regional Board to confirm the feasibility and permitting requirements of ROC management strategies and AWPF product water releases for all portfolios

With greater clarity on the potable reuse project(s) and/or portfolio moving into future phases, additional reuse-specific studies may be needed. Valley Water should coordinate with staff from DDW and the SF Bay Regional Board and consult the IAP to confirm the need for such studies, which could include the following.

- Tracer studies to confirm aquifer retention time (GWR) or to validate hydrodynamic models (SWA)
- Hydrodynamic studies to confirm mixing and dilution requirements in SWA reservoirs
- Studies to evaluate anticipated blending ratios in the SWA, RWA, and TWA portfolios
- Studies related to ROC discharge and AWPF product water release to confirm anticipated regulatory compliance

The complete process of implementing potable reuse will involve various steps over multiple years. The process starts with the development and testing of a potable reuse concept before moving forward with design, permitting, construction, and start-up of the system. Two recently permitted projects that were pursued on expedited timelines—Monterey One Water's GWR project and the City of San Diego's SWA project—required more than 10 years for completion.

8.2 Rate Impacts

As the groundwater management agency and primary wholesale water supplier for Santa Clara County, Valley Water is responsible for actively managing and replenishing groundwater basins and operating and maintaining a large, complex water system that includes three pump stations, three conventional WTPs, one AWPF, 10 surface water reservoirs with about 170,000 AF total storage, nearly 150 miles of pipe (ranging from 12-inch to 60-inch diameter), and nearly 400 acres of recharge facilities. Groundwater production charges and treated water charges paid by retail water suppliers support the costs of operating and maintaining the system, repairing/replacing aging infrastructure, and providing other services required to maintain clean, safe, reliable groundwater supplies.

The cost of implementing reuse opportunities identified in this plan would be met by ratepayers within the relevant groundwater benefit zones. Using preliminary cost estimates documented in previous drafts of this plan, Valley Water staff estimated the anticipated incremental percent increase to the municipal and industrial groundwater production charges for each portfolio and option for a planning period of fiscal years (FY) 2022 to 2030. Incremental rate increases would be in addition to anticipated rate increases unassociated with this plan's portfolios and options.

Valley Water staff estimated that implementation of a North County portfolio would result in an incremental increase to the Groundwater Benefit Zone W-2 groundwater production charge ranging from 1.6% to 1.9% per year, depending on the portfolio. Rate impacts may be lower with receipt of external funding such as grant awards or low interest loans.

In South County, the implementation of a Morgan Hill option was estimated to incrementally increase the Groundwater Benefit Zone W-5 groundwater production charge by a range of 2.2% (MH-1 [NPR+]) to 4% (MH-3 [SWA]) per year. Based on recently updated cost estimates, rate impacts for MH-2 (GWR) and MH-3 (SWA) are likely to be higher than this estimated increase. Note that Groundwater Benefit Zones W-7 and W-8 in South County do not benefit from the provision of recycled water.

While the planning level potable reuse cost estimates exceed those of existing supplies, Valley Water's current (FY 2020-21) groundwater production charge of $1,374/AF for North County municipal and industrial users is anticipated to surpass $3,000/AF by FY 2029-30 to maintain with necessary investments in water supply infrastructure and increasing operations and maintenance costs. Santa Clara County is rapidly approaching a tipping point where purified water is cost competitive with other supplies.

8.3 Public Outreach and Engagement

Public awareness, understanding, and support are integral to the success of any potable reuse program and often present a greater challenge to implementation compared to technical feasibility. Even when technology does not stop potable reuse projects from proceeding, politics and public perception have been common roadblocks. These challenges are not insurmountable; though, successful public outreach requires careful planning, cohesion among partners, commitment to consistent and transparent communication, and follow-through.

While not yet fully mainstream, potable reuse is a proven approach and yields a reliable, drought-resistant, safe, high-quality drinking water supply. Particularly in the last decade, water suppliers, industry professional associations, and research organizations have invested in robust potable reuse research portfolios to confirm protection of public health and inform regulations. For example, projects demonstrating the effectiveness of treatment processes and failproof strategies have helped assure public health is maintained. In addition to verifying technical feasibility of DPR, a substantial part of the research effort relates to public communications, outreach, and acceptance. In fact, in 2014 Valley Water participated as a utility partner in one such project. The Water Environment & Reuse Foundation's Research Project 13-02, *Model Communication Plans for Increasing Awareness and Fostering Acceptance of Direct Potable Reuse* involved opinion research including meetings with two local focus groups and a phone survey of 600 randomly selected voters in the County.

Learning lessons from successful water reuse projects.

To reiterate a critical point: technology is rarely responsible for stopping a potable reuse project. If a project does not move forward once the design, siting, and funding elements are in place, public and political opposition is often the barrier. Successful projects have comprehensive, consistent, and sustained public outreach programs. Valley Water intends to build on the momentum of implementing such a program over the last decade and seek additional ways to reach stakeholders and diverse audiences. Expanding this program Countywide can only benefit Valley Water and its Project Partners.

> **Valley Water and its Project Partners can learn and benefit from those that have successfully forged a path for securing public support—and even enthusiastic public support—by understanding and implementing best practices and remaining mindful of pitfalls to avoid.**

Developing a public outreach action plan in collaboration with Partner Agencies and their respective locally elected officials and policymakers.

Alignment on a public outreach and engagement strategy is needed at many levels, particularly between Valley Water and its Partner Agencies. An important early step is committing to executing an ongoing action plan for public outreach that includes collaboration among the project partners and their respective locally elected officials and policymakers. Ideally, this will include those officials and policymakers fully exercising their leadership voices as reuse champions.

To set the direction for future community and ratepayer engagement related to implementing a potable reuse program in Santa Clara County, Valley Water and the Project Team surveyed Partner Agencies through an online poll and compiled their input on preferred public outreach approaches, related opportunities, and key concerns/challenges. Following the online survey, Valley Water and the Project Team hosted a virtual workshop in June 2020 with Partner Agencies and water retailers throughout the County to further explore the approach for future public outreach and engagement related to potable reuse.

Through surveying the partners and receiving real-time input, the Project Team identified some key themes and insights, summarized as follows.

- **Valley Water should lead a coordinated outreach program with local support for implementation.** Partner Agencies and water retailers have strong interest in collaborating regionally to advance potable reuse and relying on Valley Water to lead and fund outreach in next steps for implementation. Most partners noted a lack of adequate internal resources to conduct effective outreach and a lack of confidence with their ability to advance a related outreach program on their own. Project partner involvement, such as conducting local educational and awareness activities and providing financial or staff support, could be fleshed out in a next phase Countywide outreach program.
- **The unique value of potable reuse needs to be articulated.** As Project Agencies have emphasized, among the earliest steps is a need to articulate the strategic and unique value potable reuse opportunities hold for the County in terms of addressing vulnerability of the existing supply portfolio, buffering risk, and strengthening resilience and dry-year supply reliability.
- **A pilot project, such as public taste tests of purified water, may be helpful.** Uncertainty about whether one project or multiple projects will proceed limits Partner Agencies' ability to identify what may be needed to increase effective outreach or whether a pilot for public taste-testing is desirable. Most agencies thought that taste testing could be helpful if/when it is appropriate based on whether a project is moving forward and/or DDW approval has been secured.
- **Issues of greatest concern mirror those of other potable reuse programs.** The Partner Agencies and water retailers identified several challenges and issues of greatest concern related to public outreach that closely resemble those from other potable reuse programs: (1) trust in water purification science and in the utility providing it, (2) quality of the water/what if something goes wrong, (3) project cost/water bill impact, and (4) real time testing and monitoring.

Looking ahead to a Countywide public outreach program.

Valley Water should continue to apply the comprehensive approach described in its *Final Draft Strategic Communication Plan for Recycled Water* (2011) to inform next steps on outreach to advance reuse projects.

In addition, Valley Water's recent public survey can help guide a more widespread countywide outreach program. There are issues still in play, such as ratepayers' tolerance for a potential rate increase. Some key takeaways from Valley Water's 2020 research related to water reuse opinions and attitudes as conducted by EMC, a research firm that specializes in polling, focus groups, and public opinion research consulting:

- The phrase "using advanced purified water for drinking" received an overall positive reaction and appears to be an adequate description of potable reuse. This finding is important: no additional explanation is needed for support of this concept by most of the population.
- Additional information about potable reuse benefits and safety further increases support.
- GWR has the most support (67%), but at least 63% support the concept of RWA (i.e., adding advanced purified water at a WTP) and 58% support the concept of TWA (i.e., introducing purified water directly into the potable distribution system).
- Themes that resonate include environmental benefits, safety of the water, and resilience to a disaster or other unknowns related to water supply.

Yet, interestingly, awareness of water reuse is low. Over 50% of respondents had not heard of recycled water/water reuse. So, while "using advanced purified recycled water for drinking" resonates as a good idea, most of the population seems to be unfamiliar with the use of recycled water, which may be an early flag indicating the need for increased public outreach efforts to proactively improve understanding ahead of project construction and associated rate increases.

Given these findings, Valley Water and Partner Agencies should consider the following eight outreach objectives and potential future actions.

Outreach Objectives and Potential Future Actions

1 Communicate key messages about reuse to external audiences and interested parties.

- Clearly explain why reuse is an important water management strategy with multiple benefits and how recycled and purified water is produced
- Raise awareness about recycled water uses among a broad range of Santa Clara County residents
- Brand recycled water as "high quality, environmentally beneficial, and water-efficient"
- Use potable reuse terminology that resonates with the public, such as "using advanced purified water for drinking"
- Ensure spokespeople are well-trained and informed.
- Translate and communicate in appropriate languages
- Provide timely information to community leaders so that information spreads through communities as they discuss recycled water with their constituencies
- Expand tours and events – virtually for now and in-person when safe
- Use social media to reach a variety of audiences

2 Communicate key messages about reuse to Board members and staff.

- Update elected officials and staff regularly with written and oral communication
- Consider employees as an equally important audience as external audiences
- Practice presentations and test talking points with employees first, before external audiences
- Inform employees first, before external audiences, and address their questions or issues with recycled water and/or potable reuse

3 Communicate key messages about reuse to water retailers and cities throughout the County.

- Seek support of elected local and state representatives for expanding both non-potable and potable reuse
- Use social media platforms as appropriate to reach specific audiences

4 Inform stakeholders about recycled and purified water, including the many possible uses.

- Demonstrate transparency by discussing pertinent aspects reuse such as water quality, regulatory oversight, fail-safe methods, and more
- Partner with local education providers at elementary, middle, and high school and beyond to inform next generations
- Partner with community groups to present information and enlist their support to distribute information about reuse through their communication channels (websites, newsletters and more)
- Provide open channels of communication for questions about recycled water and potable reuse

5 Ensure understanding and acceptance of the science and technology behind purified water and potable reuse.

- Seek assistance from public health and water quality professionals/ experts to communicate with the public about water quality and safety
- Provide successful examples of advanced reuse projects around the state, country, and world
- Focus on the work and opinion of Independent Advisory Panels about water quality and safety of potable reuse

6 Minimize confusion and opposition regarding use of purified water for potable reuse.

- Explain technical aspects of recycled water and potable reuse in layperson's terms using easy-to-understand language and visual aids for leave-behind materials
- Reach broadly into all communities and ensure presentations reach underserved population groups and multicultural audiences
- Work with multicultural elected officials, leaders, and organizations as well as faith-based leaders and organizations to build understanding and support

7 Create and maintain a pathway for all stakeholders to access information.

- Tailor information to groups and address their specific interests and concerns
- Translate all informational materials as needed
- Conduct an annual tracking poll to gauge success in reaching key stakeholders and audiences

8 Seek balanced media coverage throughout the region.

- Find an advocate for purified water within local news organizations
- Provide timely and accurate information to reporters
- Respond quickly to correct inaccurate articles or reports

Find out more online at SANTA CLARA VALLEY WATER NEWS

8.4 Partnerships and Governance

Critical to advancing next steps, Valley Water and its partners need to coordinate closely to formalize institutional arrangements and reach agreement on governance structures. While the scope of this CoRe Plan does not address institutional partnership arrangements or governance, substantial coordination and thought leadership among the project partners has occurred around these topics over many years.

For example, in November 2008, members of Valley Water's Board, San José's City Council, and Santa Clara's Mayor held a Recycled Water Liaison Committee meeting to develop long-term agreement program element options. The group discussed four collaborative agreement models that represent how Valley Water could work together with SBWR to enable increased water reuse in the County. These models, which could still be used to shape new Partner Agency agreements today, include the following.

Funding/Incentive Agreement

Valley Water would provide a unit-based financial incentive (e.g., $100-$250/AF) to the Project Partner(s). This option is likely to yield benefits to both Valley Water and the Project Partner(s), such as avoided cost of new water supply acquisition, reduced risk and cost of a water supply shortage, and joint funding opportunities for relevant new capital projects. The parties would need to agree on cost-sharing and responsibilities related to joint facilities on an individual basis.

Customer Contract for Purchase

Valley Water and the Project Partner(s) would negotiate and execute an agreement for the purchase of recycled water in future years. The Partner Agency would retain its role and relationship with existing customers and receive revenue from additional recycled water sales, while Valley Water could ask for a guaranteed supply of recycled water. This agreement structure is like the relationship between West Basin Municipal Water District and the City of Los Angeles, Bureau of Sanitation.

This option is likely to yield benefits to both Valley Water and the Project Partner(s). Valley Water would have the ability to buy available recycled water at contract price and build/operate their own new recycled and/or purified water facilities. The Project Partner(s) would have authority of their own new recycled and/or purified water facilities and existing assets and may receive increased revenue from additional recycled water sales.

Cooperative Agreement

The Partner Agency and Valley Water would pursue a cooperative situation implemented in parallel with future development of recycled water. For example, the Project Partner(s) would develop future uses for its customers, and Valley Water would act as a wholesaler for its future non-potable and potable reuse projects. This scenario, which is similar to the relationship between Orange County Water District and Orange County Sanitation District, would involve forming a committee with shared representation and agree to cost-sharing terms related to capital costs for new facilities and annual O&M costs.

This option is likely to yield benefits to both Valley Water and the Project Partner(s). For example, Valley Water could secure water supply assurance and ROC discharge capacity and build/operate their own new recycled and/or purified water facilities. The Project Partner(s) would have authority of their own new recycled and/or purified water facilities and existing assets and may receive increased revenue from additional recycled water sales.

Joint Powers Authority (JPA)

A JPA would be established as a new governing agency with authority to construct and operate new recycled and/or purified water facilities. The JPA would manage reuse within the County (including both new and existing customers), handle regional water exchanges, and act on behalf of Valley Water and its partner(s). This scenario is similar to the arrangement for the JPA formed by Dublin-San Ramon Services District and East Bay Municipal Utility District. Referred to as DERWA, the JPA is designed to allow available recycled water from

DSRSD to be sold to EBMUD customers, share O&M costs 50/50, and conduct business by an equal representation four-member Board of Directors.

This option is likely to yield benefits to both Valley Water and the Project Partner(s). For example, Valley Water could secure water supply assurance and ROC discharge capacity and equally contribute to decisions relating to building/operating own new recycled and/or purified water facilities owned by the JPA. The Project Partner(s) would have authority of their own new recycled and/or purified water facilities and existing assets and may receive increased revenue from additional recycled water sales.

In 2016, Valley Water conducted a survey to further explore governance structures related to non-potable and potable reuse partnerships. As part of this effort, Valley Water surveyed 83 water, wastewater, irrigation, and public utilities throughout California that participate in reuse programs in roles to produce, wholesale, and/or retail recycled and/or purified water. The agencies surveyed represent a mix of municipalities, JPAs, private companies, independent public agencies, and special districts. Of the agencies surveyed, thirty-three (33) are special district water agencies, including 6 that provide both water supply and wastewater services and 27 that provide water supply services, like Valley Water.

Through the survey, Valley Water sought to collect information on industry standards with respect to the roles and procedures governing the operation of recycled and purified water programs and facilities for non-potable and potable reuse. As an outcome, Valley Water found that the roles, procedures, and policies related to delivery of recycled water for NPR are complex and vary agency to agency, while water agencies typically engage in combined roles (producer, wholesaler, and/or retailer) for potable reuse.

Valley Water identified governance models for non-potable and potable reuse programs, which involve the following roles and responsibilities of water suppliers.

- **Wholesale-only**, meaning a water supplier distributes and sells recycled or purified water to a retail water supply agency for reuse.
- **Finance-only**, indicating a water supplier (typically a water wholesaler) provides financial support for other agencies (typically water retailers) to implement reuse projects.
- **Total ownership**, meaning a water supplier participates in a single role as the producer, wholesaler, and retailer collectively.
- **Build-and-transfer model**, meaning one water supplier builds reuse facilities/infrastructure and transfers ownership to another supplier.
- **Interties between NPR systems**, meaning agencies have agreed upon policies and procedures pertaining to an intertie connecting their NPR systems.

The survey yielded several conclusions related to non-potable and potable reuse applications, summarized as follows.

Non-potable Reuse

In California, water and wastewater agencies' complementary needs—water supply augmentation (particularly dry-year reliability) and compliance with WWTP effluent discharge limitations under NPDES permits—largely drive interest and willingness to participate in partnerships.

An industry standard does not yet exist for roles, procedures, and policies related to NPR systems, leading to wide variability when comparing governance across the many partnerships.

Potable Reuse

Consistent with Valley Water's objectives in leading Countywide potable reuse planning, water supply reliability and groundwater protection against seawater intrusion have motivated other agencies throughout California to develop potable reuse systems.

Valley Water's survey results indicate an observed industry trend that water agencies primarily engage in a single role as the producer, wholesaler, and retailer collectively.

As part of implementation, Valley Water and project partners will continue to consider these models and may also explore new concepts that show promise. For example, one concept involves developing governance structures focused on increasing adaptive capacity—which is, essentially, the ability to adapt based on changing conditions—and decreasing institutional fragmentation (e.g., across sectors and governmental levels). Several governance approaches along this line include integrated water resources management, polycentricity and place-based planning, and adaptive governance.

8.5 Policy Issues

Through development of the CoRe Plan, Partner Agencies identified policy issues that require consideration and/or resolution to promote willingness and establish new long-term agreements. Three examples follow.

Equity issues related to water assurance disparities

California's system for allocating water supply has long been a source of controversy due to its complexity, ambiguity, and inequities. Some Partner Agencies have security in water assurances for meeting planned future needs even during drought, while others are currently seeking supply guarantees to support housing and commercial development. San José Municipal Water is in the latter category. Thus, an imbalance in water security would be created if moving water from a community with less-secure water assurance to a neighboring water supplier's service area (and particularly to one with more secure water rights) and would require a policy-level intervention to resolve. This issue is included as a sub-criterion in the evaluation tool.

Opportunities for water supply transfers or exchanges

A water transfer or exchange could help address the issue related to equity in water assurances, whereby the areas with less-secure water rights are given an option to purchase potable supply from the area(s) with more-secure water rights in exchange for NPR supply or reuse source water. In addition, the flexibility of RWA and TWA portfolios could be increased if supported by agreements to transfer or exchange supply among water suppliers to balance needs and supplies.

Distributed systems approach with fit-for-community reuse strategies

Interest in onsite (decentralized) NPR systems has increased among private sector companies in Silicon Valley, particularly technology providers. As summarized in Section 5.3 and described in more detail in ***Appendix A-9***, onsite reuse refers to building- or development-scale wastewater treatment and reuse of the treated stream for non-potable uses at the building or development site (e.g., irrigation, toilet-flushing, cooling tower water). The combination of this growing trend and flatline WWTP influent flows over recent years could result in competing demands for wastewater as a resource. This approach must be mindfully managed to avoid unintended impacts to centralized treatment and infrastructure, which can result in ripple effects to cost, energy, and other factors. The distributed systems approach is a regionally optimized blend of both centralized and onsite reuse. These potential impacts may be mitigated by taking a Countywide approach to optimize the blend of both onsite reuse projects and centralized reuse projects—like the portfolios considered under this CoRe Plan—to reflect local conditions in a fit-for-community strategy to identify effective ways to control costs, reduce greenhouse gas emissions, increase public awareness, and advance environmental stewardship throughout the communities in the County. Valley Water and its Partner Agencies may consider reevaluating source flow availability annually to monitor impacts and trends related to onsite reuse.

8.6 Environmental Review and Documentation

Valley Water is evaluating options to produce an Environmental Impact Report/Statement (EIR/S) that addresses National Environmental Protection Act (NEPA) and California Environmental Quality Act (CEQA) requirements and encompasses the potable reuse project portfolios/options and alternative alignments. The EIR/S will support the implementation of potable reuse and consider various alternatives.

According to CEQA Guidelines, an EIR describes impacts resulting from actions related to a project or program. The latter involves developing a programmatic EIR that acts as a foundation to support subsequently prepared individual project-level environmental documents. While a programmatic approach provides for future flexibility as needed, a project-level approach can typically be completed more quickly.

The level of effort for NEPA/CEQA is anticipated to be significant. Anticipated permitting requirements for each portfolio are included as a sub-criterion of the evaluation tool (see Section 6.5 and ***Appendix A-7)***.

8.7 Program Funding

In strategizing and planning funding to support the program's implementation, Valley Water's Board considered various alternatives and decided to use a public-private partnership approach for the North County program.

In September 2020, Valley Water's Board approved the procedures for procuring design-build-finance-operate-maintain (DBFOM) services under a public-private partnership (P3) structure. Financing through a P3 partner assumes payments begin when a facility is operational, less Valley Water's 30% share of debt financing. The total program cost to be financed depends on construction timing and duration, along with apparent factors such as facility size.

For Valley Water's share of debt financing, several public funding alternatives have been explored, as summarized below.

- **Low-interest loans,** such as those offered under Water Infrastructure Finance and Innovation Act (WIFIA), Clean Water State Revolving Fund (SRF) Loan Program, and/or Infrastructure SRF (ISRF) Loan Program
- **Grant funding,** such as programs established under Title XVI of the Reclamation Projects Authorization and Adjustment Act, Water Recycling Funding Program Construction Grants, and/or Integrated Regional Water Management Grants
- **Potential stimulus funding** based on the precedent set by the American Recovery and Reinvestment Act of 2009

Each of these alternatives has a unique set of eligibility requirements, criteria for scoring, and funding terms. For example, WIFIA favors projects that generate economic benefits and address water resource challenges, specifically pointing to groundwater recharge and water reuse, with assumed repayment of 49% of capital costs 5 years after the respective AWPF is operational.

Public financing opportunities may vary with time and specific circumstances. For example, private financing may preclude eligibility to receive funding under some public financing alternatives. The future availability of current funding programs is uncertain.

8.8 Implementation Next Steps, Opportunities, and Challenges

Implementing the CoRe Plan project(s) will not be a linear process. Valley Water will work with Partner Agencies on multiple implementation steps simultaneously, and the interdependency of some of those steps adds complexity. Figure 8-2 depicts a simplistic view of implementation steps within several parallel categories without indicating the complexities added by interrelationships. For example, securing source water through establishing long-term agreements is needed before proceeding with detailed design, yet program costs and other factors may influence agreement terms and conditions.

When approving the DBFOM procurement procedures, the Board also directed Valley Water staff to launch a P3 procurement plan upon sufficiently securing agreements in principle with Partner Agencies for elements necessary to implement a proposed project. Three areas requiring agreement in principle include:

- Securing long-term source water supply (treated wastewater) for development of a purified water supply for potable reuse
- Managing ROC
- Confirming the option to purchase or lease the land needed for new facilities

To manage risk, Valley Water and its partners need to consider potential challenges to implementation, such as those summarized in Table 8-3. Addressing such challenges at the earliest opportunity possible not only reduces risk but also enables greater clarity and efficiency in the path forward.

Next Steps for Implementation

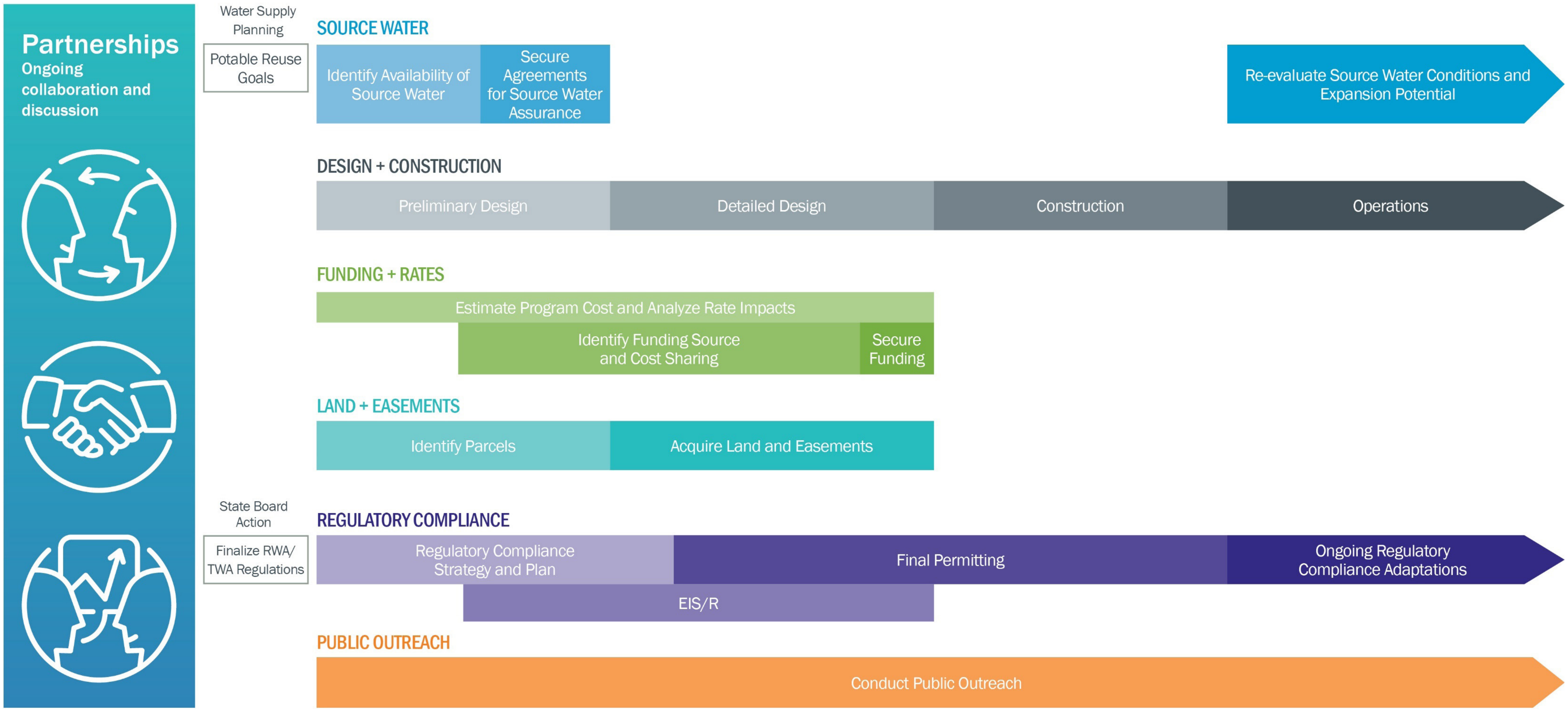


Figure 8-2. External triggers and subsequent steps for implementing Countywide reuse

Table 8-3. Implementation Challenges

Portfolio		Challenge
Portfolio 1 San José AWPF	1a: SJ GWR 1b: SJ RWA 1c: SJ TWA, Milpitas Pipeline 1d: SJ TWA, new pipeline	A long-term agreement is needed between Valley Water and San José to establish a guaranteed minimum flow of sources water (SJ/SC RWF effluent) for feed flow to the AWPF. Risks to available yield include drought, environmental needs/impacts, and operations.
	1a: SJ GWR	LGRP recharge potential may limit future yield.
	1b: SJ RWA	Consistent with Valley Water's WSMP 2040 Water Evaluation and Planning modeling assumptions, DPR water is assumed to be first-priority supply for WTPs with raw water added as diluent. If this assumption changes, Penitencia WTP's capacity may limit potable reuse yield. Since the South Bay Aqueduct and Penitencia WTP are in an active landslide area, special geotechnical considerations and evaluation are needed. Depending on the findings and planned route, construction costs may increase due to special measures for addressing geotechnical concerns at this area. Capacity of Penitencia WTP could limit potable reuse yield.
	1c: SJ TWA, Milpitas Pipeline	Using the Milpitas Pipeline to convey purified water precludes independent use of an emergency connection between Valley Water's treated water system and SFPUC's Regional Water System to transfer water in emergencies. Delivering purified water to SFPUC would require inter-agency agreements and, likely, permitting each downstream delivery point (i.e., each water supplier that could access the supply in the downstream portion of the RWS). Details regarding potential terms for inter-agency agreements and DDW permits would need to be explored and established to further pursue this concept. Blending ratios of purified water with other supplies need to be confirmed. Using the Milpitas Pipeline for purified water conveyance may result in delivering high ratios of purified water to several turnouts along the Milpitas Pipeline.
	1c: SJ TWA, Milpitas Pipeline 1d: SJ TWA, new pipeline	An evaluation is needed to confirm sufficient space for a tie-in at Piedmont valve yard. Because Gibraltar pump station belongs to the City of Milpitas, a separate agreement would be needed to use their reservoirs as blending facility, and reservoir storage capacities would need to be verified for future blending. (1c, 1d).
Morgan Hill MH-1: NPR+		A long-term agreement is needed to secure source water. The Silver Creek Pipeline Agreement granting 5 mgd of SBWR supply to Valley Water via the Silver Creek Pipeline expires in January 2027. Without a renewed agreement, MH-1 (NPR+) would be infeasible. Potential impacts of NPR/NPR+ irrigation to the quality of groundwater in the northern portion of the Llagas Subbasin are currently undetermined and warrant further study. Given shifting development trends in Morgan Hill, an updated NPR market assessment is needed.
Portfolio 2 Combined Palo Alto/Sunnyvale regional AWPF located in either: Palo Alto (2a), or Sunnyvale (2b)	2a: PA (+SV) GWR 2b: SV (+PA) GWR	Flows from Palo Alto RWQCP and Sunnyvale WPCP limit projected yield. A long-term agreement is needed between Valley Water and Sunnyvale to establish a guaranteed minimum flow of source water (WPCP effluent) for feed flow to the AWPF. ROC management permitting and regulatory compliance need to be confirmed.
	2b: SV (+PA) GWR	ROC management options are limited and less feasible compared to other reuse opportunities and AWPF locations. Technical feasibility and extent of costs related to site preparation to construct an AWPF at the parcel next to Sunnyvale's WPCP, Recycle Hill (a former landfill site), remain in question. Due to lack of available land, Recycle Hill is the site assumed for preliminary design purposes, and best available information is included to reflect potential site preparation costs.
Portfolio 4 Separate regional AWPFs located in Palo Alto and Sunnyvale	4: PA/SV GWR	Flows from Palo Alto RWQCP and Sunnyvale WPCP limit projected yield. A long-term agreement is needed between Valley Water and Sunnyvale to establish a guaranteed minimum flow of source water (WPCP effluent) for feed flow to the AWPF. Constructing and operating two separate AWPFs is estimated to be the highest cost portfolio. ROC management options are limited and less feasible compared to other reuse opportunities and AWPF locations. Permitting and regulatory compliance for ROC management need to be confirmed. Costs do not reflect land for AWPF site in Palo Alto. Due to lack of available land, Recycle Hill (the former landfill site by the WPCP) is assumed for preliminary design purposes. Technical feasibility and costs of constructing at this site remain uncertain. Best available information is included to reflect potential site preparation costs.
Morgan Hill MH-2: GWR and MH-3: SWA	MH-2: GWR MH-3: SWA	ROC management at lined evaporation ponds may be ruled infeasible during environmental review. Morgan Hill satellite facility would increase solids loads to SCRWA, posing operational issues that may be substantial. If implemented in Morgan Hill, solids handling requires further study and may increase costs significantly.
	MH-2: GWR	If further study of Morgan Hill recharge locations does not identify a suitable location, implementation of MH-2 (GWR) would be infeasible.
	MH-3: SWA	Additional evaluation is needed to confirm feasibility of water exchange without additional recharge facilities. Details around the conditions and reliability of increasing Valley Water's raw water deliveries to Llagas Subbasin remain unconfirmed. As in MH-2 (GWR), a suitable recharge location is needed. New permits may be required through the SF Bay or Central Coast Regional Board, or DDW, for discharging purified water to Anderson Reservoir.

To implement a water reuse program within the County, Valley Water will work closely with its Board of Directors, including Recycled Water Committee members, and Partner Agencies to take the following steps, many of which are interdependent and are not listed sequentially.

- ✓ Initiate Countywide collaborative potable reuse **public outreach and engagement** informed by portfolios to be implemented, planned project locations, and rate impacts.
- ✓ Start **environmental review** at the end of preliminary design and, following certification of the final EIR/S, proceed with selecting a P3 partner and permitting.
- ✓ Continue to refine **regulatory compliance** strategy as reuse opportunities take shape and new DPR regulations are established. Seek Regional Board buy-in on ROC management.
- ✓ Refine **reuse goals** based on pending updates to water demand projections. Confirm minimum available **source water** to secure partnership agreement(s) and achieve goals. Resolve **policy issues** and define governance structure.
- ✓ Execute **long-term agreements** for source water and confirm project portfolios and alternative elements for implementation based on partnership agreements.
- ✓ Acquire **land and/or easements** for reuse program/projects and identify roles and responsibilities for site preparation.
- ✓ Secure **program funding** and refine resulting **rate impacts**.
- ✓ Prepare **refined designs** to right-size projects based on available flows.
- ✓ Continue advancing **ROC management** strategies.

Section 9:
Flexible Implementation Scenarios

As directed by the Board, Valley Water is implementing a purified water project that will align near-term source water availability from one its partners with updated water supply needs. As part of this near-term project, Valley Water is currently investigating a flexible implementation ("Flex") approach that can support potential reuse expansion in the future. The term flexible implementation refers to a prudent planning approach for designing and constructing a near-term GWR project (anticipated by 2028) with sufficient flexibility to support potential future increases to treatment facility hydraulic capacity and purified water deliveries, opportunities associated with development of DPR regulations, and treatment process enhancements as applicable based on reuse type.

9.1 Context

At the Board's direction, Valley Water is advancing plans to construct an AWPF with a production capacity of 10 mgd for GWR to yield about 11,000 AFY of supply. The near-term project involves design and construction of a pipeline to convey purified water from an AWPF in the North County to the LGRP system for GWR via surface spreading. The purpose of using a flexible implementation approach is to consider design aspects at the outset that can support potential future expansion of the 10 mgd facility by increasing the production capacity for a total capacity of up to 24 mgd. Three scenarios for the flexible expansion from a 10-mgd near-term project to 24 mgd are considered: GWR Flex, RWA Flex, and TWA Flex (Figure 9-1).

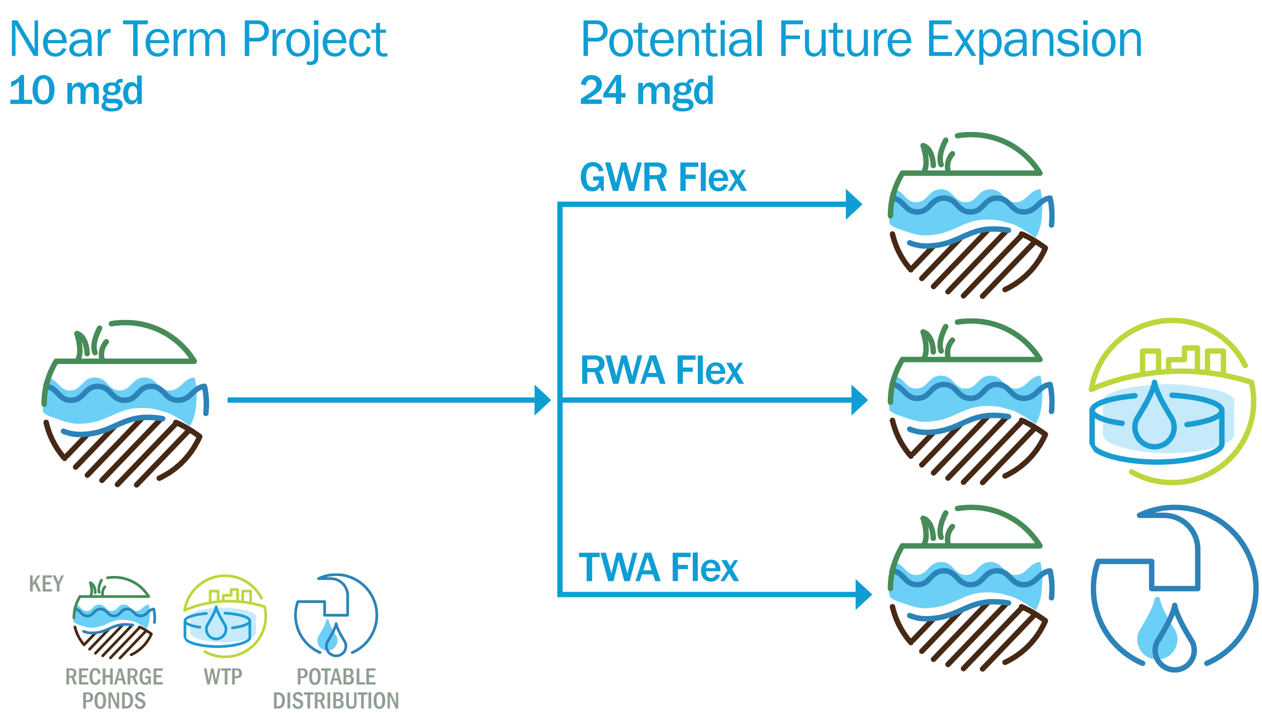


Figure 9-1. Conceptual overview of flexible implementation scenarios

Each flexible expansion scenario considered in this analysis is assumed to increase capacity of the 10 mgd AWPF to 24 mgd and treat the full extent of flow to the highest quality required by the delivery points (reuse type). For example, TWA Flex would treat all flow from the 24 mgd facility to TWA quality, even though part of the flow would be delivered to LGRP. Potential future expansion is critically linked to the following aspects of the near-term project:

- Pipelines to convey 24 mgd of purified water from the AWPF to LGRP. While the portfolios include 48-inch pipe diameter for conveyance, the Flex scenarios reduce that to 36-inch, which allows for conveyance of the full 24 mgd in the future.
- ROC management facilities
- Site layout and footprint for a 24 mgd capacity AWPF with sufficient space for the respective treatment processes, process building footprint, and facilities to meet requirements of anticipated reuse types. That is, to implement either RWA Flex or TWA Flex in the future, treatment is anticipated to require additional processes for the full 24 mgd regardless of amount used for GWR at any given time. In addition, the site layout requires sufficient space to considering the turning radius of trucks that require site access for activities such as chemical deliveries, emergency services, and construction of the expanded facility.
- Land acquisition and site preparation to accommodate the 24 mgd AWPF's site layout and footprint

It is assumed that the AWPF would shut down during construction to expand the facility and that membranes from the near-term project are feasible for continued use (as their life cycle allows) in a future RWA or TWA application.

While the near-term project is definitively GWR, various conditions, events, or processes may trigger, or hinder, future expansion to GWR, RWA, or TWA Flex, such as reliability of other water supplies[1]; evolving regulatory requirements; changes in public acceptance; varying levels of political will; or shifts in magnitude, timing, and/or location of water demand. Flexible expansion intentionally plans for an array of possible outcomes and establishes a near-term project that preserves those future opportunities.

[1] Factors that influence supply reliability may include, but are not limited to, water supply agreements/contracts, hydrologic conditions (i.e., droughts, climate change), evolving and new regulations, natural disasters (e.g., earthquakes, wildfires), and/or human-induced threats.

9.2 San José Flex Scenarios

Flexible implementation scenarios are considered using a San José-based AWPF and a Palo Alto-based AWPF. San José Flex scenarios are premised on treating effluent from the SJ/SC RWF at a new AWPF located in San José at a site adjacent to the existing Silicon Valley Advanced Water Purification Center (SVAWPC). The AWPF site, corresponding buildings, and pipeline to LGRP are sized to accommodate up to 24 mgd. However, treatment equipment, purified water pumps, and other pertinent facilities are sized to accommodate the near-term project capacity of 10 mgd. Figure 9-2 summarizes treatment capacity assumptions for the near-term project and flexible expansion (GWR, RWA, and TWA Flex scenarios).

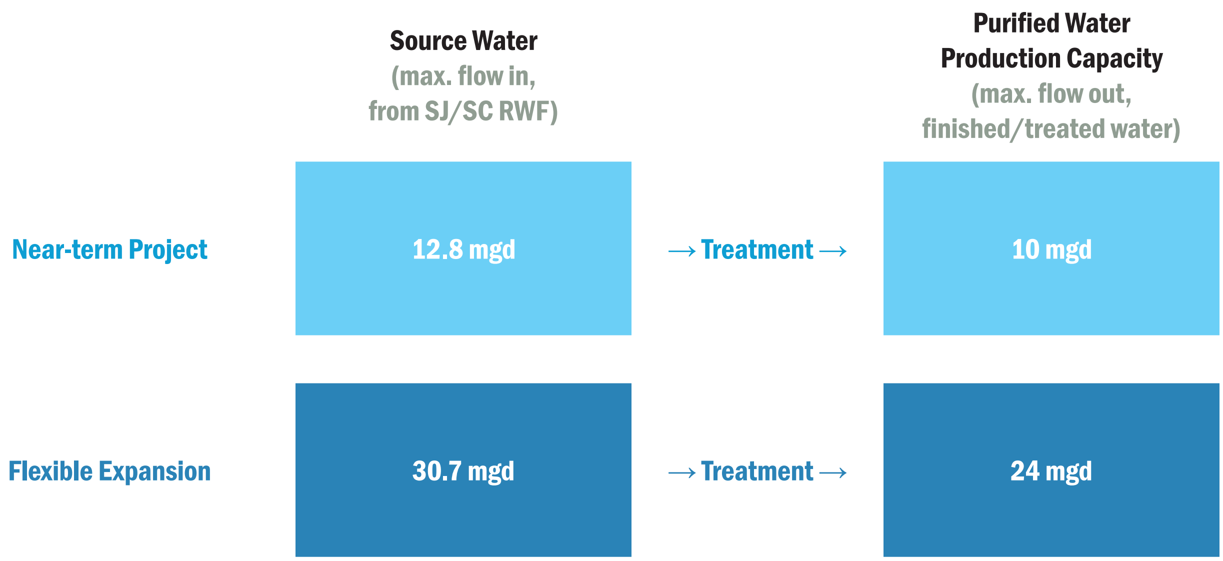


Figure 9-2. Assumed source water flow rates and production capacities for flex implementation of a San José-based AWPF

Process flow diagrams and site layouts for near-term and flexible expansion capacities are included in ***Appendix A-10.*** The proposed pipeline alignments for San José RWA and TWA Flex are shown in Figures 9-3 and 9-4. GWR Flex alignments are consistent with alignments shown in Portfolio 1a (SJ GWR), although the purified water pipeline diameter is 36 inches instead of 48 inches.

Figure 9-3. Flexible implementation from San José-based AWPF: RWA Flex facility locations and pipeline alignments

Figure 9-4. Flexible implementation from San José-based AWPF: TWA Flex facility locations and pipeline alignments

Note: GWR Flex map is consistent with Figure 6-1 (Portfolio 1a: SJ GWR)

9.3 Palo Alto Flex Scenarios

Palo Alto Flex scenarios are premised on treating available effluent from the Palo Alto RWQCP, and from Sunnyvale WPCP if AWPF is expanded in the future, with a new AWPF located at the former LATP site. Source water for the near-term project would be supplied only by the Palo Alto RWQCP. The AWPF site, corresponding buildings, and pipeline to LGRP are sized to accommodate up to 24 mgd. However, treatment equipment, purified water pumps, and other pertinent facilities are sized to accommodate the near-term project capacity of 10 mgd. A source water pipeline would be constructed between the Palo Alto RWQCP and LATP site, sized to accommodate source water necessary for the future flexible expansion (17.8 mgd to produce 14 mgd of purified water). A source water pipeline from the Sunnyvale WPCP to the LATP site would only be constructed as part of the future expansion.

Figure 9-5 summarizes treatment capacity assumptions for the near-term project and flexible expansion (GWR, RWA, and TWA Flex scenarios).

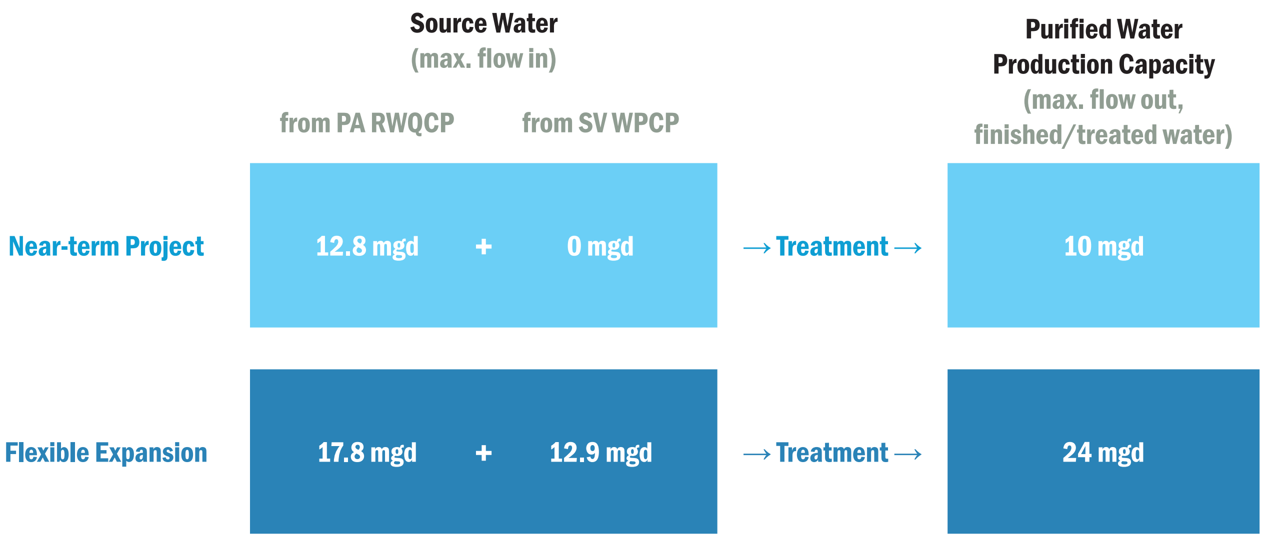


Figure 9-5. Assumed source water flow rates and production capacities for flex implementation of a Palo Alto-based AWPF

Process flow diagrams and site layouts for near-term and flexible expansion capacities are included in ***Appendix A-11***. The proposed pipeline alignments for Palo Alto RWA Flex and TWA Flex are shown in Figures 9-6 and 9-7. GWR Flex alignments are consistent with alignments shown in Portfolio 2a (PA [+SV] GWR), although the purified water pipeline diameter is 36 inches instead of 48 inches.

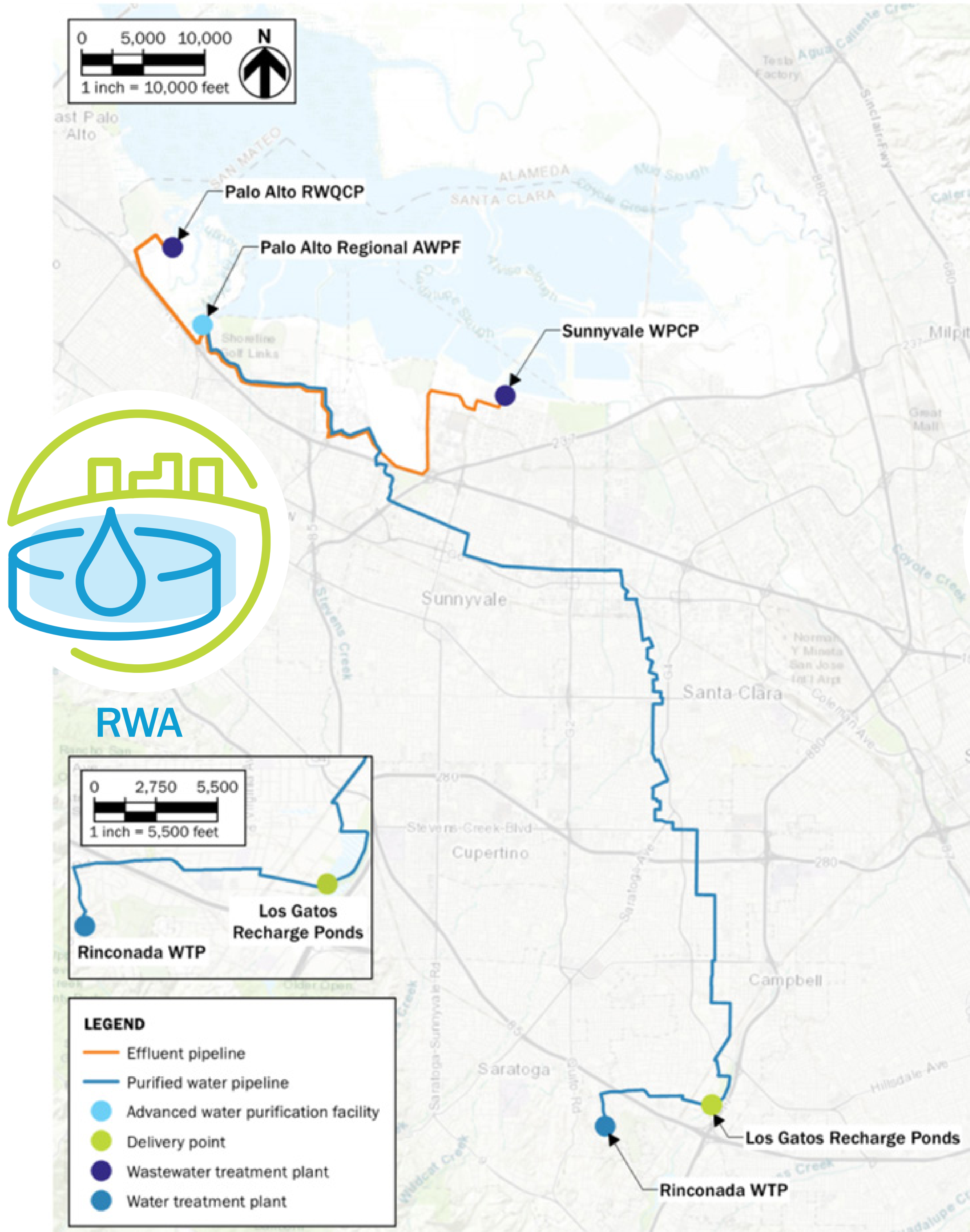


Figure 9-6. Flexible implementation from San José-based AWPF: RWA Flex facility locations and pipeline alignments

GWR

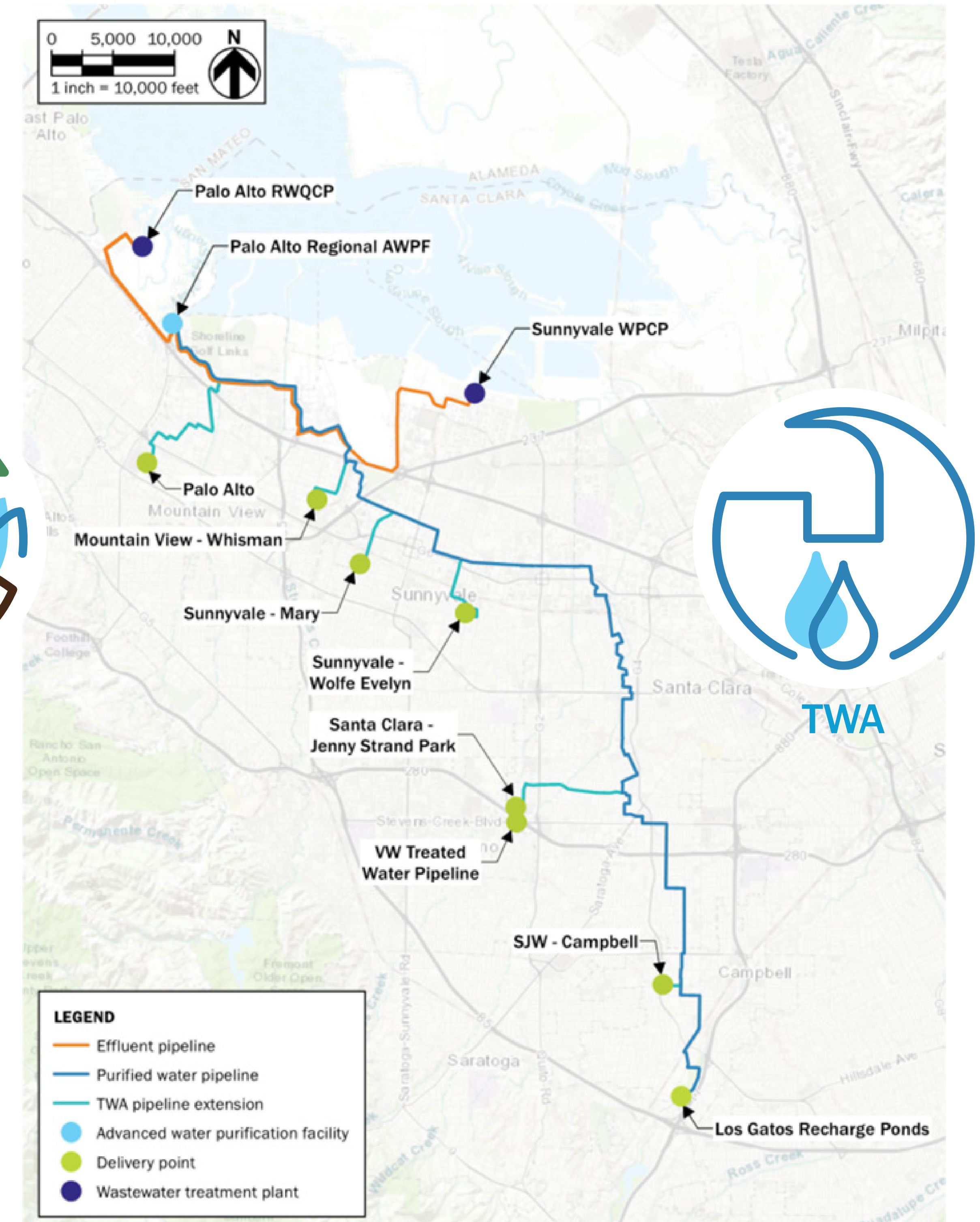


Figure 9-7. Flexible implementation from San José-based AWPF: TWA Flex facility locations and pipeline alignments

Note: GWR Flex map is consistent with Figure 6-2 (Portfolio 2a: PA (+SV) GWR)

9.4 Flex Scenario Costs

Estimated capital and annual operations and maintenance (O&M) costs for flex scenarios are presented in graphical form in Figure 9-8. Further cost details are included in ***Appendices A-10*** and ***A-11***.

The estimated unit cost for the San José GWR Flex near-term 10 mgd project over 30-year and 100-year life cycles would be $3,300/AF and $2,600/AF, respectively, and $3,600/AF and $2,700/AF, respectively, for Palo Alto GWR Flex. This estimate includes capital, O&M, renewal and replacement, and source water purchase and does not include future flex expansion as part of the life cycle. The purified water pipeline to LGRP is sized at 36-inches for the near-term project to accommodate potential future expansion to 24 mgd. CoRe Plan portfolios use a 48-inch purified water pipeline to LGRP.

San José and Palo Alto Flex scenario cost differences of note include:

- AWPF capital costs for all Palo Alto Flex scenarios are lower than for the equivalent San José AWPFs. The Palo Alto AWPF has a smaller site, translating to a smaller process building. The process building cost was based on area, making Palo Alto's process building less expensive than that of San José. Higher AWPF cost for San José was then magnified compared to Palo Alto's after applying contingencies and cost multipliers, then rounding to the nearest $5M.
- Conveyance costs for Palo Alto are higher due to long effluent pipelines between the Palo Alto RWQCP and Palo Alto AWPF for the near-term project, and between the Sunnyvale WPCP and Palo Alto AWPF for the Flex scenarios. The San José scenarios have a 60-inch effluent pipeline that is 0.4-mile long, whereas the 36-inch Palo Alto effluent pipeline is 2.9 miles long and 36-inch Sunnyvale effluent pipeline is 7.4 miles long.

Costs are likely to change as designs are refined.

For additional detail, refer to the following:

- Methodology for estimating life-cycle costs: Refer to ***Appendix A-5***
- Cost tables for conveyance infrastructure that is a consistent size in the CoRe Plan and this Flex TM: Refer to ***Appendix A-6***
- Tables with life-cycle cost details: See Table B-16 in ***Appendix A-10*** or ***Appendix A-11***

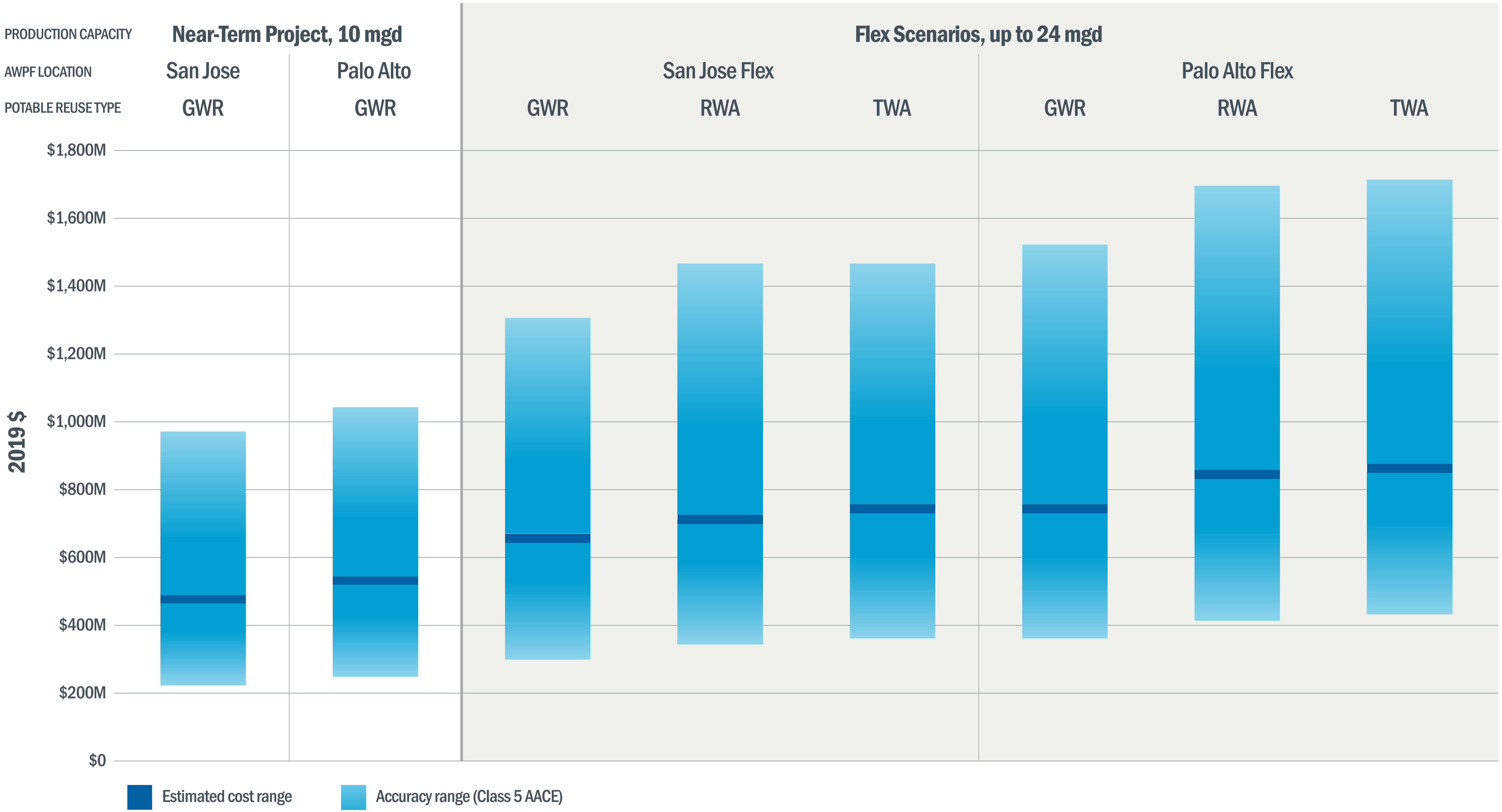


Figure 9-8. Estimated capital costs of flexible implementation scenarios

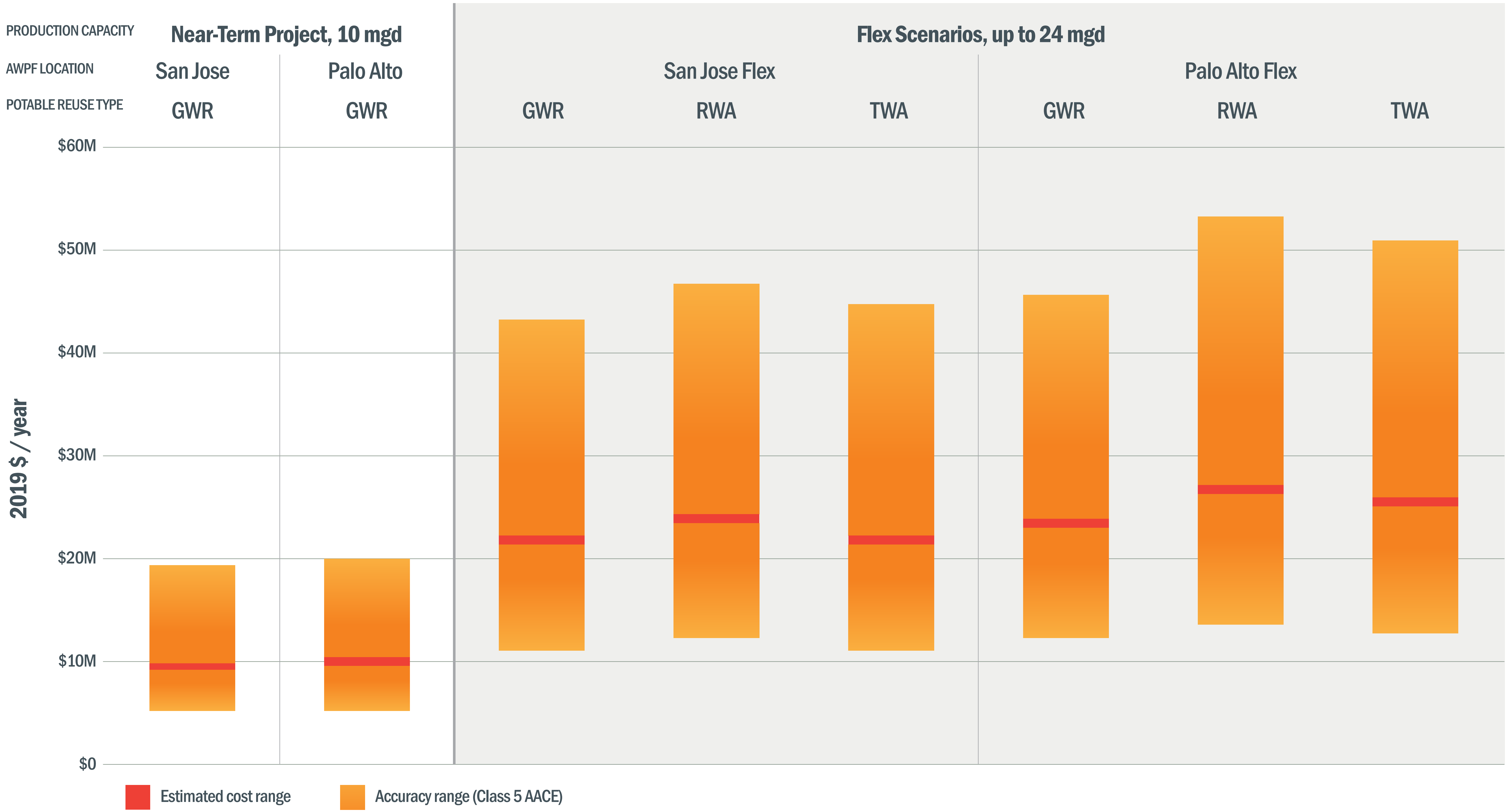


Figure 9-9. Estimated O&M costs of flexible implementation scenarios

9.5 Pipeline Sizing Cost Evaluation

The project team conducted a high-level sensitivity evaluation to determine the cost impact of conveyance based on changing diameter of the purified water pipeline from the AWPF to LGRP. The evaluation uses Portfolios 1a and 2a (SJ GWR and PA [+SV] GWR) costs as a basis and modifies conveyance sizing and costs based on an assumed diameter for the pipeline delivering purified water to LGRP. This evaluation does not include the costs of pipelines to deliver TWA via potable distribution systems or RWA via Rinconada WTP.

Five pipeline sizes (diameters) are presented in Table 9-1 and summarized as follows:

1. The first option is consistent with CoRe Plan Portfolios 1a and 2a (SJ GWR and PA [+SV] GWR) and consists of a 48-inch pipeline capable of conveying up to 40 mgd of purified water flow to LGRP.
2. The second option is consistent with scenarios in this Flex TM and consists of a 36-inch pipeline to LGRP capable of conveying up to 24 mgd of purified water.
3. The third option is a pipeline with varying diameter that allows Valley Water and its Partners to have up to 10 mgd of capacity available for GWR or RWA and up to 24 mgd of capacity available for TWA. A variable diameter pipeline could save capital cost while still delivering up to 24 mgd of purified water. For San José flex, the tapered diameter pipeline option starts as a 36-inch pipeline, reduces to a 30-inch pipeline following a large turnout at Levi's Stadium and Santa Clara's Northside Tanks, then reduces again to a 24-inch pipeline following another large turnout at Santa Clara's Serra/Jenny Strand Park tanks. For Palo Alto flex, the variable diameter pipeline starts out as a 36-inch pipeline, then reduces to a 24-inch pipeline following a large turnout at Santa Clara's Serra/Jenny Strand Park tanks. The large turnouts are locations where purified water could be delivered for TWA.
4. The fourth pipeline size evaluated is a 30-inch pipeline to LGRP to deliver up to 16 mgd—which results in saving capital cost but limits future opportunities to deliver additional purified water.
5. The fifth pipeline size evaluated is a 24-inch pipeline to LGRP to deliver up to 10 mgd—which results in saving capital cost but limits future opportunities to deliver additional purified water.

These pipeline options and turnouts require additional study to confirm engineering feasibility and are included to conceptually define order-of-magnitude cost savings of reducing pipeline diameters. Cost details of each option are shown in Attachment C of ***Appendices A-10*** and ***A-11***.

Table 9-1. Estimated Conveyance Costs under Various Scenarios for Purified Water Pipeline Diameter from AWPFs in San José or Palo Alto to LGRP

Purified Water Pipeline Diameter (in)	Conveyance Capacity for AWPF Buildout (mgd)		Conveyance Costs ($M)				Notes
			From San José AWPF		From Palo Alto AWPF		
	TWA	GWR or RWA	Capital	Annual O&M	Capital	Annual O&M	
48"	Up to 40		$320	$3.4			From San José AWPF: Reflects CoRe Plan Portfolio 1a (SJ GWR) for 24 mgd, as originally conceived in SBWR Strategic Plan and considered in the Purified Water Program Plan (i.e., sized for future expansion, up to 40 mgd).
					$445	$5.1	From Palo Alto AWPF: Reflects CoRe Plan Portfolio 2a (PA [+SV] GWR) for 24 mgd, using comparable sizing assumptions as the similar Portfolio 1a (SJ GWR).
36"	Up to 24		$245	$3.4			Reflects option included in each respective Flex Implementation TM (for near-term project and potential future expansion), included as Appendices A-10 and A-11.
					$375	$5.1	
Variable/ graduated	Up to 14 for TWA	Up to 10 for GWR or RWA	$210	$3.4			Assumes up to 24 mgd of purified water, with 14 mgd for TWA and 10 mgd for GWR or RWA. Costs shown do not include pipelines to deliver TWA (via potable distribution) or RWA (via Rinconada WTP). Reduces purified water pipeline diameter from north to south: • For pipeline from San José AWPF: diameter reduces from 36" to 30" to 24" • For pipeline from Palo Alto AWPF: diameter reduces from 36" to 24"
					$355	$5.2	
30"	Up to 16		$210	$2.4			Sized to deliver 16 mgd to any point along the purified water pipeline; delivering more than 16 mgd requires a parallel pipeline and/or pump station. • For San José AWPF: Requires same level of capital investment as graduated pipelines but supports less capacity and yield. • For Palo Alto AWPF: Assumes source water from Palo Alto (12 mgd) and Sunnyvale (8 mgd) to produce 16 mgd of purified water.
					$305	$3.6	
24"	Up to 10		$165	$1.7			Sized to deliver 10 mgd to any point along the purified water pipeline; delivering more than 10 mgd requires a parallel pipeline and/or pump station. • For Palo Alto AWPF, assumes source water from Palo Alto.
					$215	$2.5	

[a] Unless otherwise noted, general design criteria apply as follows: minimum pressure = 25 psi; pipe head loss <10 feet per 1,000 LF of pipe; pipe velocity <7 fps (generally 5-7 fps); Hazen-Williams coefficient (C) = 130, ductile iron pipe; efficiency = 65%; and safety factor = 10%. Design capacity of portfolio pump stations is included in Appendix A-5 along with cost assumptions for conveyance and other elements.

[b] Attachment C to Appendices A-10 and A-11 includes cost breakdown of pipeline size options.

[c] Assumes that pipeline easement cost is $32/foot.

[d] Costs are rounded up to the nearest $5M for capital and $0.1M for O&M. Difference in annual O&M due to reduced pipeline diameter is expected to be minimal.

9.6 Considerations for Next Steps

VW's Board has directed staff to proceed with the design and construction of a near-term potable reuse project for a 10 mgd AWPF to yield approximately 11,000 AFY using a public-private partnership (P3) delivery method. Flexible implementation scenarios offer a prudent planning approach to meeting the Board directive, while leaving a pathway to expand purified water use in the County in the future.

Flexible expansion intentionally plans for an array of possible outcomes and establishes a near-term project that preserves those future opportunities. Although implementation of flex scenarios is not certain, factors that may influence a future expansion include reliability of other water supplies; evolving regulatory requirements; changes in public acceptance; varying levels of political will; or shifts in magnitude, timing, and/or location of water demand.

Implementing a potable reuse project at San José is pending execution of agreements to define cost sharing, source water quantity and quality requirements, operational responsibilities, and other items. Valley Water and San José navigated similar issues in 2010 when negotiating the Recycled Water Facilities and Programs Integration Agreement for the existing 8-mgd SVAWPC. In 2019, Valley Water and Palo Alto executed a cost sharing and supply agreement to secure 9 mgd of effluent from Palo Alto. These past agreements provide a useful precedent for informing and guiding partnerships now and into the future.

Implementing a potable reuse project at Palo Alto is supported by the 2019 agreement between VW and Palo Alto committing a minimum average effluent volume of 9 mgd from Palo Alto's RWQCP to VW at a cost of ~$100/AF to supply a regional AWPF.

Next steps for implementation will be covered as part of the P3 project.

Section 10:
Appendices List

Appendices are compiled in a separate file and include the following (ordered by relevance/importance).

Appendix A: Feasible Project Portfolios

Appendix A-1: Feasible Project Portfolios TM

Appendix A-2: Compendium of Flow Assessments, Facility Design Capacity, and Annual Yield

Appendix A-3: Design Criteria

Appendix A-4: Preliminary Project Designs

Appendix A-5: Basis of Cost

Appendix A-6: Cost Estimates

Appendix A-7: Evaluation and Risk Assessment Tool

Appendix A-8: Treated Water Augmentation Pre-Screening Analysis

Appendix A-9: Onsite Reuse TM

Appendix A-10: San José Flex Implementation TM

Appendix A-11: Palo Alto Flex Implementation TM

Appendix B: Regulatory Compliance

Appendix B-1: Regulatory Compliance Strategy TM

Appendix B-2: Regulatory Framework TM

Appendix C: Hydraulic Modeling

Appendix C-1: Modeling Plan and Results

Appendix C-2: SBWR System Master Plan Updates TM

Appendix D: Project Definition, Roles, and Responsibilities

Appendix D-1: Project Definition, Roles, and Responsibilities

Appendix E: Baseline Analysis

Appendix E-1: Baseline Analysis

Appendix E-2: Recycle Hill Geotechnical Preliminary Study

Appendix E-3: Recycle Hill Geotechnical and Geo-environmental Exploration Plan

Appendix F: Conceptual Alternatives

Appendix F-1: Conceptual Alternatives

Appendix G: ROC Management Strategies Reference Files

Section 11: References

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Glossary

The following definitions are established for use within this Countywide Water Reuse Master Plan (CoRe Plan). While many terms listed here are industry standard[1], several are specific to Valley Water or this plan.

Foundational Terms

- **CoRe Plan** refers to the Countywide Water Reuse Master Plan developed by Valley Water and its Project Team in coordination with its Project Partners.
- **Potable Water** is drinking water that meets or exceeds state and federal drinking water standards.
- **Non-potable Water** is water not fit for human consumption.
- **Recycled Water**, or sometimes called "purple pipe" due the distinguishing color of infrastructure reserved for its conveyance and distribution, generally refers to treated domestic wastewater used more than once before passing back into the natural water cycle. While the terms water reuse and recycled water are used interchangeably in some settings, for the purpose of this CoRe Plan, the term recycled water indicates non-potable reuse.
- **Reuse, or Water Reuse**, applies to both non-potable reuse (recycled water) and potable reuse, further described below.

Water Reuse Types

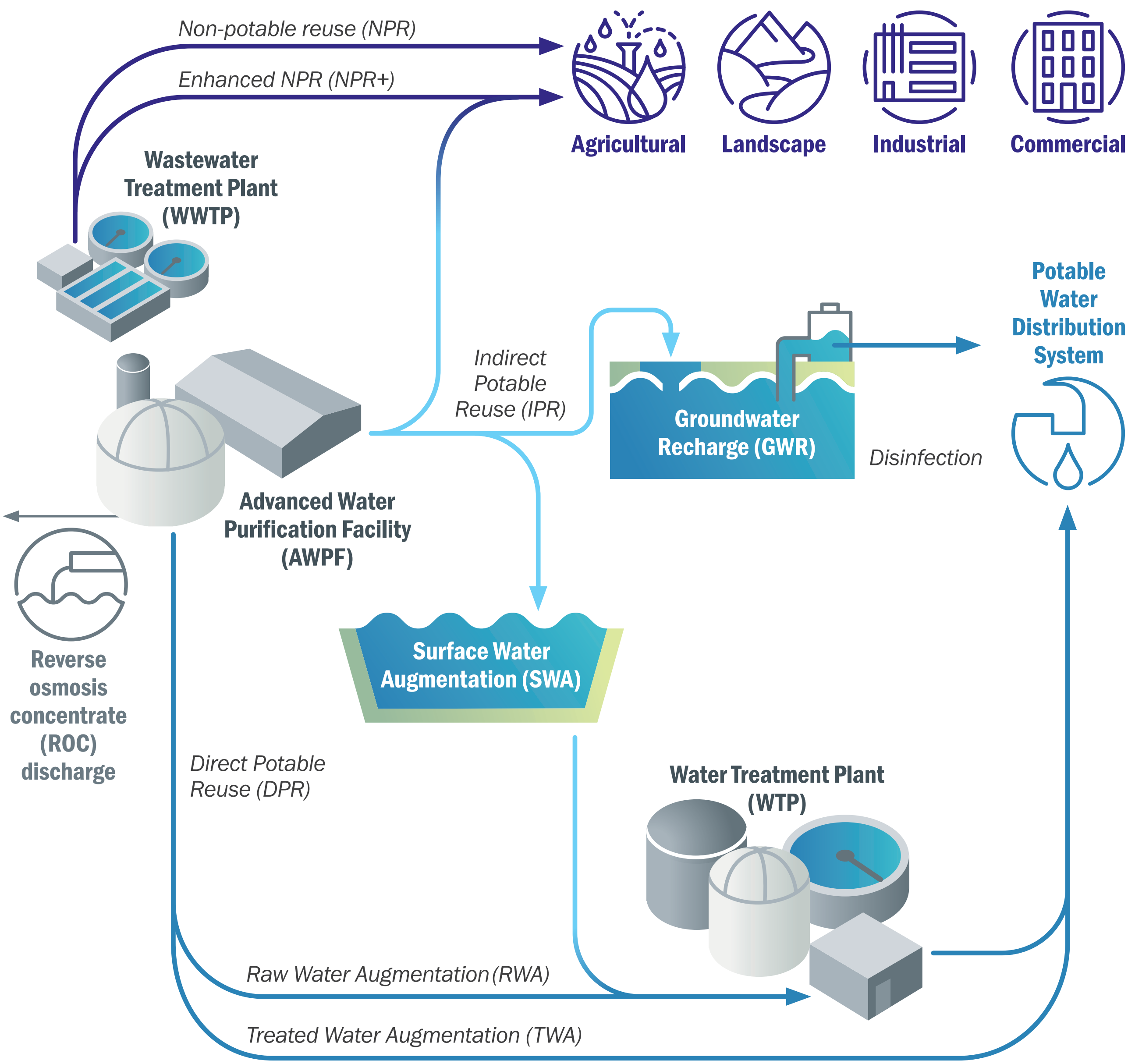
- **Non-potable Reuse (NPR)** refers to recycled water that is not used for drinking, but is safe to use for irrigation, industrial uses, or other non-drinking water purposes.
  - **Enhanced NPR, or NPR+**, is recycled water for non-potable reuse that has been blended with purified water to reduce concentration of salts and other dissolved solids to enable broader application of recycled water for non-potable end uses and protect groundwater quality.
- **Potable Reuse** refers to recycled water sufficiently purified through advanced treatment to meet or exceed federal and state drinking water standards and is safe for human consumption. Potable reuse takes one of two forms: indirect or direct potable reuse.
  - **Indirect Potable Reuse (IPR)** involves blending purified water with water supply in an environmental system, such as a surface water reservoir or groundwater basin, that acts as a buffer for retaining and diluting the reuse supply before treating the blended supply.[2] IPR can be accomplished through groundwater recharge or surface water augmentation.
    - **Groundwater Recharge (GWR)**, as defined in context of IPR, is a process that involves using constructed facilities that spread water across infiltration basins or percolation ponds (surface spreading),) or pump water directly into the subsurface through injection wells (subsurface injection) to increase water supply in a groundwater aquifer (natural underground water storage).
    - **Surface Water Augmentation (SWA)** involves adding purified water to a surface water reservoir to increase water supply.

[1] Many definitions listed here are based on the Water Reuse Terminology summary (June 2016) posted on WateReuse Association's website and developed by WateReuse California, Association of California Water Agencies, and California Association of Sanitation Agencies. https://watereuse.org/educate/water-reuse-101/glossary/

[2] Local groundwater is disinfected, while surface water goes through conventional treatment (including disinfection).

– **Direct Potable Reuse (DPR)** involves the treatment and distribution of purified water using engineering controls, without an environmental buffer, in the form of raw water augmentation or treated water augmentation.
  - **Raw Water Augmentation (RWA)** involves blending purified water with other supplies immediately upstream of a water treatment plant.
    – **Treated Water Augmentation (TWA)** involves introducing purified water directly into a potable (drinking) water distribution system downstream of a water treatment plant.

Types of Reuse



Visual Glossary-1. Types of reuse explored for Valley Water's CoRe Plan

Water Uses and Delivery Methods

- **Augmentation** is the process of adding recycled or purified water into an existing raw water supply (such as a reservoir, lake, river, wetland, and/or groundwater basin).
- **Beneficial Reuse** is the use of recycled water for purposes that contribute to the water needs of the economy and/or environment of a community.
- **Delivery Points are locations where treated water would be conveyed for reuse (NPR or PR).**
- **Environmental Flow/Benefit** is water quantity, timing, and quality to sustain ecosystems/ habitats/ natural systems.
- **Irrigation** is the physical application of water to land to assist in the production of crops or landscape.
- **Retrofit** is the process of constructing and separating potable and recycled water pipelines that allows recycled water to be used for non-potable purposes. This also includes the process of preparing customer use sites for recycled water use.
- **Percolation Ponds** (also known as **Recharge Ponds or Spreading Basins**) are constructed facilities where water is delivered and allowed to seep through the ground surface, naturally filtering underground and replenishing groundwater supply in deep **aquifers** (i.e., underground reservoirs, also referred to as **groundwater basins**).

Water Types and Quantity

- **Raw Water** is untreated surface or groundwater.
- **Wastewater** is the used water of a community (domestic households and commercial businesses for washing food, dishes, clothes, and bodies and for toilet flushing) or industry that contains dissolved and suspended matter.
- **Sewershed** is a sewer collection system that flows to a single end point for treatment; akin to watersheds in the natural environment but focused on wastewater and built environment.
- **Source Control** is careful management of harmful substances that may be introduced into the wastewater collection system.
- **Reused Water** is water used more than once and has been treated to a level that allows for its reuse for a beneficial purpose.
- **Purified Water** is highly treated water of wastewater origin that has passed through proven multistage, multibarrier processes to produce water at the quality fit to supplement or provide supply for potable (drinking) water purposes, as verified through monitoring for its safety and as regulated by the State Water Resources Control Board Division of Drinking Water.
- **Acre-feet per Year (AFY)** is a metric for the volume of water use and/or supply over one year. One acre-foot equals about 326,000 gallons, or enough water to cover an acre of land (about the size of a football field) one foot deep.
- **Efficiency** is a metric for advanced water purification facilities (AWPF) calculated as purified water produced divided by the facility's design capacity; efficiency reflects an AWPF's online factor (i.e., percent of time equipment is online vs. offline for regular maintenance) as well as source water availability.
- **Million Gallons per Day (mgd)** is a measurement of flow that represents a volume of water supplied, treated, discharged, or conveyed over one day or a facility capacity (maximum physical limit). Used in context of average water/wastewater use over any timescale or peak flows over a shorter timescale.
- **Utilization** is the average amount of purified water used for potable reuse divided by potable reuse capacity; utilization is dependent on delivery point conditions (e.g., groundwater storage capacity and water demand).
- **Yield** is the annual volume of water produced by a facility or natural system; generally lower than the maximum production (design) capacity due to source water availability, maintenance, and other factors that affect AWPF efficiency.

Water Purification/Treatment

- **Riverbank Filtration is a form of treatment where surface water is pumped out of borewells drilled along stream banks. Riverbed sediments act as a filter to remove dissolved and suspended contaminants and pathogens via a combination of physical, chemical, and biological processes.**
- **Soil Aquifer Treatment (SAT)** is a natural, passive process that occurs when applying a non-potable water supply, such as recycled water, to a soil interface under controlled conditions to recharge a groundwater aquifer. As water percolates, soil filtration treats the supply through natural, physical, chemical, and biological processes.
- **Constructed Wetlands are treatment systems that use natural processes involving wetland vegetation, soils, and their associated microbial communities to improve water quality.**
- **Granular Activated Carbon (GAC)** is used to remove chemicals that are dissolved in water.
- **Ozonation** is the process of applying ozone (03), a strong oxidant, to disinfect water.
- **Membrane Filtration is a process of physical separation to remove constituents from water or other liquid solutions or gasses.** Pressure is used to force water through a semi-permeable membrane that transmits water but stops other materials from passing through the membrane. Four common types of membrane filtration include the following:
  - **Microfiltration (MF)** membranes have an effective pore size of approximately 0.1 microns (μm), ranging from 0.03 to 5 μm, and are used to remove soil particles, cysts, algae, and some bacteria.
  - **Ultrafiltration (UF)** membranes have an effective pore size of approximately 0.01 μm, ranging from 0.002 to 0.1 μm, and remove humic materials, some viruses, and more bacteria than MF.
  - **Nanofiltration (NF)** membranes, which have an effective pore size of approximately 0.001 μm, can remove virtually all bacteria and viruses, as well as some salts and dissolved organics.
  - **Reverse Osmosis (RO)** membranes remove bacteria, viruses, nearly all contaminant ions, and most dissolved non-ions. RO is commonly used in desalination, a process that removes salt from saline water sources.
- **Advanced Oxidation** is one of the processes that can be used as a safety barrier in the water purification process. Hydrogen peroxide, ultraviolet (UV) light, and other processes are used in combination to form a powerful oxidant that provides further disinfection of water and breaks down chemicals.
- **Biofiltration** uses a bioreactor, or media containing living material, to capture and biologically degrade pollutants. Biofiltration may be used to treat wastewater, stormwater, or as part of multi-stage drinking water treatment.
- A **Multi-barrier Approach** is a paradigm for water treatment that prevents, reduces, or eliminates contamination risks by integrating robust treatment processes, operational procedures, and technical resources/tools, along with monitoring to confirm proper functionality and expected performance. A multi-barrier approach involves more than one treatment step and, depending on the circumstances, may include: riverbank filtration, SAT, constructed wetlands, GAC, biofiltration, ozonation, membrane filtration, RO, and/or advanced oxidation.

Wastewater Treatment Processes and Flow Streams

- **Influent** is the untreated water that flows into a wastewater treatment plant.
  - **Average Dry Weather Flow (ADWF)** is the average daily wastewater influent flow during the three lowest consecutive flow months of the year (e.g., June through August, or July through September), typically presented in million gallons per day (mgd).
- **Discharge** is the release of effluent that meets regulatory standards and is designated by a regulatory permit to be safe for discharge into the environment.
- **Effluent** is the treated water discharged from a wastewater treatment plant (WWTP).
  - **Remaining Effluent** is the amount of secondary- or tertiary-treated wastewater available for potable reuse (or other uses such as discharge or blending) after NPR demands, losses, and environmental flows are met; for planning purposes, the CoRe Plan assumes all remaining effluent would be available for potable reuse.
- **Primary Treatment** is a wastewater treatment process where solid matter is removed. The remaining liquid may be discharged (if allowed by regulations) or subjected to further treatment.
- **Secondary Treatment** is a wastewater treatment process where dissolved and suspended biological matter is removed to a non-potable level, so water may be disinfected and discharged into a receiving surface water or used for irrigation at controlled locations.
- **Tertiary Treatment** refers to treatment processes to remove nitrogen and phosphorus for uses such as irrigation, discharges into a highly sensitive or fragile ecosystem (e.g., estuaries, low-flow rivers), or blending with other environmental systems such as a river or groundwater basin. Tertiary treatment can include biological and filtration processes.
- **Advanced Water Treatment, or Advanced Water Purification**, refers to processes that purify water for uses such as irrigation or for water blended with other environmental systems such as a river, reservoir, or groundwater basin prior to reuse. Advanced water treatment can also include treatment processes to remove nitrogen and phosphorus to allow discharge into a highly sensitive or fragile ecosystem (e.g., estuaries, low-flow rivers, coral reefs, etc.).

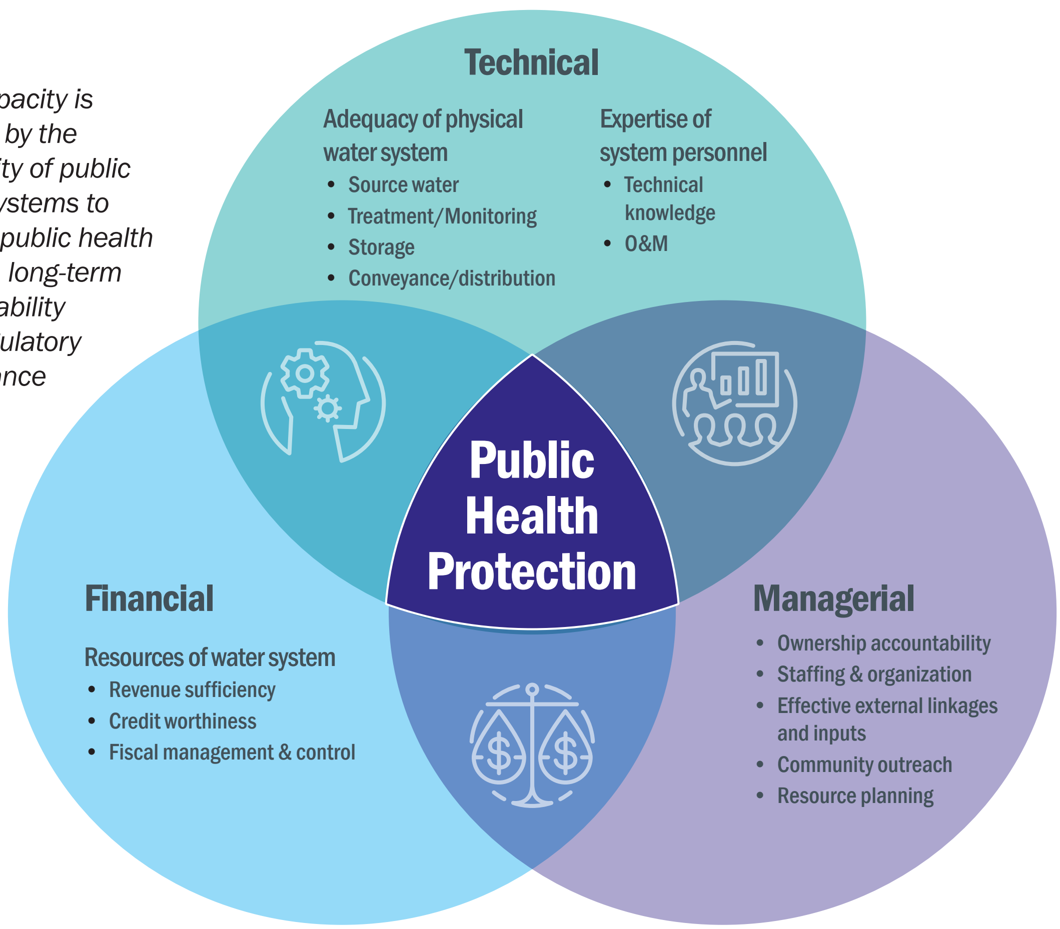
Planning Approaches

- **Valley Water's One Water Plan** is a long-term endeavor that:
  - serves as a roadmap for integrated water resource planning,
  - reflects state, regional, and local policies in a countywide framework,
  - encompasses goals and objectives for flood protection, stream stewardship, and water supply, and
  - provides a framework for incremental, intentional, and measurable improvements.
- **Portfolio** is a combination of individual project components, a project alternative.
- **Programmatic Approach** is a strategic arrangement of individual, interlinked projects that collectively yield large-scale impacts, such as the Countywide approach to improving regional water supply reliability through considering a range of water reuse opportunities.
- **Rubric** is a framework used for evaluating the potable reuse portfolios based on various regulatory criteria.

Regulations and Permits

- **National Pollutant Discharge Elimination System (NPDES)** was instituted as part of the Clean Water Act, a permit program that controls water pollution by regulating point sources of discharge.
- **Title 22 Standards** are the requirements established by the State Water Resources Control Board Division of Drinking Water (formerly the California Department of Public Health) for the production and use of recycled water. Title 22, Chapter 3, Article 3 of the California Code of Regulations, outlines the level of treatment required for allowable uses for recycled water. The most typical uses include irrigation, firefighting, residential landscape watering, industrial uses, food crop production, construction activities, commercial laundries, toilet flushing, road cleaning, recreational purposes, lakes, ponds, and decorative fountains. Section 13550 of the California Water Code is a declaration by the State Legislature that the use of potable water is a waste if recycled water is available.
- **TMF Capacity**—technical, managerial, and financial capacity—is a concept first introduced by Congress in the 1996 Amendments to the Safe Drinking Water Act. The concept derives from a philosophy that capable water systems consistently provide safe and reliable water service, meet water quality standards required by regulations, and practice ongoing vigilance in operations and maintenance of facilities to protect the public's drinking water supply. To describe capability, Congress used the term "capacity development" with three components: technical, managerial, and financial. As shown in the following figure, a water system capable of protecting public health must have adequate capacity in all three components for near-term and long-term sustainability.

TMF capacity is defined by the capability of public water systems to protect public health through long-term sustainability and regulatory compliance



Visual Glossary-2. The capability of public water systems to protect public health through long-term sustainability and regulatory compliance requires TMF capacity

Note: Figure adapted from a USEPA webpage, "Building the Capacity of Drinking Water Systems: Learn about Capacity Development"

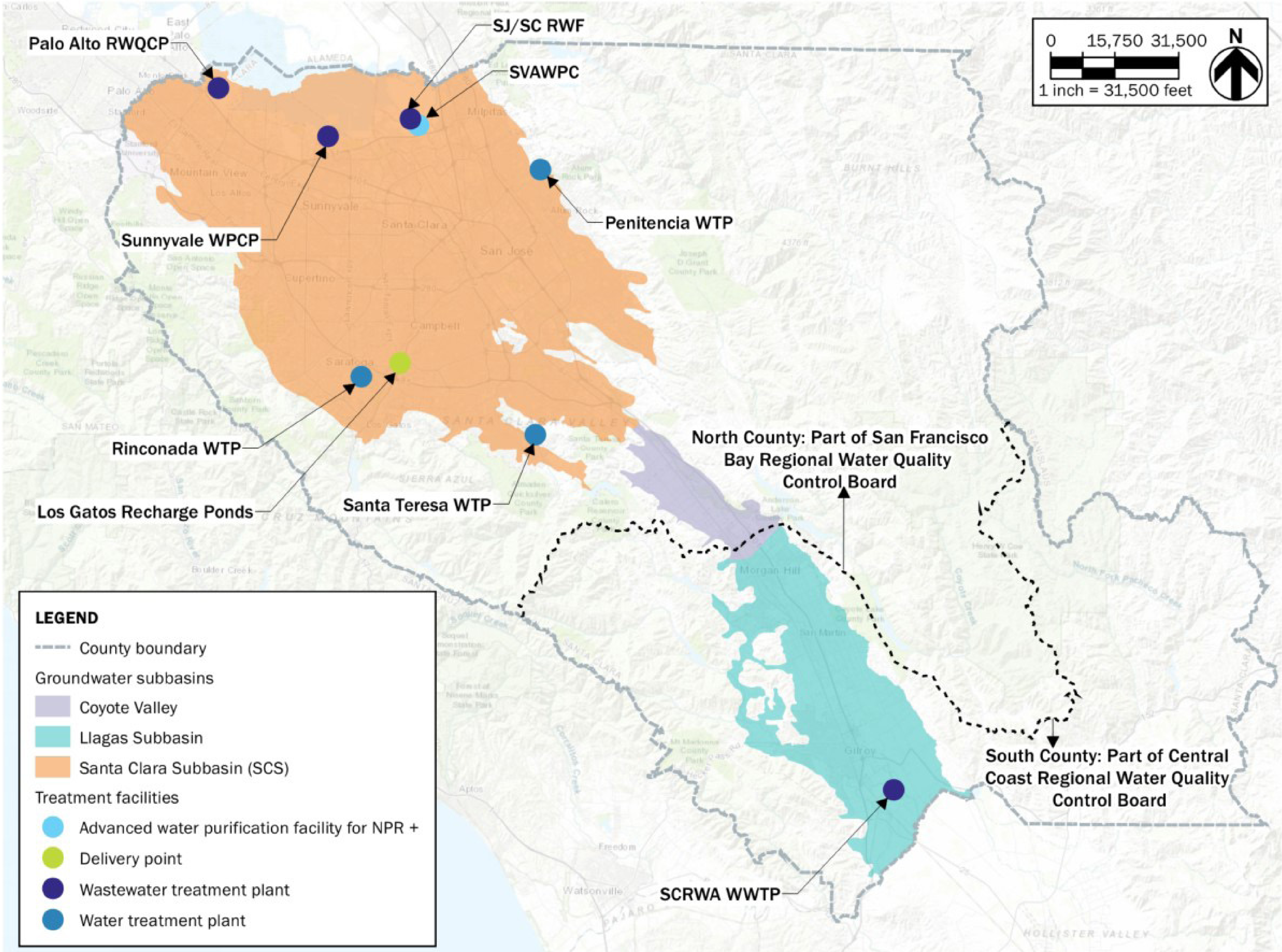
CoRe Plan Partnerships and Engagement

- **Partner Agencies** consist of staff from the cities of Palo Alto, Mountain View, Sunnyvale, San José, Santa Clara, Morgan Hill, and Gilroy that represent the four recycled water producers in Santa Clara County, along with owners/operators of recycled water systems. Valley Water will work closely with these partner agencies to secure source water for reuse and help the Partner Agencies meet their own reuse supply goals.
- **Project Partners** consist of the Partner Agencies and Valley Water. Collectively, they form the **Project Partner Group (PPG)** that meets periodically to develop and shape the CoRe Plan's projects and portfolios.
- **Executive Leadership Group (ELG)** refers to executive-level representatives (e.g., city manager or division manager) from the Partner Agencies who contribute strategic direction to the CoRe Plan.
- **Stakeholder Task Force (TF)** refers to a group convened for the purpose of providing input to Valley Water and the Project Partners with respect to developing the CoRe Plan. The Stakeholder TF is composed of representative interests/organizations related to business/economy, chambers of commerce, planning, public policy, water rates advocacy, environmental advocacy, environmental justice, medical community, diversity, stormwater, groundwater, other water and recycled water suppliers/agencies.
- **Independent Advisory Panel (IAP)** is a third-party body composed of leading potable reuse researchers and subject matter experts convened to review and provide feedback on proposed CoRe Plan projects, portfolios, and options related to technical feasibility and regulatory compliance. Panel members include:
  - James Crook, PhD, PE, BCEE
  - Katherine Cushing, PhD
  - Jean Moran, PhD
  - Adam Olivieri, DrPH, PE
  - Mehul Patel, PE
  - Shane Snyder, PhD

Santa Clara County Geography and Groundwater Basins/Subbasins

The CoRe Plan refers to North County and South County as general reference points. These terms are informal as used in this plan, yet generally consistent with the groundwater benefit zone boundaries. The following terms and figure below offer further context.

- **North County** refers to the area north of Metcalf Road, which encompasses San José, Santa Clara, Sunnyvale, Palo Alto, Mountain View, and other municipalities.
  - The North County sits atop the **Santa Clara Subbasin** (green shaded area in the figure), an area within the boundaries of the San Francisco Bay Regional Water Quality Control Board.
- **South County** refers to the area south of Metcalf Road, including Coyote Valley, Morgan Hill, and Gilroy.
  - The area south of Metcalf Road and north of Cochrane Road is the **Coyote Valley Recharge Area** (pink shaded area), which is part of the Santa Clara Subbasin.
  - The **Llagas Subbasin** is the southernmost groundwater subbasin (purple shaded area) and a critical water supply source for the cities of Morgan Hill and Gilroy.
  - This area is within the boundaries of the Central Coast Regional Water Quality Control Board.



Visual Glossary-3. Santa Clara County general location, groundwater subbasins, and existing water/wastewater treatment facilities

Abbreviations

AACE	Association for the Advancement of Cost Engineering
AB	Assembly Bill
ADWF	average dry weather flow
AFY	acre-feet per year
AWPF	advanced water purification facility
BARR	Bay Area Regional Reliability
Cal Water	California Water Service Company
CCR	California Code of Regulations
CEC	constituent of emerging concern
CEO	Chief Executive Officer
CEQA	California Environmental Quality Act
CIWQS	California Integrated Water Quality System
COO	Chief Operating Officer
CoRe	Countywide Water Reuse
County	Santa Clara County
DBFOM	design-build-finance-operate-maintain
DDW	State Water Resources Control Board’s Division of Drinking Water
DOO	Deputy Operating Officer
DPR	direct potable reuse
EIR/S	Environmental Impact Report/Statement
EPASD	East Palo Alto Sanitary District
FAT	full advanced treatment
GM	General Manager
GWR	groundwater recharge
IAP	Independent Advisory Panel
IPR	indirect potable reuse
ISRF	Infrastructure State Revolving Fund Loan Program
JPA	joint powers authority
LAFCO	Local Agency Formation Commission
LGRP	Los Gatos recharge ponds system
LRV	log reduction value
MBR	membrane bioreactor
mg/L	milligrams per liter
mgd	million gallons per day
MH	Morgan Hill
μm	micron(s), micrometer(s)
NPDES	National Pollutant Discharge Elimination System
NEPA	National Environmental Protection Act

North County	northern portion of Santa Clara County (see Glossary)
NPR	non-potable reuse
NPR+	enhanced NPR, a blend of NPR with purified water from AWPF
O&M	operations and maintenance
P3	public-private partnership
PR	potable reuse
Regional Board	Regional Water Quality Control Board
RO	reverse osmosis
ROC	RO concentrate
RWA	raw water augmentation
RWC	Valley Water Board's Recycled Water Committee
RWMP	Recycled Water Master Plan
RWQCP	Palo Alto Regional Water Quality Control Plant
RWS	recycled water system
SBWR	South Bay Water Recycling
SCRWA	South County Regional Wastewater Authority
SF Bay	San Francisco Bay
SFPUC	San Francisco Public Utilities Commission
SJ/SC RWF	San José-Santa Clara Regional Wastewater Facility
SNMP	Salt and Nutrient Management Plan
South County	southern portion of Santa Clara County (see Glossary)
SRF	Clean Water State Revolving Fund Loan Program
State Board	State Water Resources Control Board
SVAWPC	Silicon Valley Advanced Water Purification Center
SWA	surface water augmentation
TDS	total dissolved solids
TM	technical memorandum
TMF	technical, managerial, and financial
TWA	treated water augmentation
UV	ultraviolet
UWMP	Urban Water Management Plan
Valley Water	Santa Clara Valley Water District
WDR	waste discharge requirements
WIFIA	Water Infrastructure Finance and Innovation Act
WPCP	Sunnyvale Water Pollution Control Plant
WQOs	water quality objectives
WRR	water reclamation requirements
WSMP 2040	Valley Water's Water Supply Master Plan 2040
WTP	water treatment plant
WWTP	wastewater treatment plant