APPENDIX A
OUTREACH AND ENGAGEMENT SUMMARY

ALAMEDA COUNTY WATER DISTRICT
WATER RESOURCES MASTER PLAN 2050

MEMORANDUM

TO: Thomas Niesar, Alameda County Water District (ACWD)

PREPARED BY: Katie Evans, Woodard & Curran

REVIEWED BY: Chris Hewes and Katie Cole, Woodard & Curran

DATE: February 18, 2026

RE: Outreach and Engagement Summary for ACWD's Water Resources Master Plan 2050 (Phase 2, Task 2 - Outreach)

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Appendix A: Interested Parties List

ACRONYMS AND ABBREVIATIONS

ACWD	Alameda County Water District
IRP	Integrated Resources Plan
PFAS	per- and polyfluoroalkyl substances
SFPUC	San Francisco Public Utilities Commission
SGMA	Sustainable Groundwater Management Act
UWUO	Urban Water Use Objective
WEMP	Water Efficiency Master Plan
WRMP	Water Resources Master Plan

1. INTRODUCTION & BACKGROUND

1.1 Introduction

Alameda County Water District (ACWD) is undertaking an update to its 1995 Integrated Resources Plan (IRP). Since the IRP was adopted nearly 30 years ago, the District has experienced many changes that warrant an updated look at the future of its water supply. The updated Water Resources Master Plan (WRMP) 2050 serves as a long-range planning document that outlines the District's water supply strategy and informs other aspects of District planning. The goal of the WRMP is to inform critical decision making on future infrastructure and water supply investments by providing valuable information about the District's future resilience in the face of known uncertainties, such as climate change and changing regulations. This plan will create a roadmap for water supply reliability by analyzing changing conditions and the communities served by the District – now and in the future.

As part of this long-range planning process, ACWD prioritized robust outreach and engagement to ensure that the perspectives of customers and interested parties are reflected in the development of future water supply strategies.

This began with Phase 1, an information gathering phase that guided the development of planning goals and gathered initial input from the Board of Directors, the public, and key parties. In Phase 2, outreach and engagement activities focused on deepening collaboration, soliciting feedback on water supply options and resource strategies, and fostering transparency around decision-making. Through workshops, surveys, meetings, and targeted communications, ACWD has worked to educate, inform, and involve the community in shaping a resilient water future.

This summary provides an overview of the outreach and engagement efforts undertaken during Phase 2, highlighting key activities, community input, and how community feedback has informed the development and evaluation of portfolios for the WRMP.

1.2 Phase 1 Outreach Background

During Phase 1 of the WRMP, ACWD implemented a comprehensive and intentionally layered outreach strategy designed to gather insight from key decision-makers, technical experts, and the broader community. A central component of this effort was the engagement of the ACWD Board of Directors who provided early and ongoing guidance on planning priorities, desired outcomes, and overall direction for the WRMP. Through multiple Board workshops and informal one-on-one conversations, the Board offered critical insight into long-term supply considerations, policy expectations, and the issues most important to ACWD customers and constituents.

1.2.1 Phase 1 Public Opinion Survey

To better understand community attitudes, concerns, and communication preferences, ACWD also commissioned a public opinion survey designed to capture a statistically significant portion of the service area population, conducted by Probolsky Research. The survey explored local knowledge of water resources, community values related to supply reliability and environmental stewardship, and preferred channels for receiving information. Results revealed which topics resonated most with residents, where additional education may be needed, and which outreach tools including digital platforms, email updates, and targeted educational content, would be most effective in future phases.

Overall, the survey shows that while water is not among residents' top day-to-day concerns, there is strong underlying support for how ACWD approaches water management. When asked about the most important issues facing the community, water ranked behind public safety, homelessness, housing affordability, and the cost of living. This indicates that water planning competes with broader quality-of-life concerns for public attention. However, respondents expressed clear expectations that water planning should be reliable, responsible, and aligned with community resilience, even if it is not top of mind on a daily basis.

Public opinion is overwhelmingly favorable toward sustainability, reliability, and resiliency as guiding principles for the District. Support was especially strong for efforts that improve preparedness for emergencies such as earthquakes, signaling that residents value long-term system resilience, and risk reduction. At the same time, cost remains a dominant concern. Setting reasonable rates was identified as one of the District's highest priorities, and most respondents indicated reluctance to pay more for water, particularly for higher-cost supply options such as desalination. While purified water was viewed more favorably than desalinated water, some concerns about water quality and contamination remain, underscoring the importance of clear communication around safety and costs.

The public generally views conservation as an acceptable and desirable strategy when it is more cost-effective than developing new supplies, and many respondents expressed willingness to support conservation programs as part of the overall water supply approach. There is also strong support for upgrading technology to improve system performance and security, reflecting interest in innovation and modernization. Finally, residents expressed a preference for ongoing transparency, with most wanting to receive updates by email as the WRMP moves forward.

1.2.2 Phase 1 Interest Parties Meetings

Simultaneously, ACWD convened Interested Parties meetings with four key groups:

- Government agencies and related public agencies
- Regulatory and environmental organizations
- Community advocacy groups
- Groundwater users

Meeting participants were selected based on their technical expertise, regulatory role, on-the-ground knowledge, or representation of affected communities. These workshops collected detailed input on goals and priorities for the WRMP, water resource challenges, and opportunities for coordination across jurisdictions or disciplines. Participants also helped identify potential project concepts, risks or unintended consequences, and data needs.

Together, the Board guidance, public survey data, and Interested Parties feedback informed the development of Phase 1 deliverables, including WRMP evaluation criteria, goals, objectives, and the Phase 2 outreach and engagement framework.

1.3 Phase 2 Work Plan

Building on the lessons and feedback from Phase 1, the core team (defined below) developed a work plan that outlines a comprehensive strategy for continued outreach and involvement. The plan identifies several key participant groups, each with distinct roles and engagement mechanisms:

- Core Team: Comprised of the consulting team and key ACWD staff, the Core Team is responsible for the detailed development of the WRMP and met weekly to integrate input and make recommendations.

- Extended Team: This group includes executive staff and subject matter experts from across ACWD departments and provided data, reviewed drafts, and offered cross-functional insights through approximately bimonthly workshops. See more details in **Section 4**.

- Interested Parties: Entities such as local municipality staff, environmental groups, and groundwater users participated in Advisory Workshops focused on specialized topics like recycled water, equity, and groundwater impacts. See more details in **Section 5**.

- Board of Directors: The Board received regular updates and ultimately approved the final WRMP, ensuring transparency and accountability through public meetings. See more details in **Section 6**.

- Public: While polling indicated limited public interest in direct engagement, the plan emphasizes regular information sharing via the ACWD website, public input web tools, community presentations, and educational campaigns. These channels kept residents informed and provided opportunities for feedback at key milestones. See more details in **Section 7**.

All of the input gathered during Phase 1 from the Board, the special interest groups, the public poll, and the workshops, was aggregated to inform the scope and framework for Phase 2. This comprehensive foundation ensures that WRMP development was responsive to the needs and aspirations of the ACWD community, with clear goals, planning objectives, evaluation criteria, and outreach strategies tailored to interested parties and public preferences.

2. ONLINE ENGAGEMENT PLATFORM

The Core Team recognized the importance of making public engagement as accessible, transparent, and convenient as possible. Because Phase 1 meetings generated minimal attendees, adaptability in engagement was a priority in this effort. To achieve this, ACWD selected an online public engagement platform (Konveio) as the dedicated project website, launching the site at https://acwdwaterplan.konveio.com/.

The decision to use Konveio was driven by a commitment to lower barriers to participation and to meet interested parties on their preferred terms, on their own time and from their own devices. Unlike traditional engagement methods that often require attendance at scheduled, in-person meetings, the Konveio platform enabled interested parties to review project materials, explore interactive content, and provide feedback at their own convenience. This flexibility was especially valuable for busy residents, community leaders, and organizations who might otherwise be unable to participate due to scheduling conflicts or other commitments.

Through the Konveio site, ACWD was able to share up-to-date information about the WRMP, including background documents, technical reports, and summaries of key findings. The platform's interactive features allowed users to comment directly on specific sections of documents, respond to targeted questions, and participate in surveys and polls. This approach not only broadened the reach of the engagement effort but also fostered a more inclusive and representative dialogue, ensuring that a diverse range of voices could be heard and considered in the planning process.

To make the process as user-friendly as possible, ACWD created a handout document guiding people through use of the platform.

3. EMAIL DISTRIBUTION

To facilitate ongoing engagement, ACWD maintained a comprehensive email distribution list of interested parties (community members, organizational representatives, and previous workshop participants) ensuring that everyone who had expressed interest in the planning process remained informed and involved. A list of organizations represented by the interested parties who were contacted as part of outreach and participated in the WRMP process is included in **Appendix A**.

One of the first and most critical actions in Phase 2 was the distribution of an introductory email. This message, titled "Help Us Plan for the Future of Our Water Resources," set the tone for the next stage of engagement. The email accomplished several key objectives:

- Reintroducing the Planning Effort: The email began by reintroducing ACWD's integrated planning initiative, emphasizing the opportunity to "regroup, re-think, and re-imagine the future of water resources in our community." It acknowledged previous outreach and workshops, inviting recipients to continue their involvement as the process shifted toward long-term planning.
- Introducing New Engagement Tools: The email announced the forthcoming launch of an online public input tool.
- Providing Context and Vision: The message included a concise overview of the WRMP, describing its purpose as a roadmap for water supply reliability, resilience, and adaptation to climate change. It outlined the plan's 25-year planning horizon and its role in guiding infrastructure, investments, and policy decisions. The email also listed the plan's five goals, emphasizing reliability, affordability, resilience, healthy watersheds, and collaborative leadership.

Additionally, the email included a call to action: recipients were asked to fill out a survey indicating how they would like to participate in upcoming meetings. This approach respected respondent's time and preferences, aiming to make participation convenient and worthwhile. The email specified a deadline for responses and previewed the first two meetings, which would focus on water conservation/water use efficiency and watershed stewardship.

The information collected through the survey was instrumental in shaping the structure and content of the interested parties' meetings during Phase 2. By inviting people to indicate their preferred topics, meeting formats, and availability, the Core Team was able to organize separate sessions tailored to specific interests. This approach ensured that each meeting was relevant and convenient for participants, maximizing engagement and making the most of everyone's time. The feedback also helped the team identify which topics required deeper discussion and who was most invested in particular aspects of the WRMP, allowing for a more focused and productive dialogue throughout the planning process.

4. EXTENDED TEAM WORKSHOPS

The District established a dedicated Extended Team to provide technical insight, cross-departmental coordination, and strategic guidance throughout the planning process. This group, comprised of ACWD executive staff and subject matter experts from multiple departments, played a pivotal role in ensuring that water resources planning was integrated with the District's broader functions including infrastructure, operations, finance, and environmental stewardship.

The Extended Team met regularly, with in-person sessions held at ACWD's office on October 2, 2024; January 16, 2025; March 12, 2025; and July 23, 2025. A virtual session was also held on October 13, 2025. These workshops were structured to maximize the value of internal expertise and foster alignment across District departments. Prior to each session, participants received detailed agendas and supporting materials, enabling informed and focused discussions.

Meetings typically began with presentations of key information such as draft plan elements, updated data sets, or technical findings, followed by facilitated discussions and/or activities. These discussions explored data sources, interdependencies between water resources and other District functions, and the implications of proposed strategies. The Extended Team's feedback was documented by the Core Team and used to refine plan deliverables, validate assumptions, and ensure that the WRMP reflected both technical rigor and operational realities.

Each Extended Team workshop is summarized in the subsections below.

4.1 Future Supply Workshop (October 3, 2024)

The first workshop focused on information gathering and scenario planning for future baseline supply assumptions. The Extended Team reviewed the planning process and objectives, emphasizing the need to define how ACWD should approach future supply in light of new water use objectives and demand forecasts.

Scenario planning was a central theme, with participants discussing variables such as climate change, regulatory changes, operational factors, PFAS contamination, facility reliability, and catastrophic events. The team examined vulnerabilities for each major supply source (State Water Project, SFPUC Regional Water System, Del Valle Reservoir, and Niles Cone Groundwater Basin) considering how climate, regulations, water quality, aging infrastructure, and seismic risks could affect reliability. Critical data sources were identified, and the group debated which factors were within ACWD's control versus those requiring external coordination.

The meeting concluded with action items to refine assumptions and scenario frameworks for future analysis.

4.2 Supply Options Workshop (January 16, 2025)

This workshop was dedicated to reviewing and discussing water supply options and water resource strategies. The team examined a broad list of supply sources including imported water, local surface water, groundwater, ocean/bay water, and recycled water and considered each in terms of conveyance, storage, treatment, and distribution.

Rather than eliminating options, the team focused on documenting the rationale for future decisions and identifying conditions under which certain ideas might become feasible. Critical questions were raised about decision-maker awareness, feasibility factors, technical studies, and additional supply options.

Water supply options that included enhancing local groundwater, expanding imported water storage, leveraging regional partnerships, and exploring desalination and recycled water projects were discussed. Water resource strategies in topical areas of operations, watershed stewardship, and finance/affordability were also considered.

4.3 Portfolio Building Workshop (March 12, 2025)

For this workshop, the focus shifted to the approach for developing water supply portfolios and confirming evaluation criteria. The team reviewed Board-approved criteria including reliability, cost efficiency, regulatory risk, equity, stewardship, local control, regional leadership, resource leveraging, community benefits, and adaptability and discussed how these would guide comparative analysis of portfolios.

From an initial list of 44 supply options, the team consolidated and characterized 23 final options, evaluating each for volume, timing, infrastructure needs, and costs. Draft strategies were presented, spanning operational improvements, watershed stewardship, equity initiatives, and policy measures.

Portfolio-building activities engaged participants in brainstorming portfolio themes such as "Optimize Existing Supply," "Maximize Local Supply," and "Multiple Benefits." Small groups built portfolios around assigned themes, presenting their mixes of supplies and actions to the whole team. Individuals were also asked to create their own themed portfolios, incorporating ideas like operational simplicity, environmental impact, climate resilience, and community values.

4.4 Portfolio Evaluation Workshop (July 23, 2025)

This workshop focused on evaluating water supply portfolios. Participants received handouts detailing the water supply options contained within each portfolio, organized by themes such as increasing local reliance, improving imported water reliability, enhancing stewardship, and developing drought-resilient supplies.

Two key evaluation criteria were presented across all portfolios: reliability during drought (measured by shortage frequency/magnitude) and cost efficiency (measured by capital and operating costs).

Initial portfolio comparison highlighted tradeoffs: new supplies and facilities offered higher reliability but at greater cost, while banking and storage could improve reliability more cost-effectively. Projects without new storage or supplies risked shortages even under moderate climate change conditions.

Feedback from the Extended Team informed the structure of each portfolio, identified decision inputs for Board consideration, and clarified the implications of various water resource strategies.

4.5 Implementation Plan Workshop (October 13, 2025)

This workshop focused on developing the implementation plan for the selected portfolio. Participants walked through the format of the implementation schedule and spent the majority of the time providing feedback on the timing of individual project implementation tasks as well as implementation relationships across projects.

5. INTERESTED PARTIES MEETINGS

A broad spectrum of people, entities, and organizations whose work directly impacts water resources within the District's service area were engaged as Interested Parties throughout Phase 2 of the WRMP. These interested parties included city planners, parks and recreation staff, public works staff, sanitary districts, groundwater users, regulatory agency staff, ratepayer groups, school districts, elected officials' offices, and environmental organizations. Their involvement was essential for ensuring that the WRMP reflects the diverse needs, priorities, and expertise present in the community. A list of organizations represented by the interested parties who participated in the WRMP process is included in **Appendix A**.

In alignment with the Sustainable Groundwater Management Act (SGMA), ACWD, who is also the Groundwater Sustainability Agency for the Niles Cone Groundwater Basin, provided notices to all groundwater users and interested parties including relevant information to facilitate their engagement in both planning and implementation of the WRMP. Groundwater users and interested parties were specifically invited to participate in meetings whenever groundwater-related topics were on the agenda, such as the evaluation of supply options and their potential impacts on the groundwater basin.

Interested Parties meetings were organized around specialized agendas tailored to the expertise and interests of the invited entities. While participants did not have formal decision-making authority, their input was invaluable in providing data, collaborating on concepts, informing implementation, and reviewing documents. The meetings covered a range of topics, described in the subsections below.

Despite efforts to encourage participation through convenience and resource management, involvement in interested parties' meetings remained minimal, with less than 10 participants engaging consistently. Therefore, the core team decided to keep activities on Konveio open and available for participation throughout the process.

5.1 Watershed Stewardship Meeting (February 10, 2025)

The Watershed Stewardship Meeting convened a diverse group of representatives (local agencies, environmental organizations, regulatory bodies, and the Core Team) to discuss watershed challenges and strategies for adaptation and mitigation. 11 interested parties attended (excluding ACWD staff and consultants). The session focused on the impacts of changing precipitation patterns, wildfire, urban and agricultural runoff, surface water flows, and rising sea levels. Using the online engagement platform, the Core Team presented potential strategy impacts then asked participants to use online discussion boards to help identify other impacts and suggest strategies to help adapt or mitigate those impacts. Participants identified key issues such as increased erosion, flooding, degraded water quality, and impacts on habitat and infrastructure. Collaborative strategies were proposed, including interagency partnerships, floodplain improvements, enhanced stormwater management, erosion control, land acquisition for protection, and public education campaigns. The meeting emphasized the importance of resilient infrastructure, nature-based solutions, and ongoing monitoring to address evolving watershed conditions.

5.2 Conservation and Water Use Efficiency Meeting (February 10, 2025)

The Conservation and Water Use Efficiency Meeting brought together representatives from local agencies, water utilities, public works, and community members to discuss conservation programs, policy enforcement, and innovative approaches to water use efficiency. 7 interested parties attended (excluding ACWD staff and consultants). Using the online engagement portal, participants were asked to identify barriers to participation in existing programs using a digital bulletin board, share concerns and ideas about water use efficiency policies using virtual discussion boards, answer questions regarding their familiarity with Automated Metering Infrastructure via an online survey, and brainstorm new conservation ideas using the Lotus Flower method and a digital idea board. Feedback was provided on rebate programs for rain barrels and ultra-high efficiency toilets, with participants highlighting barriers such as installation challenges, product availability, and customer skepticism. The group stressed the importance of consistent policy enforcement and suggested ways to increase engagement with ACWD's Advanced Metering Infrastructure portal, including incentives and strategic messaging. New ideas included promoting flow and leak sensors, expanding educational outreach through contests and tutorial videos, and increasing support for greywater and rainwater collection systems. The meeting underscored the need for accessible resources, improved communication, and community-driven goals to advance water use efficiency.

5.3 Community and Equity Meeting (February 20, 2025)

The Community and Equity Meeting brought together representatives from local school districts, water agencies, and the Core Team to discuss equitable water service. 2 interested parties attended (excluding ACWD staff and consultants). Participants were asked to participate in an online discussion board around the question, "As it relates to our community and equity, what concerns do you have about ACWD's service as the water supplier?" and use a virtual bulletin board to brainstorm ideas around programs and solutions to enhancing community and equity. Participants emphasized the need to expand ACWD's revenue streams beyond rate payments and to strengthen partnerships with school districts to help manage costs and promote conservation. Proactive outreach strategies were discussed, including connecting with organizations that support low-income families and enhancing educational efforts about water careers and conservation. Ideas for improving rebate programs included direct install and on-bill financing, hardship waivers, and community water stations. The meeting also addressed more humane alternatives to water shutoffs, such as flow restrictors, and highlighted the importance of translation services and accessible program materials for diverse communities.

5.4 Portfolio Implementation Meeting (October 1, 2025)

The Portfolio Implementation Meeting brought together interested parties from local agencies, utilities, hospitals, schools, environmental organizations, and the Core Team to review the preferred portfolio selected by the ACWD Board of Directors and discuss the implementation phases of the portfolio which will be reflected in the WRMP. 20 interested parties attended (excluding ACWD staff and consultants). The selected portfolio's three phases were presented, and participants engaged in an interactive activity to provide comments and questions on specific projects. Using an online map as a virtual bulletin board, participants were asked to place virtual sticky notes on projects or areas to share questions, considerations, and/or concerns. Key topics included system-wide reliability, the impact of new agreements and infrastructure on local supply, expanded conservation programs, water quality improvements, adaptive triggers for future decisions, and contingency planning for invasive species and seismic events. The workshop emphasized the plan's adaptive approach, coordination with regional partners, and the importance of community feedback. Following the meeting, the online engagement portal was left open for additional input, though no further comments were received.

6. BOARD OF DIRECTORS MEETINGS

Throughout the development of the WRMP, the Board of Directors played a central role in guiding, reviewing, and ultimately approving the District's long-term water strategy. The Core Team maintained a transparent and collaborative relationship with the Board, providing regular updates and seeking feedback at key milestones. These meetings were open to the public, ensuring broad engagement and accountability.

The Board was kept informed through five major presentations, each designed to foster dialogue, share technical findings, and solicit input on ongoing work. The Core Team documented Board feedback and used it to refine plan deliverables, ensuring that the WRMP reflected both technical rigor and the District's operational realities. This iterative process culminated in a final request for Board approval, marking the completion of the planning phase.

6.1 Scoping the WRMP (October 24, 2024)

On October 24, 2024, the Board and Core Team convened to scope the WRMP. The meeting focused on the implications of new Urban Water Use Objective (UWUO) demand forecasts, which highlighted the need for enhanced water use efficiency to improve system reliability and reduce dependence on imported water. The Core Team presented the planning roadmap, reviewed the transition from Phase 1 to Phase 2, and emphasized the importance of synthesizing input from the public, interested parties, and the Board. Modeling results demonstrated that meeting UWUO targets would keep shortages below the District's 10% policy threshold and maintain sustainable groundwater elevations. The Board confirmed the proposed goals, planning objectives, and evaluation criteria, setting the stage for continued engagement and adaptation to regulatory requirements and future uncertainties.

6.2 Supply Options and Resource Strategies (February 6, 2025)

The February 6, 2025 meeting focused on reviewing and confirming the list of water supply options and water resource strategy areas. The Board was encouraged to reach consensus, ensuring that each director's priorities were represented. The distinction between supply options (projects generating new water supply) and resource strategies (initiatives supporting WRMP goals beyond supply, such as operational improvements and stewardship) was clarified. The Board reviewed a comprehensive list of supply options across supply types of imported water, local surface water, groundwater, ocean and bay water, recycled water, and conservation measures and discussed resource strategies to improve resilience, stewardship, and policy leadership.

6.3 Portfolio Concepts and Planning Objectives (May 29, 2025)

On May 29, 2025, the Core Team presented the baseline reliability analysis which modeled three potential future condition scenarios with increasing levels of climate change and regulatory impacts to external storage. The modeling results revealed that the base case ("do nothing") portfolio may not meet reliability thresholds under both moderate and more severe future conditions. The Board reviewed the portfolio building process and discussed five thematic initial portfolio concepts:

- Expand Local Groundwater
- Maximize Local Groundwater
- Minimize Operational Complexity
- Regional Focus
- Stewardship Focus

Board members provided feedback focused on enhancing water supply reliability, emphasizing local control, affordability, and contingency planning. Directors expressed opinions on desalination, recycled water, groundwater banking, and the need to document long-term scenarios and triggers for future decision-making.

The workshop also highlighted recent interested party engagement and set the direction for continued modeling, refinement, and engagement.

6.4 Portfolio Evaluation and Selection (August 28, 2025)

On August 28, 2025, the Board convened to evaluate and select the preferred portfolio for implementation planning. The technical team presented an evaluation matrix assessing portfolios against the documented evaluation criteria, and then focused on three priority evaluation criteria: reliability, local control, and cost efficiency. A series of charts were used to demonstrate the tradeoffs between different combinations of the three priority evaluation criteria. The analysis revealed that increased banking and storage were cost-effective strategies, while portfolios with significant new supply investments offered the highest reliability under severe conditions but at greater cost. Portfolio 3 ("Increase Local Reliance & Internal Banking") and Portfolio 8 ("Increased Environmental Stewardship") were highlighted for their strengths and tradeoffs. Staff presented a recommend Portfolio 12 (composed of three phases), designed to layer investments and address evolving risks, with each phase building upon the previous and achieving zero shortage frequency in reliability modeling.

The Board engaged in robust discussion about tradeoffs between reliability, cost, and local control, raising questions about investment strategies and public willingness to pay for higher reliability. The importance of monitoring, trigger frameworks, and adaptive pathways was emphasized for guiding future investments.

6.5 Portfolio Implementation (November 20, 2025)

On November 20, 2025, the Board convened to review the implementation planning phase for the WRMP. The meeting centered on translating the selected portfolio into a practical, phased implementation schedule. Presenters outlined the alignment between WRMP goals and the recommended suite of projects and policies, emphasizing the District's commitment to sustainable supply, affordability, infrastructure resilience, watershed health, and collaborative regional management. The Board examined high-level steps for each project, relationships among projects, and the timing of implementation tasks, with particular attention to decision points shaped by customer demand, water quality, regulatory requirements, and funding opportunities.

Discussion focused on the adaptive nature of the implementation plan, which incorporates regular progress reviews and the flexibility to revisit strategies as conditions evolve. The Board considered internal and external drivers including policy choices, technological advancements, and regional water reliability, that will inform future decisions. The meeting concluded with a preview of the WRMP document and next steps, reaffirming the District's commitment to transparency, community engagement, and ongoing evaluation.

7. PUBLIC ENGAGMENT

The Public Opinion Poll (Phase 1, see **Section 1.2**) showed that the public had limited interest in plan engagement but did want to be informed at regular intervals on the progress. While the WRMP involves a public review and comment period on a Public Draft and their input was welcome in the process, the majority of communication with the public was providing information via existing ACWD outreach strategies.

The public had access to information via the website, public input tools, and public Board of Directors meetings. ACWD's website houses a webpage with general information about the plan. The public had the opportunity to sign up for an email distribution list to be notified whenever new information was added to the public input tool. Any member of the public who was interested was able to sign up to the public opinion poll and participate in the online activities.

8. CONCLUSION

The outreach and engagement efforts detailed in this summary demonstrate ACWD's commitment to transparency, collaboration, and responsiveness in long-term water resources planning. By leveraging a variety of engagement platforms and mechanisms, ACWD successfully involved a broad spectrum of representatives in shaping the WRMP, ranging from technical experts and interested parties to the general public and Board of Directors.

Though the number of participants was lower than the team had hoped, the feedback that was provided was extremely valuable. The process fostered meaningful dialogue, surfaced innovative ideas, and built consensus around key challenges and opportunities. Workshops and meetings enabled participants to contribute data, share expertise, and provide feedback on supply options, resource strategies, and portfolio concepts. The use of online tools and targeted communications lowered barriers to participation and broadened the reach of engagement efforts.

Ultimately, the input gathered through these activities informed the development and evaluation of water supply options, ensuring that the WRMP reflects both technical rigor and community values. The plan is positioned to guide ACWD toward a resilient, equitable, and sustainable water future, with ongoing community involvement and adaptive management as central pillars of its implementation.

APPENDIX A: INTERESTED PARTIES LIST

Representatives of the following agencies/organizations participated in the WRMP process:

Phase 1:	Phase 2:
• Alameda County Board of Supervisors • Alameda Creek Watershed Forum • Bay Area Water Supply & Conservation District • Boehringer Ingelheim • California Department of Fish and Wildlife • California State Assembly • City of Fremont • City of Hayward (2 people) • City of Newark (2 people) • City of Union City • East Bay Municipal Utility District • East Bay Park Regional Park District (3 people) • Fremont Family Resource Center • Metro Transportation Commission • Nature Learning Center • Newark Unified School District • Regional Water Quality Control Board (2 people) • San Francisco Public Utilities Commission • Spectrum Community Services • Union Sanitary District (2 people) • Valley Water • Zone 7 Water Agency	• Alameda County Board of Supervisors • Alameda Creek Alliance • California Department of Fish and Wildlife • California Sportfishing Protection Alliance • City of Fremont (3 people) • City of Newark • East Bay Municipal Utility District (4 people) • Math Science Nucleus • Newark Unified School District (2 people) • Private Citizen • Quarry Lakes • San Francisco Bay Regional Water Quality Control Board • San Francisco Public Utilities Commission (2 people) • Senator Wahab's Office • Sierra Club of California • Union City Public Works • Union Sanitary District (5 people) • Washington Hospital (2 people) • Zone 7 Water Agency (2 people)

APPENDIX B
DEMAND FORECASTING

ALAMEDA COUNTY WATER DISTRICT
WATER RESOURCES MASTER PLAN 2050

TECHNICAL MEMORANDUM

TO: Thomas Niesar, Alameda County Water District (ACWD)

PREPARED BY: Chris Hewes & Max McNally, Woodard & Curran

REVIEWED BY: Katie Cole, Woodard & Curran

DATE: June 19, 2025

RE: Demand Forecasting for ACWD's Water Resources Master Plan 2050 (Phase 2, Task 3 - Demand Forecasting)

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ACRONYMS AND ABBREVIATIONS

ABAG	Association of Bay Area Governments
ACS	American Community Survey
ACWD	Alameda County Water District
CII	Commercial, Institutional, and Industrial
CIMIS	California Irrigation Management Information System
DIM	dedicated irrigation meter
DSS	Least Cost Planning Decision Support System
DWR	Department of Water Resources
GPCD	gallons per capita per day
IRP	Integrated Resources Plan
LAM	Landscape Area Measurement
LEF	Landscape Efficiency Factor
LEHD	Longitudinal Employer-Household Dynamics
mgd	million gallons per day
NAICS	North American Industry Classification System
PPH	Persons-per-household
RHNA	Regional Housing Needs Assessment
SLA	Special Landscape Area
SWRCB	State Water Resources Control Board
TM	Technical Memorandum
UWMP	Urban Water Management Plan
UWUO	Urban Water Use Objective
WEMP	Water Efficiency Master Plan
WRMP	Water Resources Master Plan

1. INTRODUCTION

Alameda County Water District (ACWD) is undertaking an update to its 1995 Integrated Resources Plan (IRP). Since the IRP was adopted nearly 30 years ago, the District has experienced many changes that warrant an updated look at the future of its water supply. The updated Water Resources Master Plan (WRMP) 2050 will serve as a long-range planning document that outlines the District's water supply strategy and informs other aspects of District planning. The goal of the WRMP is to inform critical decision making on future infrastructure and water supply investments by providing valuable information about the District's future resilience in the face of known uncertainties, such as climate change and changing regulations. This plan will create a roadmap for water supply reliability by analyzing changing conditions and the communities we serve – now and in the future.

This technical memorandum (TM) details the baseline demand forecasting analysis. In the context of the WRMP 2050, this analysis is used to estimate a supply gap forecast which helps inform the development of the water supply options, water resource strategies, and the portfolios.

1.1 Baseline Demands: Maddaus Water Management's Least Cost Planning Decision Support System (DSS) Model

Since beginning work on the 2020 Water Efficiency Master Plan (WEMP), Alameda County Water District (ACWD or the District) has used the Least Cost Planning Decision Support System (DSS) Model (proprietary software developed by Maddaus Water Management) to prepare its long-range, annual water demand projections. This forecasting methodology incorporated the most up to date "land use planning information, water use trends, economic projections, survey data on current and future water use collected from the District's single family residential customers, regional population and jobs projections, policies affecting water utilization, and water use efficiency from plumbing code changes" (ACWD, 2021a). ACWD adopted the same baseline water demand forecast for its 2020 Urban Water Management Plan (UWMP). The assumptions behind the DSS Model projections are summarized further in **Section 2**.

This baseline demand projection includes water savings from a portfolio of water conservation measures designed to reduce unconstrained water demand, referred to as Strategy B, which was approved by ACWD's Board of Directors in April 2021.

1.2 Updated Direction on Incorporating Consideration of Urban Water Use Objectives

At the September 12, 2024 ACWD Board of Directors meeting, District staff presented on the newly adopted "Making Conservation a California Way of Life" regulations and their impact on ACWD's existing water demand forecast. Effective January 1, 2025, urban water suppliers must adhere to calculated urban water use objectives (UWUO) set forth by the State Water Resources Control Board (SWRCB). UWUOs have been established for the following water use categories: indoor Residential, outdoor Residential, Commercial, Industrial, and Institutional (CII) landscapes with dedicated irrigation meters (DIMs), and water loss. These requirements are discussed in further detail in **Section 3**.

Upon reviewing the existing DSS Model forecast, staff concluded that the District would not be able to comply with the State's UWUO starting in 2035. Furthermore, staff determined that the District's degree of noncompliance will increase further in 2040, given the tightening nature of the objectives. The repercussions for noncompliance include daily financial penalties (which increase tenfold during droughts) and other disincentives such as information orders, conservation orders, monthly reporting orders, and civil liability.

Therefore, the Board of Directors has instructed ACWD staff to refine its water demand forecast to satisfactorily meet future UWUOs. The revised demand forecast that takes into consideration the UWUO is described further in **Section 4**.

2. BASELINE DEMAND PROJECTION

2.1 DSS Model Overview

2.1.1 Background

Using the DSS Model, ACWD staff developed baseline demand projections for 11 demand sectors that include Single-Family Residential, Multifamily Residential, Multifamily Landscape, Business, Business Landscape, Industrial, Industrial Landscape, Institutional and Other, Institutional and Other Landscape, Hydrant and Legacy Fireline Demand, and Non-Revenue Water. While the DSS Model considers these 11 sectors, the UWUOs only pertain to four categories: Residential Indoor, Residential Outdoor, CII Landscapes with DIMs, and Water Loss. **Table 1** shows the linkage between which demand sectors are considered part of the UWUO and which are not.

TABLE 1: DEMAND SECTORS VS UWUO CATEGORIES

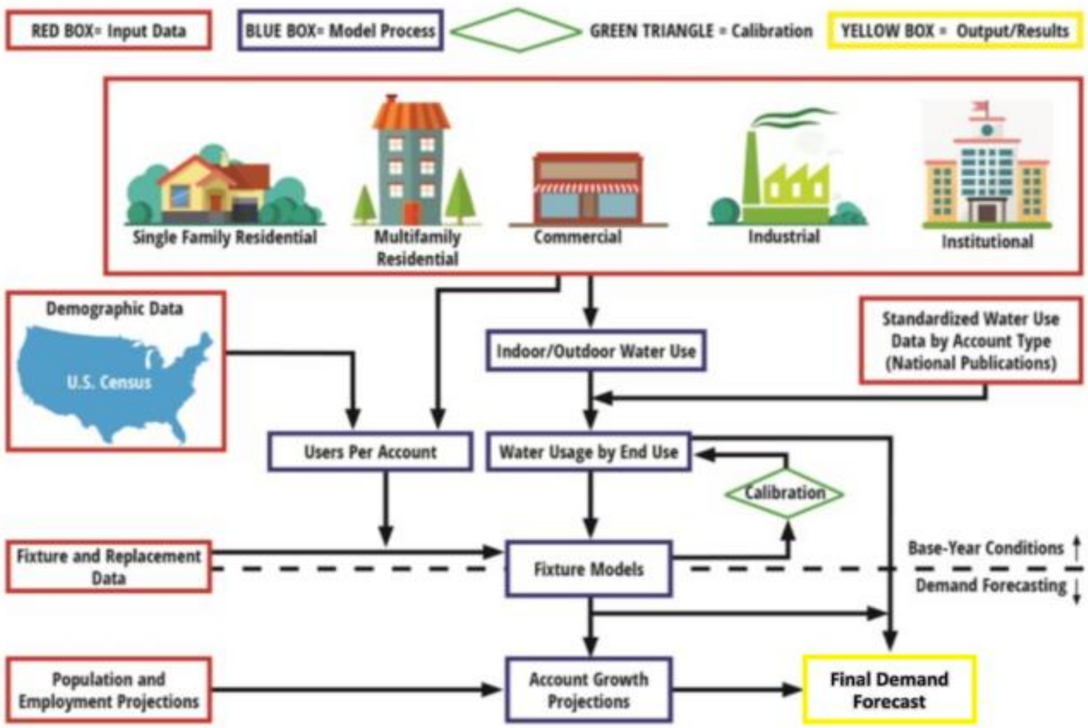
ACWD Demand Sector	UWUO Category
Single-Family Residential Multifamily Residential Multifamily Landscape	Residential Indoor + Residential Outdoor
Business Industrial Institutional Other	*Not included in the UWUO*
Business Landscape Industrial Landscape Institutional and Other Landscape	CII Landscapes with DIMs
Hydrant and Legacy Fireline Demand	*Not included in the UWUO*
Non-Revenue Water	Water Loss *(covers only Real Losses portion of Non-Revenue Water)*

Future demand growth is ultimately driven by projections of population and/or job growth (described further in **Section 2.1.2**). ACWD's baseline demand projection begins by gathering billed consumption data to characterize water usage for each customer category and generate unit demand factors that align with future demand drivers (e.g., volume per person or volume per job).

The DSS Model considers multiple water conservation factors to adjust the baseline demand, including both passive effects (i.e., natural fixture replacement due to plumbing code) as well as active conservation efforts by ACWD (e.g. rebate programs, outreach and education, etc.). State and federal plumbing codes and appliance standards are modeled by customer category, yielding two demand forecasts: one with conservation and one without conservation.

Ultimately, this approach provides a detailed modeling framework for assessing the impact of water efficiency measures on future water demands. Furthermore, the DSS Model can quantify additional demand reductions, if needed during a water shortage, by increasing targets within individual conservation measures. A flowchart outlining the DSS Model's methodology is depicted in **Figure 1.**

FIGURE 1: DSS MODEL OVERVIEW



Source: Figure 3-1 of the 2020 WEMP (ACWD, 2021b)

A summary of the various inputs to the DSS Model (both historical data and estimated or calculated inputs) are shown in **Table 2**.

TABLE 2: DSS MODEL ESTIMATED AND HISTORICAL INPUTS

Historical Model Inputs	Estimated/Calculated Model Inputs
• Water supplies, 1986 - 2019 • Water demands, 1986 – 2019 • Population, 1995 – 2019 • Jobs, 1995 – 2019 • Conservation program participation	Provided by ACWD: • Number & type of fixtures in service area • Population forecast • Jobs forecast • Conservation program savings amounts Provided or calculated by DSS Model: • Fixture market shares for replacement • Fixture replacement rates • Water use proportions by end-use type • Population split by residential category • Non-revenue water percentage • Indoor/outdoor water split • Jobs split by employment sector • Non-revenue water percentage

2.1.2 Population and Jobs Forecast

Population and job growth data are primarily sourced from the Association of Bay Area Governments' (ABAG) Regional Housing Needs Assessment (RHNA) report, the *Final Regional Housing Need Plan for the San Francisco Bay Area: 2015-2023,* and long-range regional plan, *Plan Bay Area 2050*. This input step is represented by the Population and Employment Projections box depicted in **Figure 1**.

Through 2040, ACWD derives its population and job forecasts from anticipated growth outlined in ABAG's RHNA projections. However, for its 2045 and 2050 forecasts, ACWD adopts the growth projections from *Plan Bay Area 2050*. The District opted for this approach to avoid overly aggressive short-term forecasts and to instead align demand projections for the 2020 UWMP's 20-year planning horizon with historically observed growth rates from 1995 to 2019. After 2040, the growth in population and jobs realigns with *Plan Bay Area 2050*'s regional projections, creating a sharp uptick at the end of the demand forecasting period.

ACWD's population forecast was calculated by multiplying the anticipated number of new housing units by an initial persons-per-household (PPH) value provided by the California Department of Finance. In 2020, ACWD's service area had a PPH of 3.13. Gradually, the PPH value is adjusted so that the weighted average of new and old PPH values linearly approaches the Bay Area average of 2.8 PPH by 2045. The PPH is anticipated to decline because all new housing in ACWD's service area is assumed to be Multifamily Residential (ACWD, 2021b).

To determine the initial population split between Single-Family and Multifamily Residential Maddaus Water Management used American Community Survey (ACS) data for Fremont, Union City, and Newark along with historical billing data. After correcting for discrepancies between ACWD's billing practices and ACS designations, the final population split was calculated as 65.3% for Single-Family Residential, 34% for Multifamily Residential, and 0.7% for Institutional populations (Maddaus Water Management, Inc., 2024). This input step is visualized by the Demographic Data box of the flowchart displayed in **Figure 1**.

2.1.3 Unconstrained Demand Forecast

Using the projected population and jobs, the DSS Model generates an initial water demand forecast. This unconstrained demand volume does not consider potential water savings achieved via conservation measures. At its core, unconstrained demand is calculated by multiplying baseline unit demand factors (e.g., volume per person or volume per job) by future demand drivers (e.g., population or job growth). The unconstrained demand forecast is represented across multiple inputs (e.g. sector icons and "Users per Account") in the flowchart found in **Figure 1**.

The DSS Model demand projection includes the application of a climate change factor of 2.58% increase in water demand between years 2025 through 2050 (Maddaus Water Management, Inc., 2022).

Finally, a non-revenue water factor that scales with population growth is added on top of all demands (more details in **Section 2.4**).

2.1.4 Passive Water Savings

For each sector, unconstrained demands are broken down into one of several end uses listed below, based on data collected from various national studies that are compiled in the DSS Model. This is visualized by the "Standardized Water Use Data by Account Type" and "Water Usage By End Use" boxes found in the flowchart presented in **Figure 1**.

- Toilets
- Urinals
- Showers
- Baths
- Lavatory Faucets
- Process
- Non-Lavatory/Kitchen Faucets
- Dishwashers
- Kitchen Spray Rinse
- Clothes Washers
- Internal Leakage
- External Leakage
- Cooling
- Irrigation
- Outdoor
- Pools
- Car Washing
- Wash Down
- Other

The DSS Model then accounts for the anticipated volume of passive water savings (i.e., from fixture replacements due to plumbing codes). This analysis is driven by three rates for each type of water fixture:

- Rate of breakage – the inverse of a fixture's natural lifespan expressed as a percentage (i.e., a fixture type with a lifespan of 10 years would have a replacement rate of 10% per year).
- Rate of new installs – the rate at which new, water-efficient fixtures are installed in new construction.
- Rate of replacement installs – the rate at which new, water-efficient fixtures are installed in existing structures to replace old, water-inefficient fixtures.

The forecasted number of total fixtures is assessed by taking the previous year's total, subtracting the number of fixtures anticipated to be replaced based on the rate of breakage, and adding the number of new install and replacement install fixtures. The quantity and type of new/replacement installs is scaled by the market share of a given fixture type, which is informed by plumbing code requirements (e.g., inefficient 3.5 gallon per flush toilets being replaced by models that use 1.6 or 1.28 gallons per flush). This is visualized by the "Fixture and Replacement Data" and "Fixture Models" boxes found in the flowchart presented in **Figure 1**.

Once the number of each fixture type is determined for a given year, the DSS Model then calculates the level of water savings. Passive water savings are estimated by taking the actual volume of water used by each fixture type and multiplying by the difference between the distribution of fixture types in the year of interest and the start year. This volume accounts for the passive savings accrued that year and is subtracted from the unconstrained demand total.

2.1.5 Active Conservation Savings

The DSS Model includes projected water savings estimates for conservation programs implemented by ACWD. A significant component of the 2020 WEMP included evaluation of different portfolios of water conservation measures, considering a range of factors such as volume of savings, market potential, cost and cost-benefit metrics, etc. Ultimately, ACWD's Board elected to pursue "Strategy B" for the short term (five years 2020-2025). Strategy B includes a variety of measures ranging from outdoor efficiency (surveys, online landscape water budgets, incentives), to CII (surveys and rebates), to incentives for high-efficiency fixtures for both residential and CII properties.

For each active conservation measure, the DSS Model includes assumptions about water savings rates, lifetime of savings, and which end uses the measure impacts, among other factors. Together, the estimated water savings from active programs combine with passive savings to reduce the unconstrained demands.

2.2 Residential

The residential sector accounts for the largest portion of ACWD's total demands. The DSS Model calculates residential projections based upon the anticipated population of the Single-Family Residential and Multifamily Residential customer sectors. While the DSS Model disaggregates use for each sector into indoor and outdoor estimates, this is primarily used for the purpose of calculating passive and active savings. Separately, ACWD approximates the split between indoor and outdoor residential water use, assuming indoor use to be roughly equal to the minimum use in the winter when outdoor usage is depressed (ACWD, 2021b). This is known as the minimum month method and results in a 70% indoor and 30% outdoor split.

2.2.1 Residential Indoor

The residential indoor projection is calculated by multiplying the sum of projected consumption from Single-Family Residential, Multifamily Residential, and Multifamily Landscape by 70%.

Table 3 summarizes the residential indoor projection from 2025 to 2049.

TABLE 3: RESIDENTIAL INDOOR PROJECTIONS (MGD)

Fiscal Year Starting	Total Residential Indoor Use
2025	16.09
2030	15.94
2035	16.00
2040	16.17
2045	16.37
2049	17.77

2.2.2 Residential Outdoor

The residential indoor projection is calculated by multiplying the sum of projected consumption from Single-Family Residential, Multifamily Residential, and Multifamily Landscape by 30%.

Table 4 summarizes the residential outdoor projections from 2025 to 2049.

TABLE 4: RESIDENTIAL OUTDOOR PROJECTIONS (MGD)

Fiscal Year Starting	Total Residential Outdoor Use
2025	6.90
2030	6.83
2035	6.86
2040	6.93
2045	7.01
2049	7.62

2.3 Commercial, Institutional, Industrial Landscapes with Dedicated Irrigation Meters

The DSS Model calculates the CII landscapes with DIMs projection which applies to all non-residential ACWD accounts categorized as Business Landscape, Industrial Landscape, and Institutional and Other Landscape. Using a historical billing data baseline from 2017 to 2023 and the Census Bureau's Longitudinal Employer-Household Dynamics (LEHD) program for job projections, Maddaus Water Management split and scaled anticipated job growth by sector to forecast the outdoor demands for each customer sector. The jobs in ACWD's boundary were categorized using a mapping from their North American Industry Classification System (NAICS) codes to ACWD location classes (business, industrial, or institutional/other) in the most recently reported year at the time of model development, 2021. The final split was 60% business, 31% industrial, and 9% institutional/other (Maddaus Water Management, Inc., 2024).

Table 5 summarizes the CII landscape with DIMs projections from 2025 to 2049.

TABLE 5: CII WITH DIMS PROJECTIONS (MGD)

Fiscal Year Starting	Business Landscape	Institutional and Other Landscape	Industrial Landscape	Total CII Landscape Demand
2025	0.96	0.83	0.81	2.59
2030	1.00	0.81	0.84	2.65
2035	1.06	0.82	0.90	2.78
2040	1.13	0.85	0.96	2.95
2045	1.22	0.89	1.03	3.14
2049	1.27	0.97	1.07	3.31

2.4 Water Loss

The DSS Model calculates a non-revenue water value that is based on the historical percentage difference between production and consumption. The percent non-revenue water is applied to future demands based on the projected population increase.

Note that for the purpose of this technical memorandum, the existing/"as-is" projection of non-revenue water from the DSS Model was replaced with alternate assumptions for future water loss to match how it is being projected for the UWUO (see **Section 3.4**). **Table 6** compares the original non-revenue water projection to the updated water loss projection from 2025 to 2049.

TABLE 6: WATER LOSS PROJECTIONS (MGD)

Fiscal Year Starting	Non-Revenue Water from DSS Model	Updated Water Loss Projection
2025	3.04	2.28
2030	3.09	2.29
2035	3.16	2.31
2040	3.23	2.32
2045	3.30	2.42
2049	3.55	2.44

2.5 Total Demands

The total water demand produced by the DSS model for categories that align with the UWUO is shown in **Table 7**. These baseline demands are compared to individual water budgets from the UWUO in **Section 4.**

Additionally, the total demand for the sectors not regulated by the UWUO is tabulated in **Table 8**. Total baseline demand from both UWUO-related and non-UWUO components is summarized in **Table 9**.

TABLE 7: TOTAL BASELINE DEMANDS FROM DSS MODEL THAT ARE RELEVANT TO THE URBAN WATER USE OBJECTIVE (MGD)

Fiscal Year Starting	Residential Indoor	Residential Outdoor	CII with DIMs	Water Loss[1]	Total
2025	16.09	6.90	2.59	2.28	27.86
2030	15.94	6.83	2.65	2.29	27.72
2035	16.00	6.86	2.78	2.31	27.95
2040	16.17	6.93	2.95	2.32	28.38
2045	16.37	7.01	3.14	2.42	28.94
2049	17.77	7.62	3.31	2.44	31.14

Note: 1. Water Loss was calculated separately from the DSS Model, see ***Section 2.4****.*

TABLE 8: TOTAL BASELINE DEMANDS FROM DSS MODEL THAT ARE NOT RELEVANT TO THE URBAN WATER USE OBJECTIVE (MGD)

Fiscal Year Starting	Business	Industrial	Institutional and Other	Hydrant and Legacy Fireline	Non-Revenue Water[1]	Total
2025	4.11	2.15	1.14	0.13	0.77	8.29
2030	4.33	2.27	1.17	0.13	0.80	8.69
2035	4.57	2.40	1.19	0.13	0.85	9.14
2040	4.75	2.49	1.22	0.14	0.91	9.50
2045	4.93	2.59	1.24	0.14	0.88	9.78
2049	5.08	2.67	1.35	0.15	1.11	10.37

Note: 1. Non-Revenue Water excludes Real Losses, which are regulated by the UWUO and accounted for in the Water Loss category.

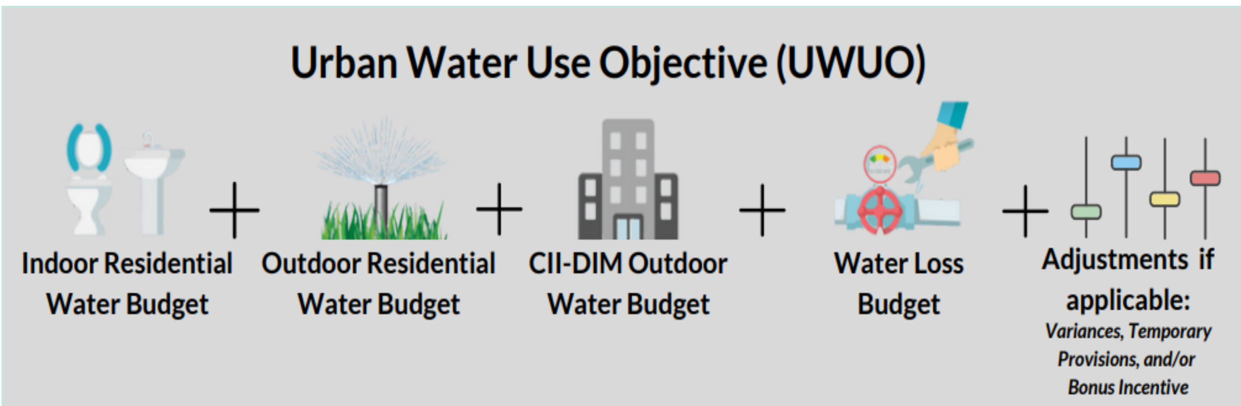
TABLE 9: TOTAL BASELINE DEMANDS FROM THE DSS MODEL – UWUO AND NON-UWUO

Fiscal Year Starting	Demand from UWUO Categories	Other Non-UWUO Demands	Total
2025	27.86	8.29	36.15
2030	27.72	8.69	36.41
2035	27.95	9.14	37.09
2040	28.38	9.50	37.88
2045	28.94	9.78	38.72
2049	31.14	10.37	41.51

3. URBAN WATER USE OBJECTIVE PROJECTION

In 2024, the California State Water Resources Control Board (SWRCB) adopted the "Making Conservation a California Way of Life" regulations, which become effective January 1, 2025. A key component of the regulation involves the calculation of an UWUO which is defined as "an estimate of aggregate efficient water use for the previous year based on adopted water use efficiency standards and local service area characteristics" (SWRCB, 2024). While the objective is broken up in several components, ACWD is only required to meet the objective at an aggregate level. The four water use categories regulated by the UWUO are displayed in **Figure 2**. Each component of the UWUO is described in the sections below.

FIGURE 2: URBAN WATER USE OBJECTIVE



Source: (CalWEP, 2023)
Note: ACWD does not anticipate using adjustments or variances.

3.1 Residential Indoor

The residential indoor standard applies to both single-family and multifamily properties and is applied as a per capita per day metric (gallons per capita per day, or GPCD) that decreases over time. The calculation of the standard is shown in the equation below. **Table 10** shows how the standard becomes more restrictive through time.

$$Residential\ Indoor\ Standard = [Per\ Capita\ per\ Day\ Standard] * [Population]$$

TABLE 10: RESIDENTIAL INDOOR STANDARD

Fiscal Years Starting	Allowable GPCD
2020-2024	55
2025-2029	47
2030 Onward	42

The projected residential indoor standard and resulting water budget for ACWD is shown in **Table 11**.

TABLE 11: RESIDENTIAL INDOOR STANDARD & WATER BUDGET

Fiscal Year Starting	Population	Standard (GPCD)	Water Budget (mgd)
2024	344,000	55.0	18.92
2025	346,000	47.0	16.26
2030	353,000	42.0	14.78
2035	359,000	42.0	15.08
2040	365,000	42.0	15.33
2045	375,000	42.0	15.75
2049	406,000	42.0	17.05

3.2 Residential Outdoor

The residential outdoor standard applies to both single-family and multifamily properties and is applied as a landscape efficiency factor (LEF) that decreases over time. The residential outdoor water budget is calculated by multiplying the LEF by values including irrigated square footage and local climate factors, as shown in the equation below:

$$Residential\ Outdoor\ Water\ Budget = LAM * LEF * \left(ET_O - P_{eff}\right) * 0.62$$

Where:

- LAM – Landscape Area Measurement (square feet (SF)) which be broken down into multiple sub-components:
  - Irrigable-Irrigated
  - Irrigable-Not-Irrigated
  - Residential Special Landscape Areas (SLA) – defined by the regulation as residential pools, spas, and similar water features, residential areas dedicated solely to edible plants, and residential areas irrigated with recycled water
  - New Construction
- LEF – Landscape Efficiency Factor (unitless), also known as the outdoor residential standard, which differs based on the types of landscape categories (see **Table 12**)
- ET_0 – Reference Evapotranspiration (inches per year)

- P_{eff} – Effective Precipitation (inches per year)
- 0.62 – Conversation Factor to generate units in gallons per year

Table 12 shows the different standards for the various LAM types, as well as how the standard becomes more restrictive through time.

TABLE 12: RESIDENTIAL OUTDOOR STANDARD

Fiscal Year Starting	Irrigable-Irrigated	Irrigable-Not-Irrigated	Special Landscape Areas	New Construction
2025	0.80	0.80	1.0	0.55
2035	0.63	0.63		
2040	0.55	0.55		

The Department of Water Resources (DWR) provided estimates of residential LAM to every urban retail water supplier based on 2018 aerial imagery that was processed by DWR's consultant (DWR, 2023). ACWD's 2018 LAM included:

- 174,502,793 SF of Irrigable-Irrigated landscape
- 51,574,794 SF of Irrigable-Non-Irrigated landscape
- 1,264,297 SF of existing pools, spas, and similar water features – ACWD has opted to not include this residential Special Landscape Areas in the calculation of the residential outdoor urban water use objective.

At the time of this TM's development, ACWD has not estimated the area of new residential landscape installed from 2019 – 2024 (New Construction), which is the time between when the LAM aerial imagery was captured and when the regulation becomes effective in 2025.

To estimate the expected growth in residential landscape area from 2025 and beyond, the 2018 Irrigable-Irrigated landscape area was escalated by an annual growth factor equal to the projected annual percent increase in residential consumption (as described in **Section 2.2**).

Note that the total projected residential consumption includes the impact of passive and active conservation which is why total residential demands remain nearly flat for an extended period of time, despite continued growth in population. While it's possible new residential landscapes will be built between now and 2034, ACWD expects that a large share of population growth will be accommodated by redevelopment and infill which will likely be represented by either a decrease in irrigated residential landscape area or a like-for-like replacement. Thus, scaling new residential landscape area growth with total residential demands is considered a conservative approach that is appropriate for purpose of high-level planning projections.

The projected residential outdoor standard and resulting water budget for ACWD is shown in **Table 13**.

TABLE 13: RESIDENTIAL OUTDOOR STANDARD & WATER BUDGET

Fiscal Year Starting	Residential Irrigable-Irrigated (Existing)		Residential Irrigable-Not-Irrigated (Existing)		Residential Irrigable-Irrigated (New Construction)			Water budget (mgd)
	Standard	*Square Feet*	*Standard*	*Square Feet*	*Standard*	*% Annual Increase in Residential Outdoor Consumption*	*Square Feet*	
2024	0.80	174,502,793	0.80	51,574,794	0.55	0.0%	-	10.25
2025	0.80	174,502,793	0.80	51,574,794	0.55	<0.1%	6,085	10.25
2026	0.80	174,502,793	0.80	51,574,794	0.55	<0.1%	22,839	10.25
2027	0.80	174,502,793	0.80	51,574,794	0.55	<0.1%	41,155	10.25
2028	0.80	174,502,793	0.80	51,574,794	0.55	<0.1%	60,874	10.25
2029	0.80	174,502,793	0.80	51,574,794	0.55	<0.1%	83,086	10.25
2030	0.80	174,502,793	0.80	51,574,794	0.55	<0.1%	106,430	10.26
2031	0.80	174,502,793	0.80	51,574,794	0.55	<0.1%	133,199	10.26
2032	0.80	174,502,793	0.80	51,574,794	0.55	0.1%	161,011	10.26
2033	0.80	174,502,793	0.80	51,574,794	0.55	0.1%	189,770	10.26
2034	0.80	174,502,793	0.80	51,574,794	0.55	0.1%	220,421	10.26
2035	0.63	174,502,793	0.63	51,574,794	0.55	0.1%	251,860	8.08
2036	0.63	174,502,793	0.63	51,574,794	0.55	0.1%	284,017	8.08
2037	0.63	174,502,793	0.63	51,574,794	0.55	0.1%	316,396	8.08
2038	0.63	174,502,793	0.63	51,574,794	0.55	0.2%	348,969	8.09
2039	0.63	174,502,793	0.63	51,574,794	0.55	0.2%	382,481	8.09
2040	0.55	174,502,793	0.55	51,574,794	0.55	0.2%	416,149	7.06
2041	0.55	174,502,793	0.55	51,574,794	0.55	0.2%	449,950	7.06
2042	0.55	174,502,793	0.55	51,574,794	0.55	0.3%	484,265	7.07
2043	0.55	174,502,793	0.55	51,574,794	0.55	0.3%	519,048	7.07
2044	0.55	174,502,793	0.55	51,574,794	0.55	0.3%	554,259	7.07
2045	0.55	174,502,793	0.55	51,574,794	0.55	0.3%	589,859	7.07
2046	0.55	174,502,793	0.55	51,574,794	0.55	0.5%	840,771	7.08

Fiscal Year Starting	Residential Irrigable-Irrigated (Existing)		Residential Irrigable-Not-Irrigated (Existing)		Residential Irrigable-Irrigated (New Construction)			Water budget (mgd)
	Standard	*Square Feet*	*Standard*	*Square Feet*	*Standard*	*% Annual Increase in Residential Outdoor Consumption*	*Square Feet*	
2047	0.55	174,502,793	0.55	51,574,794	0.55	0.6%	1,091,634	7.09
2048	0.55	174,502,793	0.55	51,574,794	0.55	0.7%	1,342,681	7.10
2049	0.55	174,502,793	0.55	51,574,794	0.55	0.9%	1,593,869	7.11

Assumptions:

- ET_0 assumes 45.5” based on the average observed across 2017-2023 at California Irrigation Management Information System (CIMIS) Station 171 at Town Estates Park in Union City
- P_{eff} assumes18.4” of average annual precipitation across 2017-2023 at CIMIS Station 171

3.3 Commercial, Institutional, Industrial Landscapes with Dedicated Irrigation Meters

The Commercial, Institutional, and Industrial (CII) Landscapes with Dedicated Irrigation Meters (DIMs) standard applies only to CII properties that have a dedicated meter tracking outdoor irrigation use. Similar to residential outdoor, the standard is applied as a LEF that decreases over time. The CII with DIMs water budget is calculated by multiplying the LEF by values including irrigated square footage and local climate factors, as shown in the equation below:

$$CII\ with\ DIMs\ Water\ Budget = LAM * LEF * \left(ET_O - P_{eff}\right) * 0.62$$

Where:

- LAM – Landscape Area Measurement (square feet (SF)) which be broken down into multiple sub-components:
  - SLAs – defined more thoroughly in the regulation and California Water Code Section 491, but notably includes recreational areas, cemeteries (built before 2015), and public swimming pools.
  - Existing Landscapes (constructed before 1/1/2020)
  - New Landscapes (constructed on or after 1/1/2020)
- LEF – Landscape Efficiency Factor (unitless), also known as the outdoor residential standard, which varies based on the type of LAM (see Table 14)
- ET_0 – Reference Evapotranspiration (inches per year)
- P_{eff} – Effective Precipitation (inches per year)
- 0.62 – Conversation Factor to generate units in gallons per year

Table 14 shows how the standard becomes more restrictive through time.

TABLE 14: CII WITH DIMS STANDARD

<table>
<tr><th>Fiscal Year Starting</th><th>Existing Landscapes (as of 1/1/2020)</th><th>New Landscapes (1/1/2020 and after)</th><th>Special Landscape Areas</th></tr>
<tr><td>2028-2034</td><td>0.80</td><td rowspan="3">0.45</td><td rowspan="3">1.0</td></tr>
<tr><td>2035 – 2039</td><td>0.63</td></tr>
<tr><td>2040 Onward</td><td>0.45</td></tr>
</table>

ACWD has estimated the following CII with DIMs landscape areas:

- 13,332,405 SF of SLAs which are exclusively City Parks which complete annual water budget reporting and were previously digitized to identify irrigated landscape area.
- 31,476,456 SF of existing CII DIM irrigated landscapes which have been estimated by ACWD's consultant, WaterFluence, for all parcel boundaries tied to DIMs in ACWD's billing system.

To estimate the expected growth in CII with DIMs landscape area from 2025 and beyond, the existing irrigated landscape area (both SLA and non-SLA) was escalated by an annual growth factor equal to the projected annual percent increase in CII DIMs consumption (as described in **Section 2.3**).

The projected CII with DIMs standard and resulting water budget for ACWD is shown in **Table 15**.

TABLE 15: CII WITH DIMS STANDARD & WATER BUDGET

Fiscal Year Starting	*% Annual Increase in CII DIMs Consumption*	Existing Landscapes (as of 1/1/2020)		New Landscapes (1/1/2020 and after)		Existing SLAs (as of 1/1/2020)		New SLAs (1/1/2020 and after)		Water budget (mgd)
		Standard	*Square Feet*	*Standard*	*Square Feet*	*Standard*	*Square Feet*	*Standard*	*Square Feet*	
2024	0.0%	0.80	31,476,456	0.45	0	1.00	13,332,405	1.00	-	2.77
2025	0.2%	0.80	31,476,456	0.45	65,635	1.00	13,332,405	1.00	27,801	2.78
2026	0.2%	0.80	31,476,456	0.45	121,772	1.00	13,332,405	1.00	51,579	2.78
2027	0.2%	0.80	31,476,456	0.45	177,099	1.00	13,332,405	1.00	75,013	2.79
2028	0.2%	0.80	31,476,456	0.45	231,939	1.00	13,332,405	1.00	98,242	2.79
2029	0.9%	0.80	31,476,456	0.45	511,692	1.00	13,332,405	1.00	216,736	2.81
2030	0.9%	0.80	31,476,456	0.45	792,157	1.00	13,332,405	1.00	335,532	2.83
2031	0.8%	0.80	31,476,456	0.45	1,060,494	1.00	13,332,405	1.00	449,191	2.84
2032	0.8%	0.80	31,476,456	0.45	1,329,233	1.00	13,332,405	1.00	563,020	2.86
2033	0.8%	0.80	31,476,456	0.45	1,598,463	1.00	13,332,405	1.00	677,057	2.88
2034	1.1%	0.80	31,476,456	0.45	1,972,593	1.00	13,332,405	1.00	835,526	2.90
2035	1.1%	0.63	31,476,456	0.45	2,347,337	1.00	13,332,405	1.00	994,256	2.55
2036	0.9%	0.63	31,476,456	0.45	2,637,104	1.00	13,332,405	1.00	1,116,992	2.57
2037	0.9%	0.63	31,476,456	0.45	2,927,882	1.00	13,332,405	1.00	1,240,156	2.59
2038	0.9%	0.63	31,476,456	0.45	3,219,708	1.00	13,332,405	1.00	1,363,764	2.61
2039	1.7%	0.63	31,476,456	0.45	3,794,603	1.00	13,332,405	1.00	1,607,270	2.65
2040	1.6%	0.45	31,476,456	0.45	4,372,984	1.00	13,332,405	1.00	1,852,254	2.29
2041	1.6%	0.45	31,476,456	0.45	4,946,115	1.00	13,332,405	1.00	2,095,014	2.33
2042	1.6%	0.45	31,476,456	0.45	5,522,032	1.00	13,332,405	1.00	2,338,954	2.36
2043	1.6%	0.45	31,476,456	0.45	6,095,724	1.00	13,332,405	1.00	2,581,951	2.40
2044	0.8%	0.45	31,476,456	0.45	6,412,709	1.00	13,332,405	1.00	2,716,215	2.42
2045	0.8%	0.45	31,476,456	0.45	6,730,133	1.00	13,332,405	1.00	2,850,666	2.44

Fiscal Year Starting	*% Annual Increase in CII DIMs Consumption*	Existing Landscapes (as of 1/1/2020)		New Landscapes (1/1/2020 and after)		Existing SLAs (as of 1/1/2020)		New SLAs (1/1/2020 and after)		Water budget (mgd)
		Standard	*Square Feet*	*Standard*	*Square Feet*	*Standard*	*Square Feet*	*Standard*	*Square Feet*	
2046	1.4%	0.45	31,476,456	0.45	7,249,450	1.00	13,332,405	1.00	3,070,632	2.47
2047	1.3%	0.45	31,476,456	0.45	7,767,421	1.00	13,332,405	1.00	3,290,027	2.51
2048	1.3%	0.45	31,476,456	0.45	8,279,274	1.00	13,332,405	1.00	3,506,832	2.54
2049	1.3%	0.45	31,476,456	0.45	8,789,930	1.00	13,332,405	1.00	3,723,129	2.57

Assumptions:

- ACWD’s existing (as of 2024) irrigated landscape values were all reported under “Existing Landscapes (as of 1/1/2020)”; no effort was made to identify if any of the existing irrigated landscape was constructed 2020-2024
- ET_0 assumes 45.5” based on the average observed across 2017-2023 at CIMIS Station 171 at Town Estates Park in Union City
- P_{eff} assumes 18.4” of average annual precipitation across 2017-2023 at CIMIS Station 171

3.4 Water Loss

The water loss standard was adopted separately from "Making Conservation a California Way of Life" on October 19, 2022 by the SWRCB. For ACWD, the standard is calculated based on the equation shown below:

$$Water\ Loss\ Water\ Budget = [Water\ Loss\ Standard] * [Number\ of\ Service\ Connections]$$

Where the water loss standard is expressed in gallons per connection per day. The standard is calculated uniquely for each urban retail water supplier using the SWRCB's economic model, which takes in information about historical water loss and other economic factors for each urban water supplier (SWRCB, 2022).

ACWD's calculated water loss standard is 26 gallons per connection per day. The projected water loss water budget for ACWD is shown in **Table 16**.

TABLE 16: WATER LOSS STANDARD & WATER BUDGET

Fiscal Year Starting	Number of Connections	Standard (GPCD)	Water Budget (MGD)
2024	87,350	26	2.27
2025	87,520	26	2.28
2030	88,150	26	2.29
2035	88,744	26	2.31
2040	89,347	26	2.32
2045	92,952	26	2.42
2049	93,823	26	2.44

3.5 Total Water Budget from Urban Water Use Objective

ACWD's total water budget from the UWUO is shown in **Table 17**.

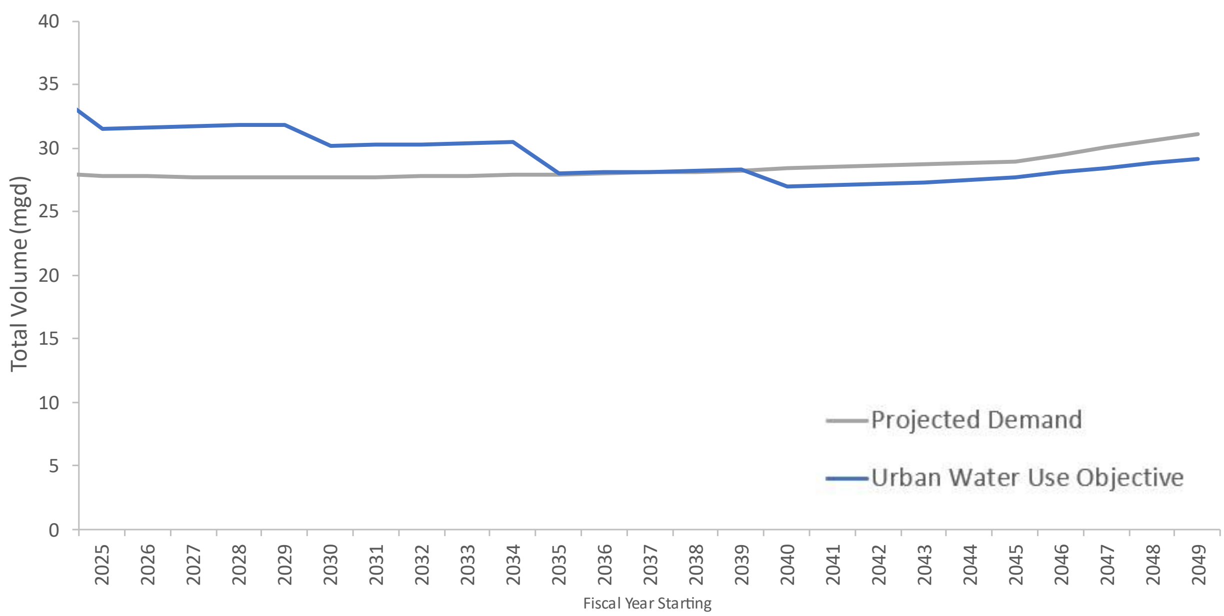
TABLE 17: TOTAL WATER BUDGET FROM URBAN WATER USE OBJECTIVE (MGD)

Fiscal Year Starting	Residential Indoor	Residential Outdoor	CII with DIMs	Water Loss	Total
2025	16.26	10.34	2.78	2.28	31.65
2030	14.78	10.34	2.80	2.29	30.21
2035	15.08	8.19	2.48	2.31	28.05
2040	15.33	7.23	2.15	2.32	27.03
2045	15.75	7.31	2.22	2.42	27.70
2049	17.05	7.90	2.28	2.44	29.68

4. ADJUSTED DEMAND PROJECTION

As shown in **Figure 3** below, relevant projected demands are lower than the UWUO until 2035 when the values are very similar (blue line above the gray line through 2035). Beginning in 2040, projected demand begins to exceed the objective (blue line below the gray line). Per direction provided by ACWD's Board of Directors, the District intends to meet the regulated UWUO. The difference in the gray and blue lines beginning in 2040 represents a supply volume gap (an average of 1.35 mgd from 2040-2049) that the District anticipates meeting through policy decisions and resource augmentations (e.g., additional conservation programs).

FIGURE 3: PROJECTED DEMANDS VS URBAN WATER USE OBJECTIVE – TOTAL



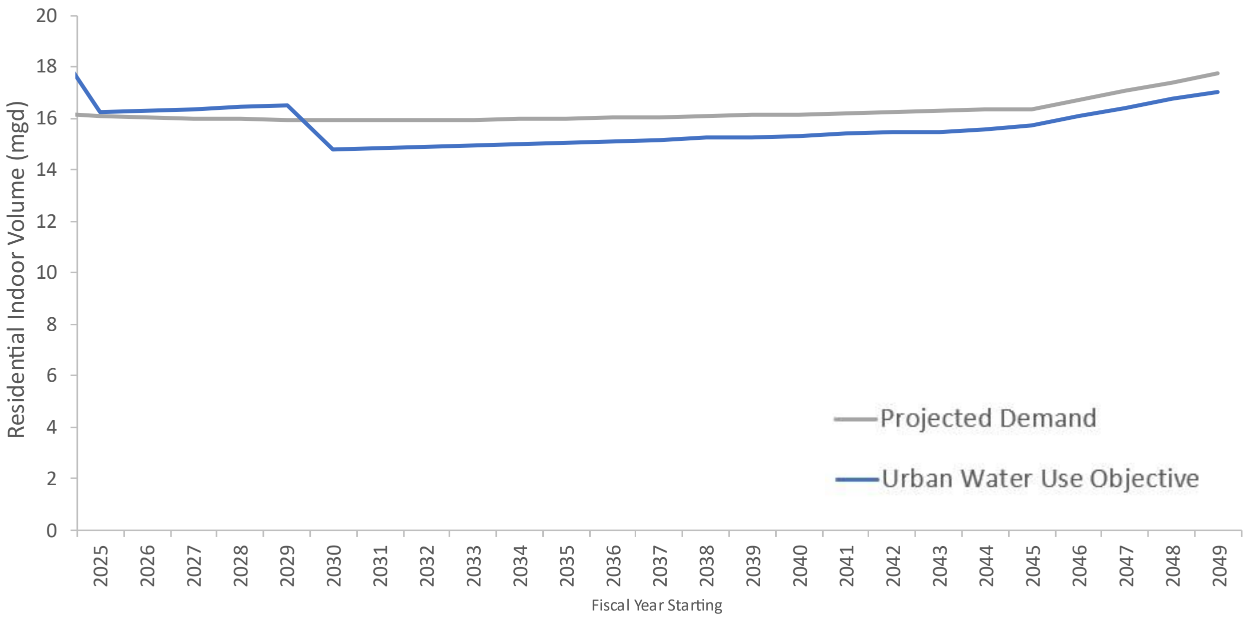
While the UWUO must only be met at an aggregate level, the sections below compare each individual objective category to the relevant projected demand type to highlight potential areas where ACWD staff may focus effort to achieve additional savings. **Section 4.5** provides the updated demand forecast for both UWUO and non-UWUO categories.

4.1 Residential Indoor

As described in **Section 2.2.1**, projected residential indoor demand is estimated by multiplying total residential demand by 70%. **Figure 4** below shows that the UWUO is greater than projected demand until 2030 when the standard becomes more restrictive.

From 2040-2049, the average gap between projected demand and the UWUO for residential indoor is 0.73 mgd (compared to the total 1.35 mgd gap across categories).

FIGURE 4: PROJECTED DEMANDS VS URBAN WATER USE OBJECTIVE – RESIDENTIAL INDOOR

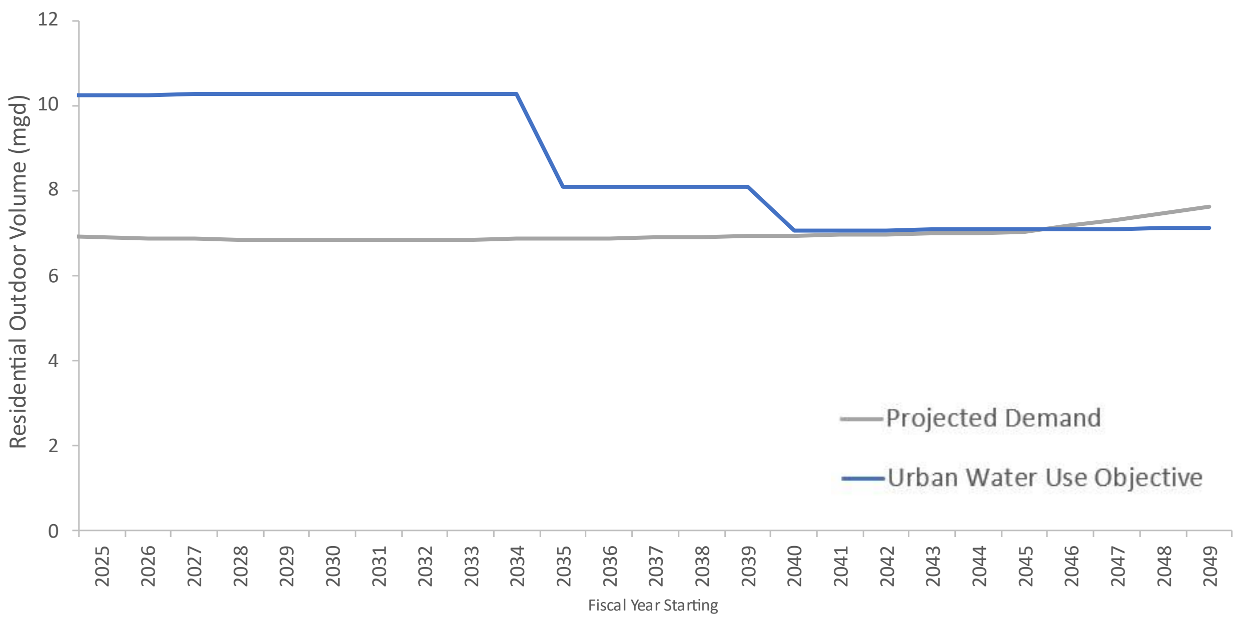


4.2 Residential Outdoor

As described in **Section 2.2.2**, projected residential outdoor demand is estimated by multiplying total residential demand by 30%. **Figure 5** below shows that the UWUO continues to be higher than projected demand throughout the time horizon, though the values become close starting in 2040 when the standard reaches its most restrictive value. From 2040-2049, there is an average "surplus" of 0.30 mgd from residential outdoor UWUO compared to projected demand.

Taking into account the "surplus" from residential outdoor, the 2040-2049 average gap between projected demand and the UWUO for total residential is 0.43 mgd (compared to the 0.73 mgd gap of residential indoor alone and the total 1.35 mgd gap across categories).

FIGURE 5: PROJECTED DEMANDS VS URBAN WATER USE OBJECTIVE – RESIDENTIAL OUTDOOR

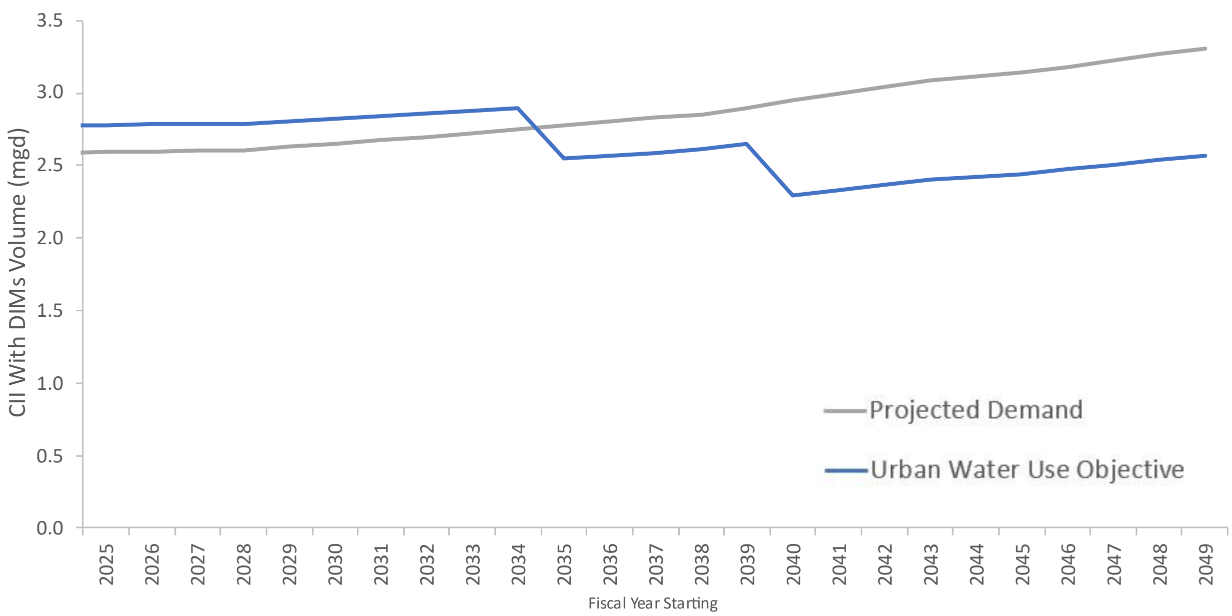


4.3 CII with DIMs

Figure 6 below shows that for CII with DIMs the urban water objective is close in volume to the projected demand until 2035 when the standard becomes more restrictive. Projected demand in this category continues to rise well beyond the standard. It is possible projected demand is an over-estimate; as described in **Section 2.3**, CII with DIMs demands are projected by the DSS Model based on increases in employment. Growth in landscape area will not likely be as steep as employment, given trends toward densification. New non-residential landscapes are likely to use less water than existing landscapes, given more restrictive landscape requirements for new construction.

From 2040-2049, the average volume gap between projected demand and the UWUO is 0.91 mgd (compared to the total 1.35 mgd gap across categories).

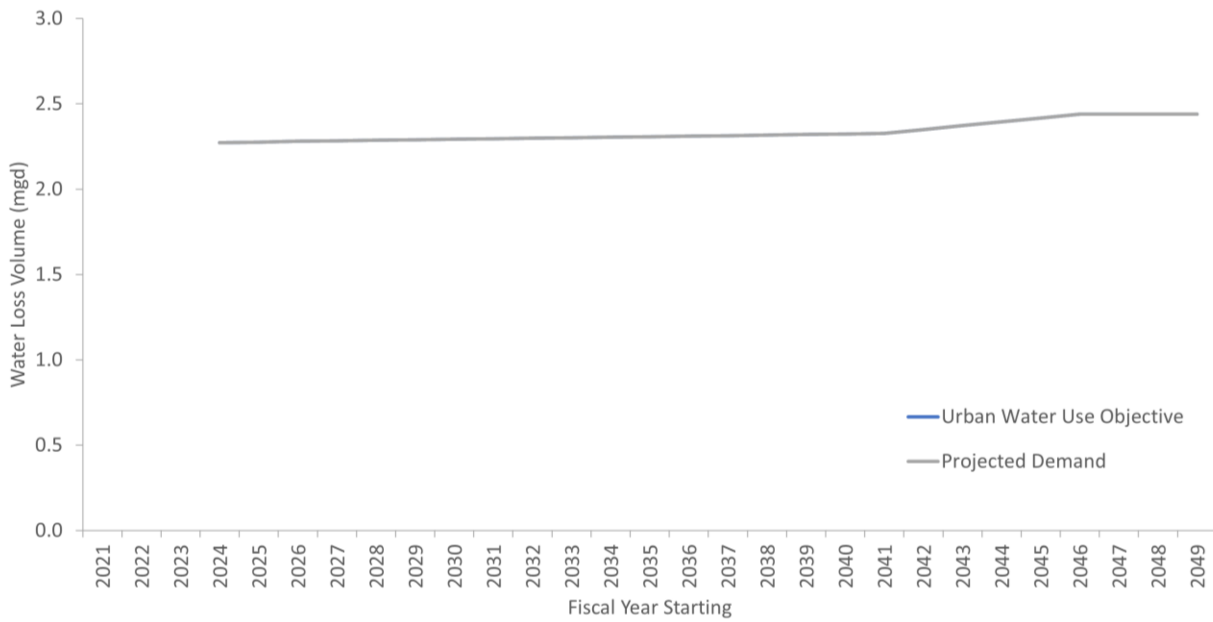
FIGURE 6: PROJECTED DEMANDS VS URBAN WATER USE OBJECTIVE – CII WITH DIMS



4.4 Water Loss

Future water loss is projected to be equal to the standard, so the lines overlap perfectly in **Figure 7**. Note that water loss was originally calculated differently by the DSS Model (see more details in **Section 2.4)**.

FIGURE 7: PROJECTED DEMANDS VS URBAN WATER USE OBJECTIVE – WATER LOSS



4.5 Final Adjusted Demand Forecast

Total demands for both UWUO-regulated categories and other demand sectors projected by the DSS Model are shown in **Table 18**.

TABLE 18: TOTAL PROJECTED WATER DEMANDS INCLUDING URBAN WATER USE OBJECTIVE (MGD)

Fiscal Year Starting	Residential Indoor[1]	Residential Outdoor[1]	CII with DIMs[1]	Water Loss	Business	Industrial	Institutional and Other	Hydrant and Legacy Fireline	Non-Revenue Water[2]	Total
2025	16.26	10.25	2.78	2.28	4.11	2.15	1.14	0.13	0.77	39.87
2030	14.78	10.26	2.83	2.29	4.33	2.27	1.17	0.13	0.80	38.86
2035	15.08	8.08	2.55	2.31	4.57	2.40	1.19	0.13	0.85	37.16
2040	15.33	7.06	2.29	2.32	4.75	2.49	1.22	0.14	0.91	36.51
2045	15.75	7.07	2.44	2.42	4.93	2.59	1.24	0.14	0.88	37.46
2049	17.05	7.11	2.57	2.44	5.08	2.67	1.35	0.15	1.11	39.53

Notes:

1. *In this table, fiscal years starting 2025 and 2030 reflect demands calculated via the urban water use objective; prior to 2035, ACWD expects demands in these sectors to be lower in accordance with what has been projected by the DSS Model.*
2. *Non-Revenue Water from the DSS Model excludes Real Losses, which are regulated by the UWUO and calculated separately in the Water Loss column.*

5. CONCLUSION

In response to the direction provided by the Board of Directors, ACWD has developed a new water demand forecast intended to comply with the UWUO regulations through 2050. This updated forecast is displayed in **Figure 8** and **Table 19**. This demand forecast is used for the Water Resources Master Plan 2050.

FIGURE 8: ACWD FINAL DEMAND FORECAST

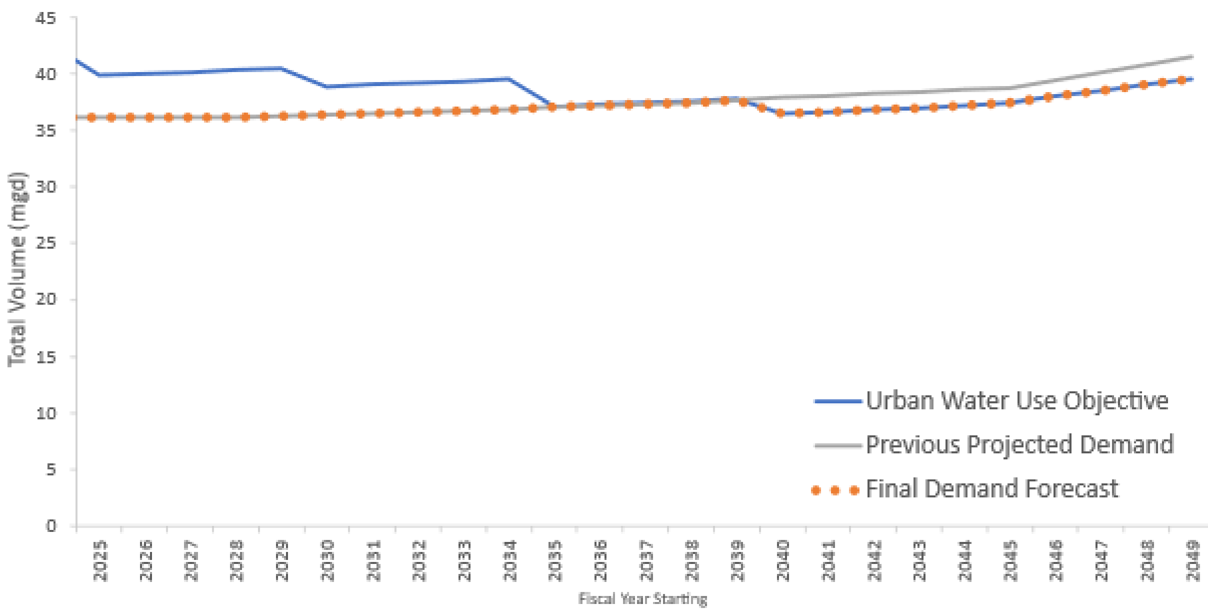


TABLE 19: ACWD FINAL DEMAND FORECAST (MGD)

Fiscal Year Starting	Total Demand
2025	36.15
2030	36.41
2035	37.09
2040	36.51
2045	37.46
2049	39.54

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APPENDIX C

BASELINE SUPPLY AVAILABILITY FORECAST

ALAMEDA COUNTY WATER DISTRICT

WATER RESOURCES MASTER PLAN 2050

FINAL TECHNICAL MEMORANDUM

TO: Thomas Niesar, Alameda County Water District (ACWD)

PREPARED BY: Dawn Flores, Woodard & Curran

REVIEWED BY: Chris Hewes and Persephene St. Charles, Woodard & Curran

DATE: December 29, 2025

RE: Baseline Supply Availability Forecast for ACWD's Water Resources Master Plan 2050 (Phase 2, Task 4 – Baseline Supply Availability)

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ACRONYMS AND ABBREVIATIONS

ACWD	Alameda County Water District
AFY	Acre-Feet per Calendar Year
AHF	Above Hayward Fault
ARP	Aquifer Reclamation Program
BHF	Below Hayward Fault
BiOp	Biological Opinion
cm	centimeter
DCR	Delivery Capability Report
DWR	Department of Water Resources
IGSM	Integrated Groundwater Surface Water Model
IRP	Integrated Resources Plan
ITP	Incidental Take Permit
IWFM	Integrated Water Flow Model
LOC	levels-of-concern
mgd	million gallons per day
msl	mean sea level
MSJWTP	Mission San Jose Water Treatment Plant
NEBIGSM	Niles Cone East Bay Plain Integrated Groundwater Surface Water Model
NEBIM	Niles East Bay Integrated Model
RMSE	root mean square error
RWS	Regional Water System
SBA	South Bay Aqueduct
Semitropic	Semitropic Groundwater Bank
SFPUC	San Francisco Public Utilities Commission
SWP	State Water Project
SWRCB	State Water Resources Control Board
TM	Technical Memorandum
UWMP	Urban Water Management Plan
WRMP	Water Resources Master Plan
WSA	Water Supply Agreement
WTP	Water Treatment Plant

GLOSSARY

Term	**Definition**
Aquifer	A three-dimensional body of porous and permeable sediment or sedimentary rock that contains sufficient saturated material to yield significant quantities of groundwater to wells and springs (Title 23 California Code of Regulations Section 341[f]).
Availability	Supply volumes available for use by ACWD based on hydrology, facilities, and operations
Baseline Supply	Scenario used to represent supply availability, facility capacity, and operations in the future without implementation of any options or strategies
Imported Water	Water supply that is delivered from watersheds outside of local watersheds
Leave-behind	Water intentionally left in a groundwater basin to support its long-term health and sustainability
Local Surface Water	Water use for supply that is diverted from local watersheds
Supply Option	Water supply project that generates a volume of water
Percolation	Downward movement of water through soil or alluvium to the groundwater table
Portfolio	Combination of supply options and resource strategies
Pumpback	Water extracted from the Semitropic Groundwater Bank and delivered to ACWD
Recharge	Replenishment of an aquifer with a surface water supply, such as stormwater, local surface water, recycled water, or imported water
Water Supply Reliability	The consistent ability of water supplies to meet demand while considering factors such as hydrology, facilities, and operations
Scenario	Future conditions that impact future demands and supply availability
Stormwater	Water that originates from precipitation within a local area and can be collected for use before reaching a stream channel
Resource Strategy	Water management action that does not generate a volume of water but has a cost

Water Banking	Water management technique where water is stored in groundwater basins or aquifers during periods of supply surplus for use during periods of drought or emergency

1. INTRODUCTION

Alameda County Water District (ACWD or District) is undertaking an update to its 1995 Integrated Resources Plan (IRP). Since the IRP was adopted nearly 30 years ago, the District has experienced many changes that warrant an updated look at the future of its water supply. The updated Water Resources Master Plan (WRMP) 2050 will serve as a long-range planning document that outlines the District's water supply strategy and informs other aspects of District planning. The goal of the WRMP is to inform critical decision making on future infrastructure and water supply investments by providing valuable information about the District's future resilience in the face of known uncertainties, such as climate change and changing regulations. This plan will create a roadmap for water supply reliability by analyzing changing conditions and the communities we serve – now and in the future.

This technical memorandum (TM) details the process and results of the baseline supply availability forecast conducted as part of the WRMP 2050. The baseline supply availability analysis applied ACWD's current supply sources and systems against three scenarios representing a range of future conditions in 2050 as a result of potential climate and regulatory changes. In the context of the WRMP 2050, this analysis will be used to estimate future supply needs and potential issues relative to forecasted demands. The baseline of supplies used in the analysis will form the foundation upon which portfolios of different water supply options and water resource strategies identified through the WRMP process can be added to improve future sustainability and resiliency.

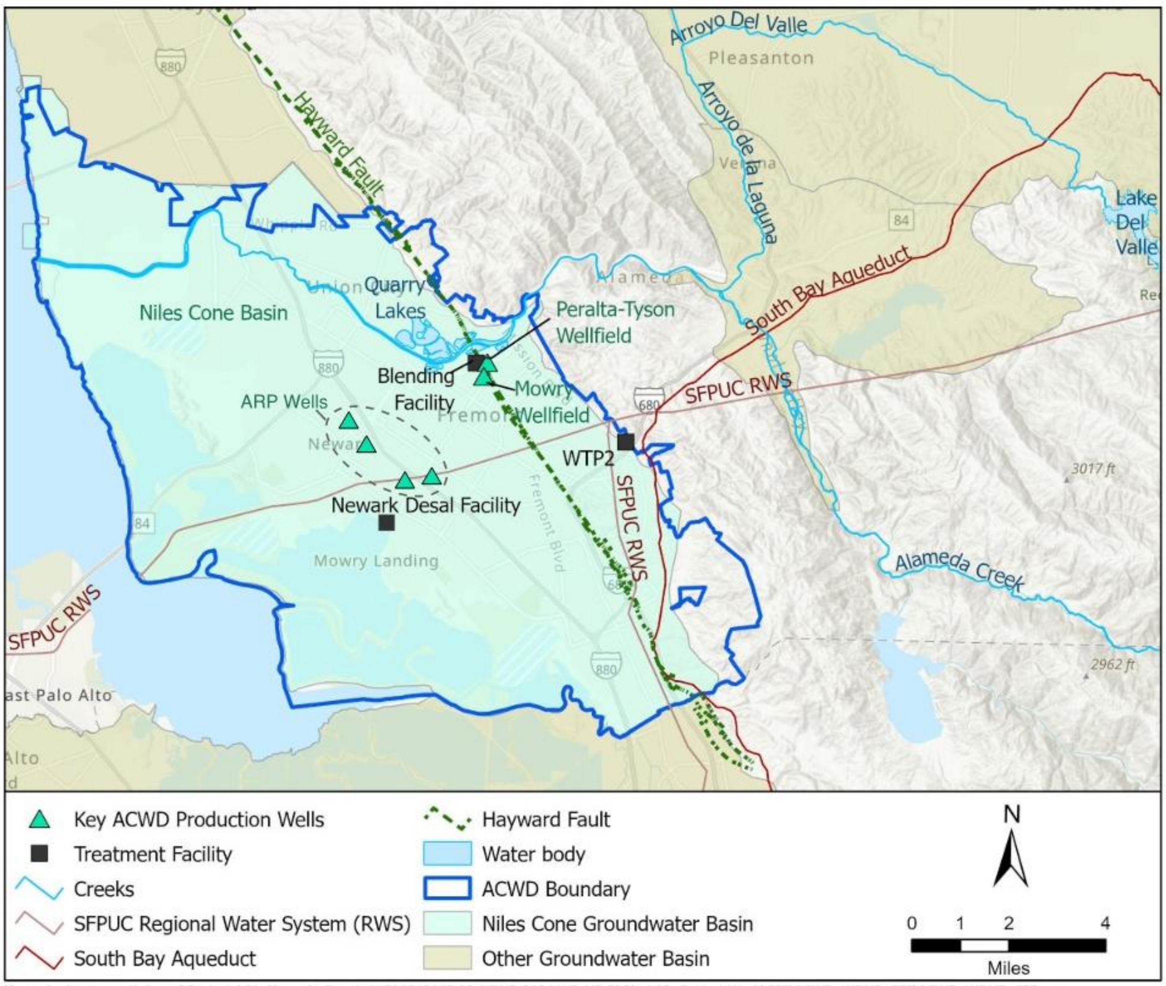
This TM is organized into the following five sections.

- **Section 1 - Introduction**: An overview of the WRMP 2050 and this TM's purpose and structure.
- **Section 2 - Baseline Supply Sources**: A description of ACWD's current water supplies and infrastructure.
- **Section 3 - Baseline Supply Reliability Methodology**: Methodology used to project supply reliability.
- **Section 4 - Baseline Reliability Projections**: Results of the baseline supply reliability analysis.
- **Section 5 - Conclusion**: Key results to be used in the next steps of the planning process

2. BASELINE SUPPLY SOURCES

ACWD meets its potable water demands using multiple supply sources that include imported water from the State Water Project (SWP) and San Francisco Public Utilities Commission (SFPUC), local groundwater from the Niles Cone Groundwater Basin (Niles Cone), and local surface water from Del Valle Reservoir in the Alameda Creek Watershed. **Figure 1** provides a map of ACWD's major supply sources and facilities. This diverse mix of water supplies has allowed ACWD to reliably meet demands in the service area in combination with conservation efforts. In the future, however, changes to climate, regulations, and regional facilities may impact the reliability of supply. This section describes each of ACWD's baseline supply sources.

FIGURE 1: ACWD'S SUPPLY SOURCES AND FACILITIES



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2.1 Local Surface Water from the Alameda Creek Watershed

ACWD, jointly with Zone 7 Water Agency, is permitted to divert up to 60,000 acre-feet per year (AFY) of surface water from Arroyo Del Valle, though the availability of flow can vary significantly due to seasonal and annual variation as well as in-stream flow requirements. Diverted water is conveyed for storage at Del Valle Reservoir, which is owned and operated by the California Department of Water Resources (DWR). Del

Valle Reservoir provides multiple benefits to the region, including seasonal and annual supply storage for South Bay Aqueduct (SBA) users, downstream flood control for Alameda Creek, conservation of stormwater flows for supply use, local recreation, and fish and wildlife habitat. DWR typically makes a total of 15,000 AF of storage available in Del Valle Reservoir annually, which is split evenly between ACWD and Zone 7 Water Agency, though the actual volume stored is typically limited by available creek flows (ACWD, 2021b).

ACWD can take delivery of water stored at Del Valle Reservoir three ways:

1. Via the SBA to ACWD's treatment facilities
2. Via the SBA and released into Alameda Creek for groundwater recharge
3. Via direct release into Arroyo Del Valle where it flows to Arroyo de la Laguna and into Alameda Creek then diverted to Quarry Lakes for percolation into the Niles Cone Groundwater Basin

ACWD generally takes delivery of all water stored each water year to ensure storage space is available for diversions the next year. ACWD also has the right to divert up to 40,000 AFY of Alameda Creek flow from October 1 to June 1 for recharge of the groundwater basin, separate from the Arroyo Del Valle diversion rights. Since 2010, ACWD has taken delivery of on average about 5,000 AFY of Arroyo Del Valle diversions stored at Lake Del Valle, and 11,000 AFY from Alameda Creek diversions (SWRCB, 2024).

2.2 Niles Cone Groundwater Basin

The Niles Cone Groundwater Basin or Niles Cone includes portions of the City of Fremont, the City of Newark, portions of the City of Union City, and the southern portion of the City of Hayward and is managed by ACWD. The Niles Cone is divided into two sub-basins by the Hayward Fault, which creates a nearly impermeable barrier between the "Below Hayward Fault" (BHF) Sub-basin located to the west of the fault and the "Above Hayward Fault" (AHF) Sub-basin located to the east of the fault. The BHF Sub-basin is bounded to the west by San Francisco Bay.

The AHF Sub-basin, which is geographically smaller in area than the BHF Sub-basin, features the AHF Aquifer, conceptualized as a single thick unconfined aquifer from ground surface to bedrock. It is productive mostly in the upper third of the sub-basin proximal to Alameda Creek. In contrast, the BHF Sub-basin consists of a stack of four principal aquifers separated by intervening aquitards. By order of depth, they are the Newark Aquifer, Centerville Aquifer, Fremont Aquifer, and Deep Aquifer. The Centerville and Fremont Aquifers are commonly referred to as the singular "Centerville-Fremont Aquifer" due to significant interconnection between these two units.

Over an inland part of the sub-basin proximal to Alameda Creek and recharge ponds, the Newark Aquifer is unconfined, whereas the deeper Centerville, Fremont, and Deep Aquifers are confined over the entire geographic area of the BHF Sub-basin. The aquitards separating the BHF aquifers are thick and pervasive in the western part of the sub-basin. However, in the inland part to the east, the aquitards are less thick and more permeable, enabling recharge of groundwater from the Newark Aquifer to the Centerville, Fremont, and Deep Aquifers. The Newark Aquifer, in turn, receives replenishment water from recharge ponds and other surficial sources. ACWD's complex of recharge ponds, which span the Hayward Fault, also recharges the AHF Aquifer in its most productive northern third region. Groundwater levels in this region of the AHF and the unconfined part of the Newark Aquifer in the BHF reasonably represent the amount of *working* storage of groundwater in the two respective sub-basins and thus the Niles Cone overall. Accordingly, groundwater levels in these two aquifers, specifically as measured by ACWD's main indicator wells in the greater vicinity of Alameda Creek and the recharge ponds, are what is being referred to by the term "water levels" or "groundwater levels" throughout this document.

At the western edge of the BHF, the Newark Aquifer is substantially interconnected hydraulically with San Francisco Bay. Accordingly, the Niles Cone suffered seawater intrusion when Newark Aquifer levels were below sea level between 1920 and 1970. Since that period, ACWD has been able to maintain groundwater levels in the Newark Aquifer mostly above sea level, enabling the slow process of reversing seawater intrusion. Under current basin operating rules, levels in the BHF Newark Aquifer typically range between 10 and 20 feet above MSL in normal to wet years, with levels dipping between 0 and 10 feet in dryer years.

The AHF Sub-basin, situated between the low-permeable Hayward Fault and the East Bay hills, accommodates higher groundwater levels than those in the BHF Aquifers. In normal-to-wet years, AHF groundwater levels typically range between 30 and 50 feet MSL.

Groundwater Recharge Operations

Water is recharged to the basin naturally through infiltration of rainfall and runoff, and through ACWD's managed groundwater recharge operations. Managed groundwater recharge serves to:

1. Replenish groundwater extracted to meet local demands; and
2. Maintain groundwater levels and flow (in the Newark Aquifer) toward San Francisco Bay to displace existing brackish water from historic seawater intrusion and to prevent additional intrusion.

The groundwater replenishment program recharges the basin through the Alameda Creek Flood Control Channel and percolation ponds in the Quarry Lakes Regional Recreational Area. ACWD recharges creek flows (using the diversions discussed in **Section 2.1** above) as well as water from the State Water Project (discussed further in **Section 2.4**.

Groundwater Treatment and Production

The basin does not have a set safe yield. The sustainable (pumping) yield of the Niles Cone is the amount of water that can be extracted without causing significant and unreasonable undesirable results. The amount of water that can be extracted without causing undesirable results is determined by the amount of recharge to productive aquifers (both natural and artificial) less natural (non-pumping) sinks from these aquifers. The Peralta-Tyson Wellfield pumps from the AHF Aquifer or Sub-basin, while the Mowry Wellfield pumps from aquifers in the BHF Sub-basin. Since 2016, ACWD has pumped an average of 4,500 AFY of groundwater via the Peralta-Tyson Wellfield and 2,700 AFY via the Mowry Wellfield (ACWD, 2021a). Water from the Peralta-Tyson and Mowry Wellfields is blended with SFPUC water to meet ACWD's hardness goals and create an equalized level of taste and hardness for all customers. ACWD has also constructed the Ion Exchange Facility to remove PFAS from groundwater supplies at the Blender Facility. This treatment facility treats approximately 6 million gallons per day (mgd) from the Peralta-Tyson and Mowry Wellfields (ACWD, 2021b).

In the 1920s, saltwater intrusion was first noticed in the Niles Cone. Many years of chronic overdraft caused groundwater levels in the Newark Aquifer to drop below sea level and allowed saline water to extend inland impacting both shallow and deeper aquifers. This continued for the next few decades while ACWD implemented a number of management programs to restore the basin's natural Bay-ward hydraulic gradient in the Newark Aquifer. ACWD implemented the Aquifer Reclamation Program (ARP) to address the saline plume that remained (ACWD, 2021b). The ARP uses 11 wells to pump brackish groundwater for treatment at the 12 mgd Newark Desalination Facility (10 mgd of treated permeate water which is blended with 2 mgd of raw ARP water). Through the ARP, ACWD produces an average of 7,700 AFY of potable water. The management protocols allow ACWD to temporarily reduce groundwater levels to as low as five feet below mean sea level (msl) for a short period of time during a critical drought, but otherwise maintain levels above sea level.

2.3 SFPUC Imported Water

ACWD receives water from SFPUC's Regional Water System (RWS). The 2009 Water Supply Agreement (WSA), amended and restated most recently in 2021, addresses water supply, water shortages, and the SFPUC rate-setting methodology used for Wholesale Customers. The 2021 WSA provides for a 184 mgd Supply Assurance to the 26 Wholesale Customers (including ACWD) which is allocated amongst the agencies. This supply volume is subject to reduction in the event of shortage due to drought, emergencies, or the malfunctioning or rehabilitation of RWS facilities. ACWD also entered into an Individual Water Sales Contract which provides ACWD with an "Individual Supply Guarantee" of 13.76 mgd of the 184 mgd guaranteed to Wholesale Customers. Both contracts are set to expire in 2034 (SFPUC, 2022).

During system-wide shortages, SFPUC implements a Water Shortage Allocation Plan which allocates water from the RWS to retail and Wholesale Customers for shortages up to 20 percent. Allocated supplies to the Wholesale Customers are then subject to a further allocation process administered by BAWSCA. The formula used by BAWSCA is revised periodically in coordination with the members and depends on several external factors, including demonstrated dependence on RWS supply. Accordingly, reduced use of SFPUC supply during normal years typically results in reduced allocations during drought shortages. ACWD is also subject to minimum purchase requirements from the SFPUC RWS of 6.682 mgd (equal to approximately 7,500 AFY), meaning that ACWD is billed for this minimum quantity of water.

Since 2010, ACWD has received an average of 8,800 AFY of water from the SFPUC RWS, though this has ranged from approximately 6,660 AFY to 13,100 AFY, primarily due to annual hydrologic variations and ACWD demand. Given that SFPUC is one of the most expensive supplies for ACWD, ACWD prioritizes use of other supplies first.

In the future, the availability of supply may be impacted by implementation of the 2018 San Francisco Bay/Sacramento-San Joaquin Delta Estuary Water Quality Control Plan Amendment (Bay-Delta Plan Amendment) which requires 40 percent of "unimpaired flows" from February through June for rivers flowing into the Delta. These flow requirements will directly offset the available supply for ACWD and are required in every water year type, whether wet, normal, or dry. At this time, the impact of the Bay-Delta Plan Amendment is unknown because an implementation plan has not yet been developed. SFPUC has provided ACWD with a dataset that reflects compliance with the Bay-Delta Plan's 40 percent unimpaired flow criterion for use in modeling future supply availability. Based on this data, up to 15,400 AFY of SFPUC RWS water will be available to ACWD for purchase in the future (ACWD, 2021b).

The water that ACWD receives through the RWS is potable and softer than the local groundwater supply, allowing it to be blended with groundwater at ACWD's Blending Facility to reduce hardness, as described in **Section 2.2**.

2.4 State Water Project

ACWD is contracted with DWR to receive water from the State Water Project. Through this contract, ACWD can receive:

- Table A water: Annual allocation of water determined by factors such as the Sierra Nevada Mountain snowpack, water storage and required operations to maintain ecosystems. ACWD can receive a maximum of 42,000 AF of Table A water.
- Article 21 water: Wet year water available on an intermittent, interruptible basis.
- Article 56 water: Unused Table A water stored in San Luis Reservoir also referred to as carryover water. This water is subject to losses during wet years with San Luis Reservoir spills.

ACWD takes delivery of SWP water through the SBA and treats the water at Water Treatment Plant No. 2 (WTP2). WTP2 has an operational capacity of 26 mgd and treats 15 mgd on average. ACWD also owns the Mission San Jose Water Treatment Plant (MSJWTP), but the plant was decommissioned in 2015 due to low demand.

ACWD is contracted with the Semitropic Water Storage District to store SWP supplies in the Semitropic Groundwater Banking Program (Semitropic). ACWD stores SWP water in the bank in wet years and recovers the supplies in dry years. ACWD recovers the water through either an in-lieu exchange or through a pumpback program. ACWD is currently contracted to store up to 150,000 AF in Semitropic, with annual storage volumes limited by contractual availability and infrastructure capacity constraints. ACWD has a minimum guaranteed volume of 13,500 AFY for return to the service area, with a potential recovery range of 13,500 AFY to 33,450 AFY. ACWD has a 10% "leave behind" water requirement under the current contract, a condition which is assumed subject to upward revision when the contract renewal comes about in 2035. Since 2010, ACWD has received an average of 12,000 AFY of SWP water for direct use and 7,500 AFY of Semitropic water bank recovery for direct use (ACWD, 2021b).

ACWD currently manages Semitropic both as a long-term drought reserve and as a supply optimization facility. The District typically prioritizes recovery of stored water to offset SFPUC purchases when sufficient storage is available to maintain a five-year drought reserve (estimated at 100,000 AF). When storage exceeds this reserve threshold, ACWD may elect to recover additional supplies during low SWP allocation years prior to initiating additional SFPUC purchases. This operational approach reflects a combined management strategy influenced by Semitropic recovery rates and overall system conditions.

DWR completes a Delivery Capability Report (DCR) for the SWP every two years that provides planning information for users of SWP water, and includes information about how changing climate, regulatory, and operational considerations impact SWP delivery capability. The 2023 DCR, released in July 2024, (at the time of publishing) incorporates a more robust climate change analysis than was used in previous years. Like SFPUC water, the SWP is expected to be impacted by the Bay-Delta Plan Amendment, however, assumptions for SWP delivery impacts were not included in the 2023 DCR. Instead, the 2023 DCR incorporates the requirements of the 2019 US Fish and Wildlife Service and National Marine Fisheries Service Biological Opinions (BiOps) and the 2020 Incidental Take Permit (ITP).

As part of the 2023 DCR, DWR generated three risk-informed climate scenarios for supply planners to use in forecasting future SWP water availability that captures a certain threshold of system performance values. These scenarios are referred to as levels-of-concern (LOC) and are assigned a percentile that represents a percentage of possible temperature and precipitation futures that were modeled. Larger LOC percentiles result in the capture of more extreme changes to climate (DWR, 2024).

3. BASELINE SUPPLY RELIABILITY METHODOLOGY

The WRMP's baseline supply reliability analysis uses RiverWare (a water resources systems model) to identify future potential supply gaps that may be faced by ACWD in 2050. RiverWare forecasts supply reliability by modeling known (or assumed) information about existing ACWD and regional facilities and storage potential against one or more projections of potential future climate, regulatory, and demand conditions. The following sections describe the analysis in more detail.

3.1 RiverWare Systems Model

RiverWare is a water supply-specific network simulation platform that uses operating rules to determine how water will move through natural and engineered systems. The model runs on a daily timestep to represent supplies that can vary from day to day, though results are rolled up to monthly and annual levels. The main components of the RiverWare model tailored for use in ACWD's WRMP include:

- A model network representative of natural and engineered water conveyance, storage, treatment, and production infrastructure that links all ACWD water supply sources to end use demands.
- Model input data, including ACWD water demand, SWP Table A allocations, SWP Article 21 availability, SFPUC allocations, creek hydrology, and precipitation.
- An operating rule set for distributing water throughout the network dependent on dynamic system conditions (such as hydrology and supply availability).

The ACWD RiverWare model network, illustrated in **Appendix A**, includes the major facilities needed to convey SFPUC, SWP, Niles Cone, and Alameda Creek water supplies for treatment to meet direct demands and for storage to meet later demands. The model highlights monthly and annual variations in hydrology to account for the impacts of seasonal variations in precipitation and drought cycles on supply availability. Storage in Lake Del Valle, San Luis Reservoir, the Niles Cone, and Semitropic are incorporated in the model to simulate the management of supplies and facilities more accurately during wet and dry periods, and are shown in **Section 3.2**.

To simulate groundwater levels, RiverWare uses a simplified set of equations which, in turn, were developed through regression of results of prior simulations with the Niles Cone East Bay Plain Integrated Groundwater Surface Water Model (NEBIGSM), a highly discretized finite element model.[1] The root mean square of the error of model-simulated heads relative to observations at the AHF and BHF indicator wells is 2 feet, which is adequate considering RiverWare's current objectives. Therefore, RiverWare's simulated groundwater levels for the future scenarios described in this document are expected to be reliable.

[1] NEBIGSM, which runs on the IGSM platform, served as ACWD's groundwater basin flow model from 2003 to 2021. NEBIGSM has since been replaced by the Niles East Bay Integrated Model (NEBIM), which operates on the Integrated Water Flow Model (IWFM) platform, a successor code to the Integrated Groundwater Surface Water Model (IGSM) platform. A planned future improvement of ACWD's Riverware will include replacement of its groundwater equations based on runs with NEBIM. Such improvement is expected to reduce the root mean square error (RSME) between RiverWare-simulated groundwater levels and groundwater levels measured at the main AHF and BHF indicator wells. The current RMSE, approximately 2 feet, is adequate considering Riverware's current objectives.

Since ACWD has committed to meeting its State Urban Water Use Objectives, the model assumes a 2050 level of demand equal to 39.54 mgd determined by the California State Water Resources Control Board. Additional information about the demand forecast can be found in the Demand Forecasting TM prepared for ACWD in January 2025.

3.2 Future Supply Availability Condition Scenarios

Three future condition scenarios for 2050 were developed to represent a range of potential impacts to future water supply availability from changes outside of ACWD control. Based on input from ACWD staff, the following conditions are used to create the scenarios:

- Climate change: Climate change is expected to increase temperatures, change precipitation patterns, and increase sea level rise, all of which will impact both local and imported supplies.
- Storage facility operations: The potential that ACWD's two major external storage facilities, San Luis Reservoir and Semitropic Groundwater Bank, may have a reduced ability to provide supplies during drought periods in the future.

Table 1 lists the condition assumptions used to create each of the three scenarios. The scenarios are used by RiverWare as potential future conditions against which future supply availability is determined. The baseline supply analysis applies ACWD's existing supply sources and infrastructure to those future conditions to determine how reliable ACWD's current suite of supplies would be under a range of potential future conditions.

TABLE 1: WRMP SCENARIOS

	Scenario A	Scenario B	Scenario C
Climate Change	• Average temperature increase of 1.5 degrees Celsius	Average temperature increase of 1.7 degrees Celsius	Average temperature increase of 1.8 degrees Celsius
	• Average precipitation that is 1.5% wetter than current conditions • 10.5% increase in the 99th percentile daily precipitation event	• Average precipitation similar to current conditions • 12% increase in the 99th percentile daily precipitation event	• Average precipitation that is 1.8% drier than current conditions • 12.6% increase in the 99th percentile daily precipitation event
	• Sea level rise of 15 centimeter (cm)	• Sea level rise of 30 cm	• Sea level rise of 30 cm
	• Maximum drought length of 6 years	• Maximum drought length of 6 years	• Maximum drought length of 7 years[1]
Storage Facility Operations	• Semitropic: Current contract requirements for leave-behind, no change to pumpback capacity	• Semitropic: Slightly increased leave-behind, reduced pumpback capacity	• Semitropic: Increased leave-behind, further reduction in pumpback capacity
	• San Luis Reservoir: No change from current conditions (carryover storage available)	• San Luis Reservoir: No change from current conditions (carryover storage available)	• San Luis Reservoir: No carryover storage available

Hydrologic inflows used in the RiverWare model were developed starting with historic inflows from 1922 to 2015 that were adjusted for these scenarios based on the assumptions shown in **Table 2**. The resulting SWP

[1] Extended droughts have typically been limited to six years in California. By extending drought to seven years under Scenario C, the potential for longer droughts in the future can be incorporated into the reliability analysis.

Table A allocations, SFPUC water, and Alameda Creek inflows are shown in **Figure 2** (Scenario A), **Figure 3** (Scenario B), and **Figure 4** (Scenario C).

Note that the years shown on the x-axis in the figures represent the historic years used as the basis for each inflow, with adjustments to each volume based on the assumptions in **Table 2**.

TABLE 2: SUPPLY HYDROLOGIC INFLOW ASSUMPTIONS

Supply Source	Scenario A	Scenario B	Scenario C
SWP Table A Allocations	• Climate Change: 2023 Delivery Capability Report, 50% LOC • Delta Regulations: BiOps 2019, 2020 ITP	• Climate Change: 2023 Delivery Capability Report, 75% LOC • Delta Regulations: BiOps 2019, 2020 ITP	• Climate Change: 2023 Delivery Capability Report, 95% LOC • Delta Regulations: BiOps 2019, 2020 ITP
SFPUC water	• Delta Regulations: Bay-Delta Plan's 40 percent unimpaired flow criterion plus 15 cm sea level rise and early long-term climate change conditions	• Delta Regulations: Bay-Delta Plan's 40 percent unimpaired flow criterion plus 15 cm sea level rise and early long-term climate change conditions	• Delta Regulations: Bay-Delta Plan's 40 percent unimpaired flow criterion plus 15 cm sea level rise and early long-term climate change conditions
Local Surface Water (including diversions from Arroyo Del Valle to Lake del Valle and Alameda Creek)	• Climate Change: Mid-level 2050 rainfall and inflow	• Climate Change: Average of mid-level and extreme level 2050 local rainfall and inflow	• Climate Change: More extreme 2050 local rainfall and inflow, and deep percolation, • 20% increase of multi-year drought (from 1987 to 1992 -> 1987 to 1993, with repeated 1992 as 1993)
Niles Cone Groundwater Basin	• Climate Change: Mid-level 2050 local rainfall, inflow, and deep percolation	• Climate Change: Average of mid-level and extreme level 2050 local rainfall, inflow, and deep percolation	• Climate Change: More extreme 2050 local rainfall, inflow, and deep percolation, 20% increase of multi-year drought (from 1987 to 1992 -> 1987 to 1993, with repeated 1992 as 1993)

The resulting variable annual SWP Table A water, SFPUC water, and local surface water supplies at Lake Del Valle (from the Arroyo Del Valle diversion) are depicted for each scenario in **Figure 2** through **Figure 4**, reflecting the significant variability of supplies available from year to year. These supplies are used directly to meet demand, as well as to store in San Luis Reservoir, Semitropic Water Bank, and Niles Cone Groundwater Basin.

FIGURE 2: SCENARIO A ANNUAL SURFACE WATER SUPPLY AVAILABLE

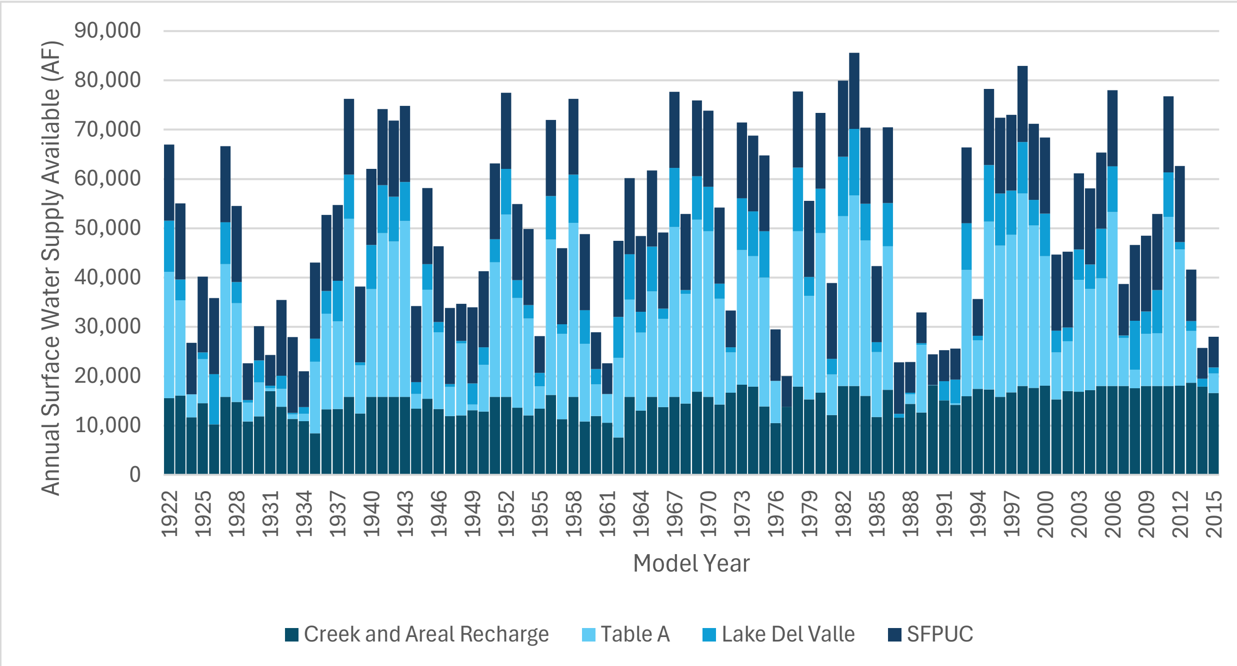


FIGURE 3: SCENARIO B ANNUAL SURFACE WATER SUPPLY AVAILABLE

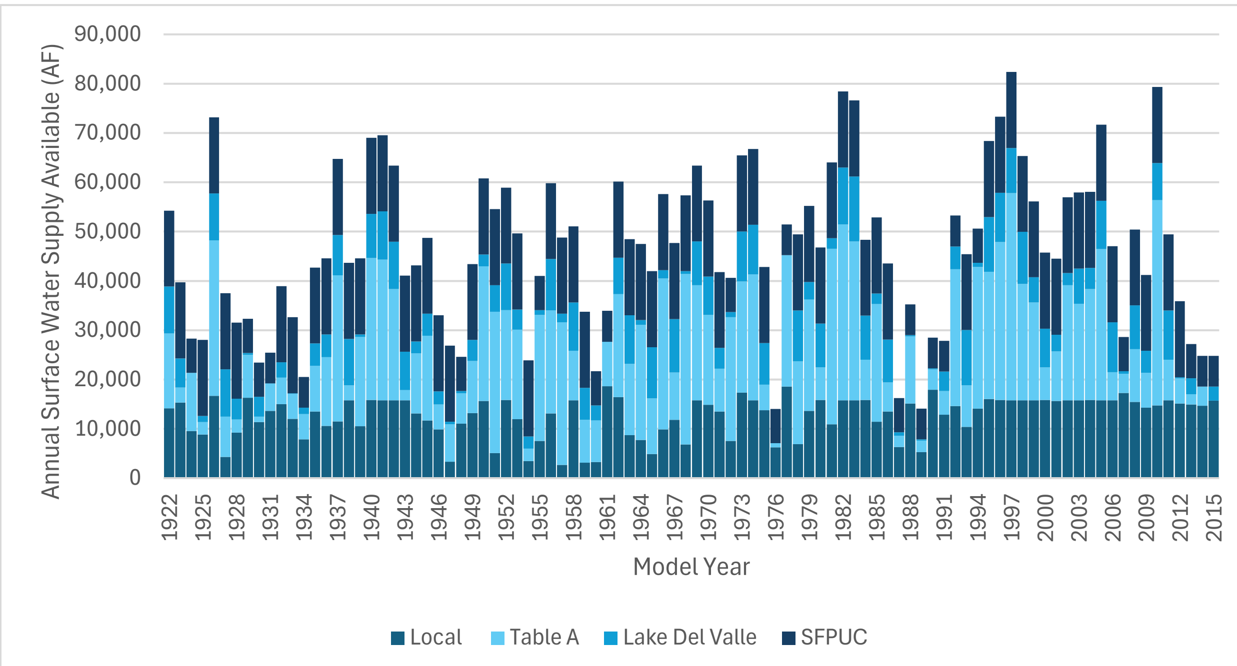
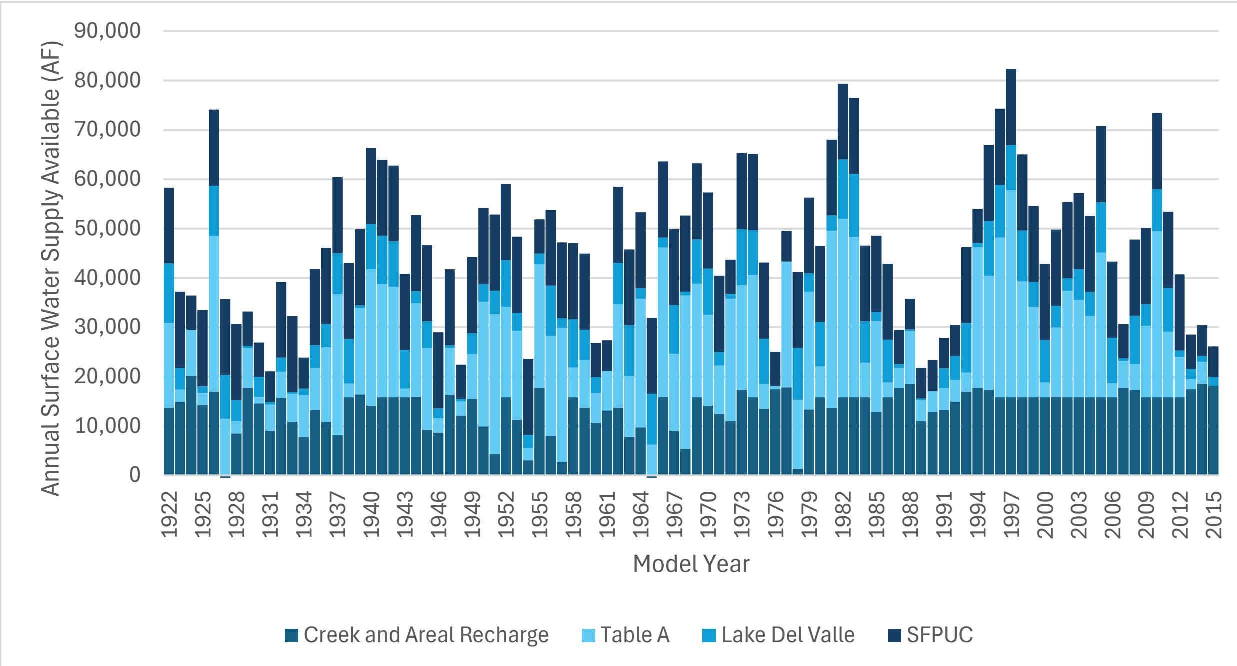


FIGURE 4: SCENARIO C ANNUAL SURFACE WATER SUPPLY AVAILABLE



4. BASELINE RELIABILITY PROJECTIONS

The scenarios and available surface water supplies described in **Section 3** were used as inputs into the RiverWare model. Each scenario was then run in the model to identify potential facility limitations and shortages resulting from limited supplies or facility capacities.

Note that the 1922-2015 range of model years shown on the x-axis of figures in this section represent the historic inflows during this time period, with adjustments to each volume based on the scenario-specific assumptions described earlier in **Table 2**.

4.1 Scenario A Projections

Compared to Scenarios B and C, Scenario A represents a relatively lower level of future climate change impacts and assumes external storage operations are unchanged. The adjusted supplies described in **Section 3** were used as input to the RiverWare model which was run against 2050 demands held constant against the modeled hydrology to forecast supply reliability through deliveries, storage, and potential shortages. The modeled deliveries to meet ACWD demands, shown in **Figure 5**, reflect current baseline ACWD supplies and other facility capacities and operational limitations. For example, during dry periods, SFPUC supply reductions are typically offset with additional groundwater pumping, such as the drought period from 1987 to 1992. **Figure 5** also shows that WTP2, which primarily treats SWP supply along with some Alameda Creek supply, is relatively steady regardless of drought years – reflecting ACWD's practice of recovering Semitropic Bank and San Luis Reservoir supplies to offset SWP Table A reductions provided Semitropic has a sufficient dry year reserve.

Groundwater levels for the AHF and BHF sub-basins simulated under Scenario A are shown in **Figure 6** and indicate that groundwater pumping occurs during multi-year drought periods up until groundwater levels reach five feet below sea level for the BHF Sub-basin and 15 ft above sea level for the AHF Sub-basin.

FIGURE 5: SCENARIO A ANNUAL SUPPLY DELIVERIES TO MEET POTABLE DEMAND

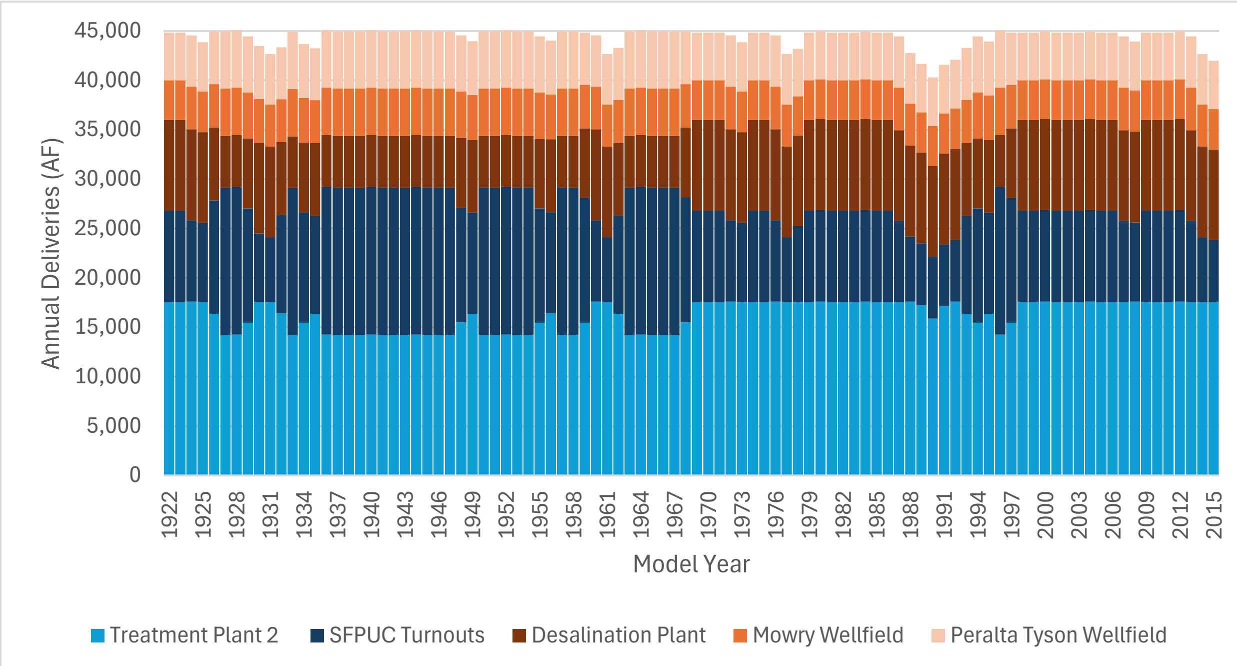
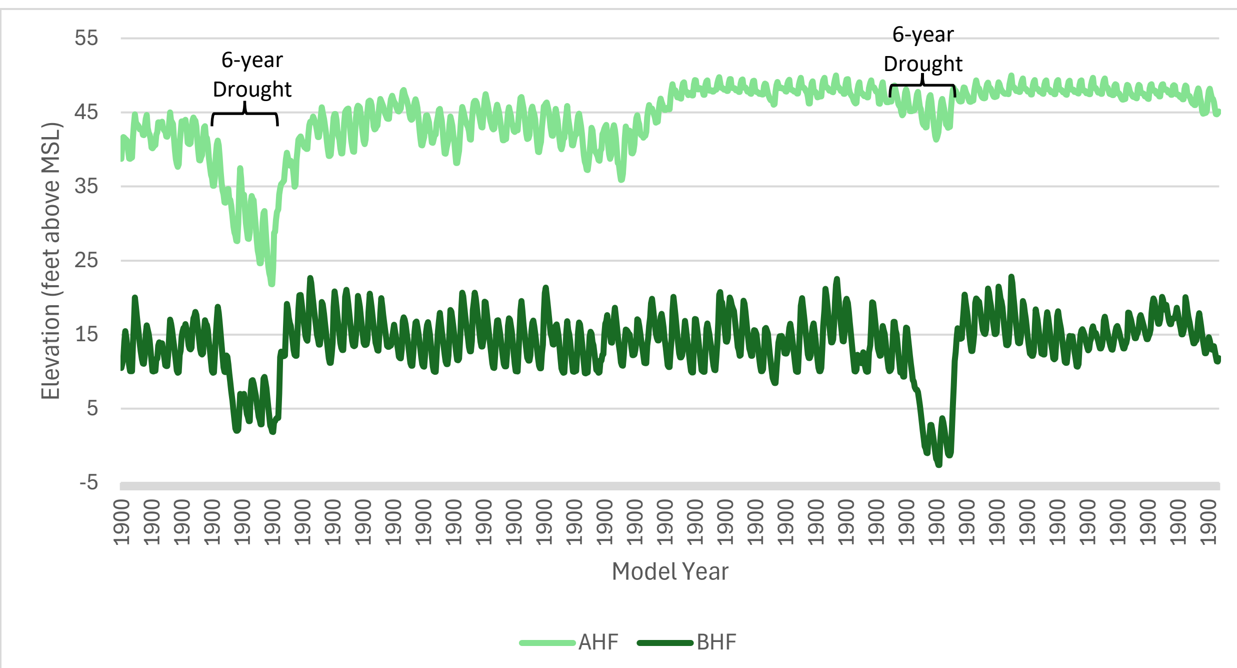
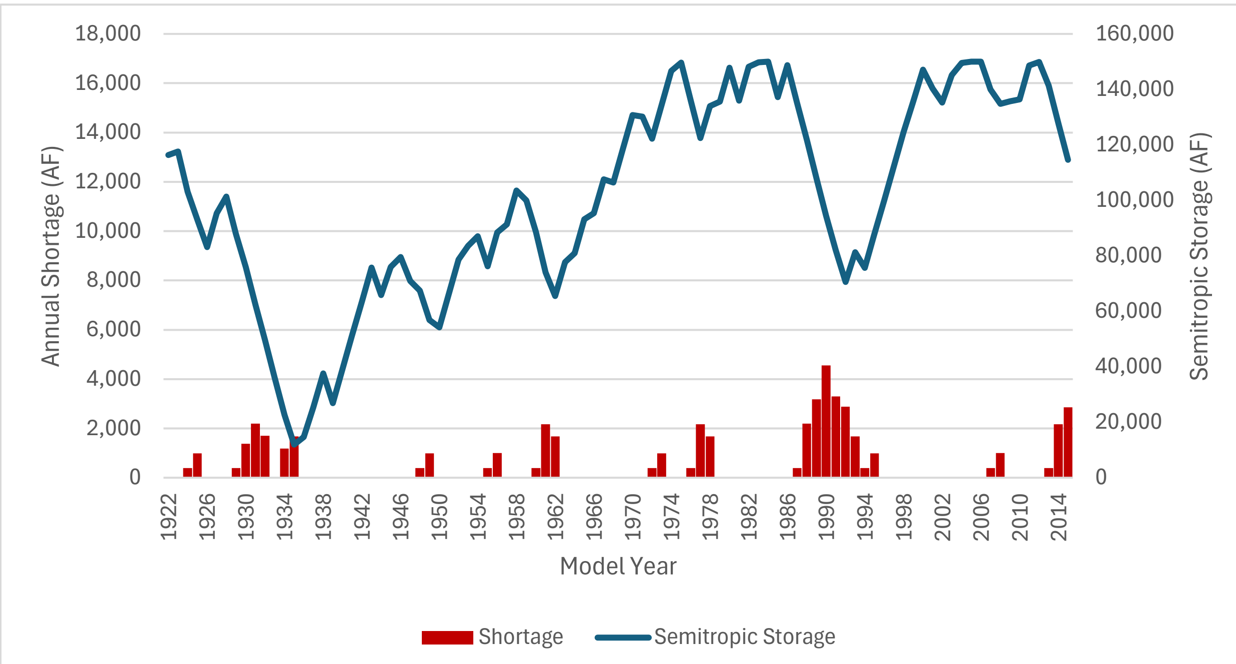


FIGURE 6: SCENARIO A NILES CONE BASIN GROUNDWATER ELEVATIONS



Water Supply shortages are defined as years where annual modeled demands exceed annual supplies. **Figure 7** shows that under Scenario A, the frequency of shortages (red bars) is forecasted to be about 36 percent of the model period. Of those shortages, only one year (or one percent of years) is forecasted to be intense enough to exceed 10 percent of demand which is equal to a shortage of 4,450 AF or more and has historically been ACWD's accepted level of service goal. It should be noted that shortages occurred in the model despite ACWD having water available in storage at Semitropic, also shown in **Figure 7** as the blue line, indicating that conveyance facility capacities and/or operations are limiting the ability to deliver the stored supply.

FIGURE 7: SCENARIO A ANNUAL SHORTAGE VERSUS SEMITROPIC WATER BANK STORAGE



4.2 Scenario B Results

Scenario B represents a relatively higher level of future climate change impacts and assumes storage operations are impacted by increasing a leave-behind requirement at Semitropic and reducing pumpback capacity to reflect SGMA pressures on banking operations. The adjusted supplies described in **Section 3** were used as input to the RiverWare model which was run against 2050 demands and held constant against the modeled hydrology to forecast supply reliability through deliveries, storage, and potential shortages. The modeled deliveries to meet ACWD demands, shown in **Figure 8**, reflect current facility capacities and operational limitations. For example, during dry periods, SFPUC supply reductions are typically offset with additional groundwater pumping, such as the drought period from 1987 to 1992. **Figure 8** also shows that WTP2, which primarily treats SWP supply along with some Alameda Creek supply, is relatively steady regardless of drought years - indicating that in years when less Table A water is available, stored water in the Semitropic Bank and San Luis Reservoir is treated to offset SWP Table A reductions. If Semitropic storage levels are below an ACWD-defined critical threshold, ACWD modifies its priority to offset SWP Table A reductions with SFPUC supplies up to the Individual Supply Guarantee before further depleting water stored in Semitropic.

Groundwater levels for the AHF and BHF sub-basins simulated under Scenario B are shown in **Figure 9** and indicate that, similar to Scenario A, groundwater pumping occurs during multi-year drought periods up until groundwater levels reach five feet below sea level for the BHF Sub-basin and 15 ft above sea level for the AHF Sub-basin.

FIGURE 8: SCENARIO B ANNUAL SUPPLY DELIVERIES TO MEET POTABLE DEMAND

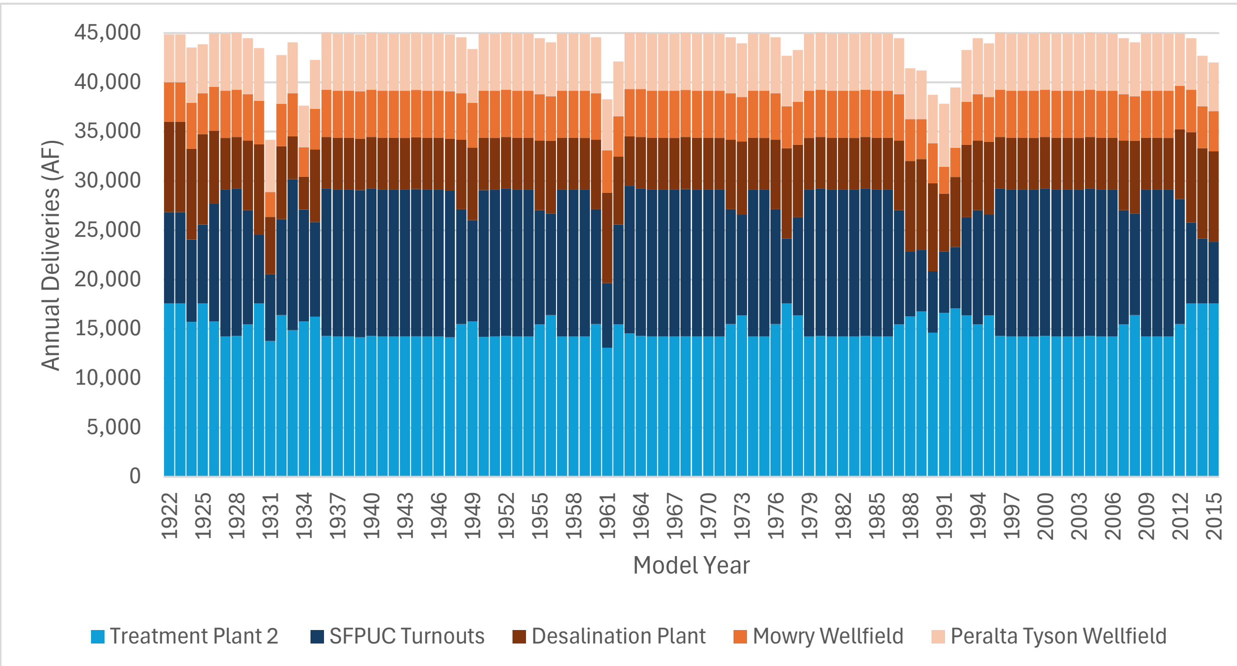
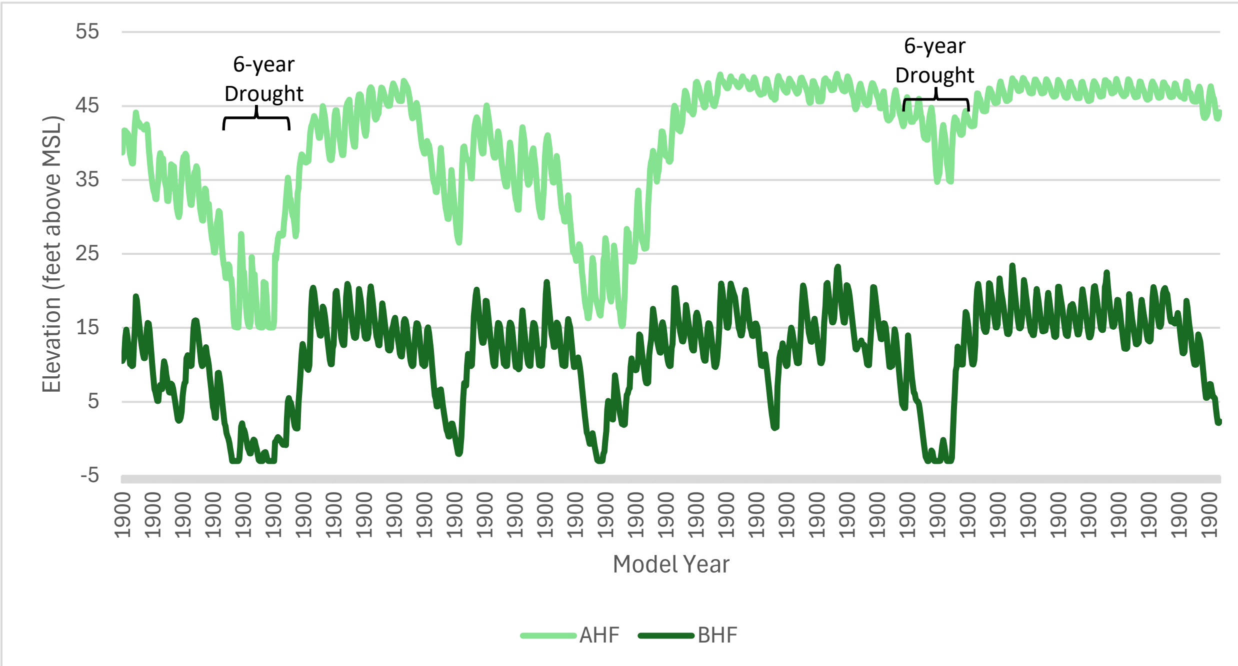
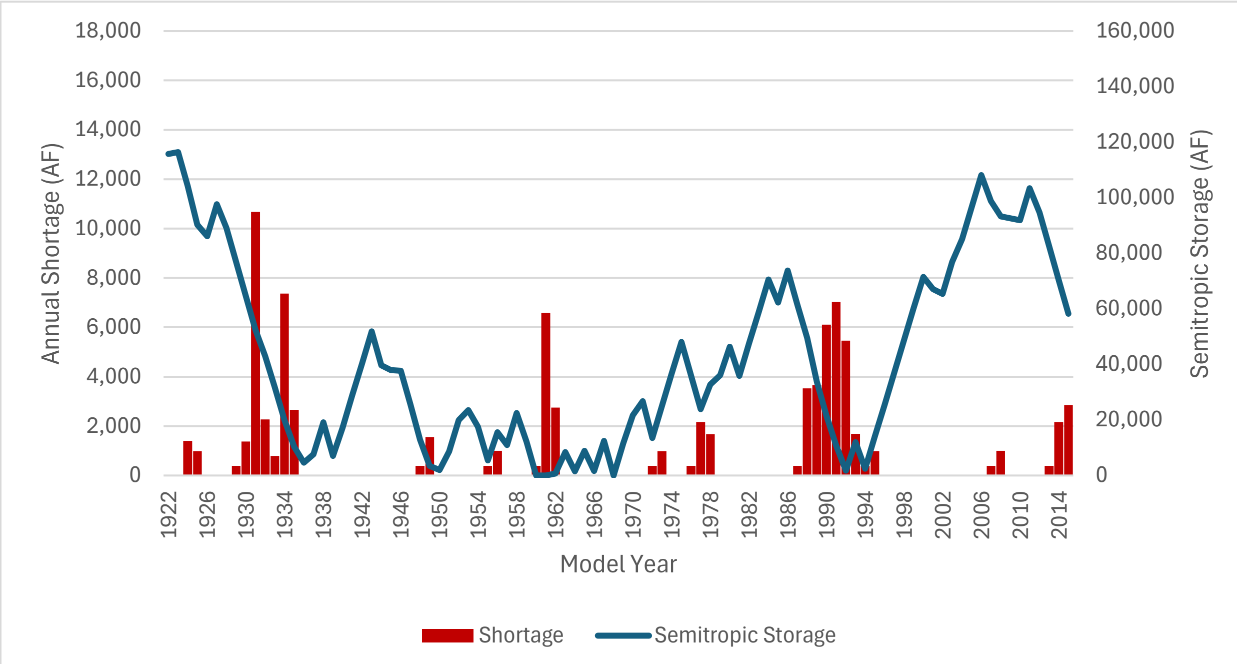


FIGURE 9: SCENARIO B NILES CONE BASIN GROUNDWATER ELEVATIONS



Water Supply shortages are defined as years where annual modeled demands exceed annual supplies. **Figure 10** shows that under Scenario B, the frequency of shortages (red bars) is forecasted to be about 37 percent of years. Of those shortages, six years (or six percent of years) are forecasted to be intense enough to exceed 10 percent of demand, which has historically been ACWD's accepted level of service goal.

FIGURE 10: SCENARIO B ANNUAL SHORTAGE VERSUS SEMITROPIC WATER BANK STORAGE



4.3 Scenario C Results

Scenario C represents a higher level of future climate change impacts. It is assumed that ACWD will no longer be able to store water in the San Luis Reservoir and will be required to have a higher leave-behind in Semitropic Water Bank as well as a reduced ability to pumpback Semitropic water, reflecting an even greater SGMA impact. The adjusted supplies described in **Section 3** were used as input to the RiverWare model which was run against 2050 demands and held constant against the modeled hydrology to forecast supply reliability through deliveries, storage and potential shortages. The modeled deliveries to meet ACWD demands, shown in **Figure 11**, reflect current facility capacities and operational limitations. For example, during dry periods, SFPUC supply reductions are typically offset with additional groundwater pumping, such as the drought period from 1987 to 1993. **Figure 11** also shows that WTP2, which primarily treats SWP supply along with some Alameda Creek supply, is relatively steady but during multi-year droughts there is insufficient ability to deliver stored Semitropic water to effectively offset Table A reductions.

Groundwater levels for the AHF and BHF sub-basins simulated under Scenario C are shown in **Figure 12** and indicate that, similar to Scenarios A and B, groundwater pumping occurs during multi-year drought periods up until groundwater levels reach five feet below sea level for the BHF Sub-basin and 15 ft above sea level for the AHF Sub-basin. The basin is more frequently drawn down to these limits under Scenario C, likely due to a combination of more extreme drought periods, reducing the availability of surface water for both direct use and recharge.

FIGURE 11: SCENARIO C ANNUAL SUPPLY DELIVERIES TO MEET POTABLE DEMAND

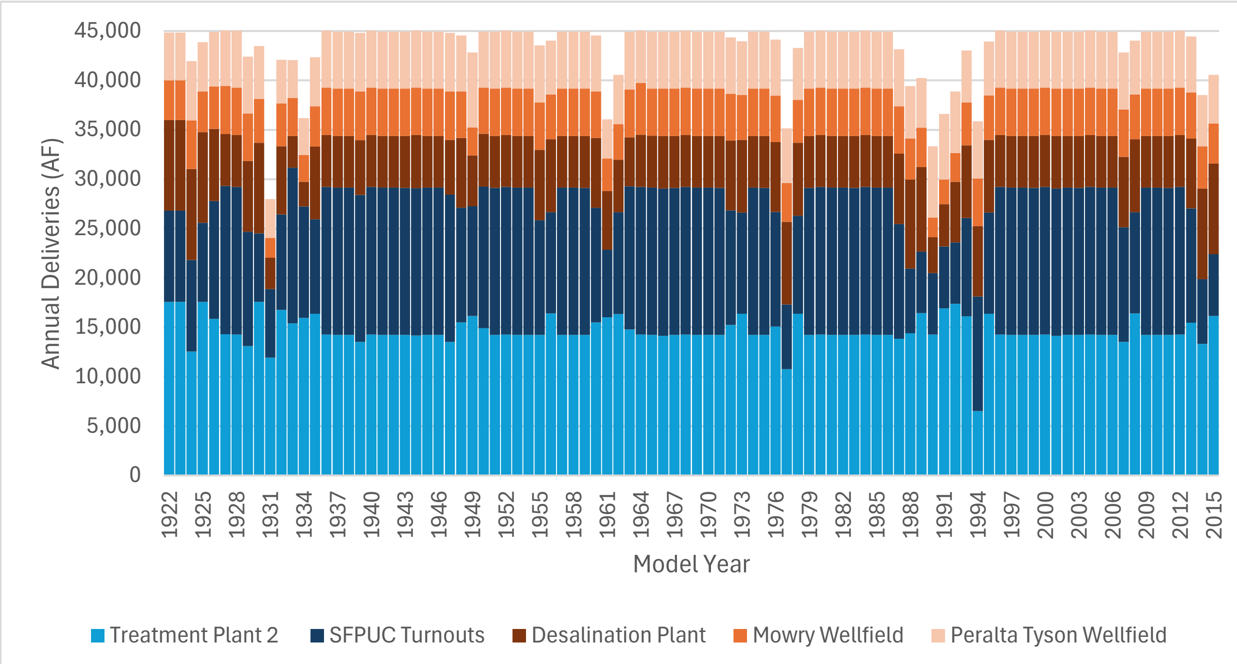
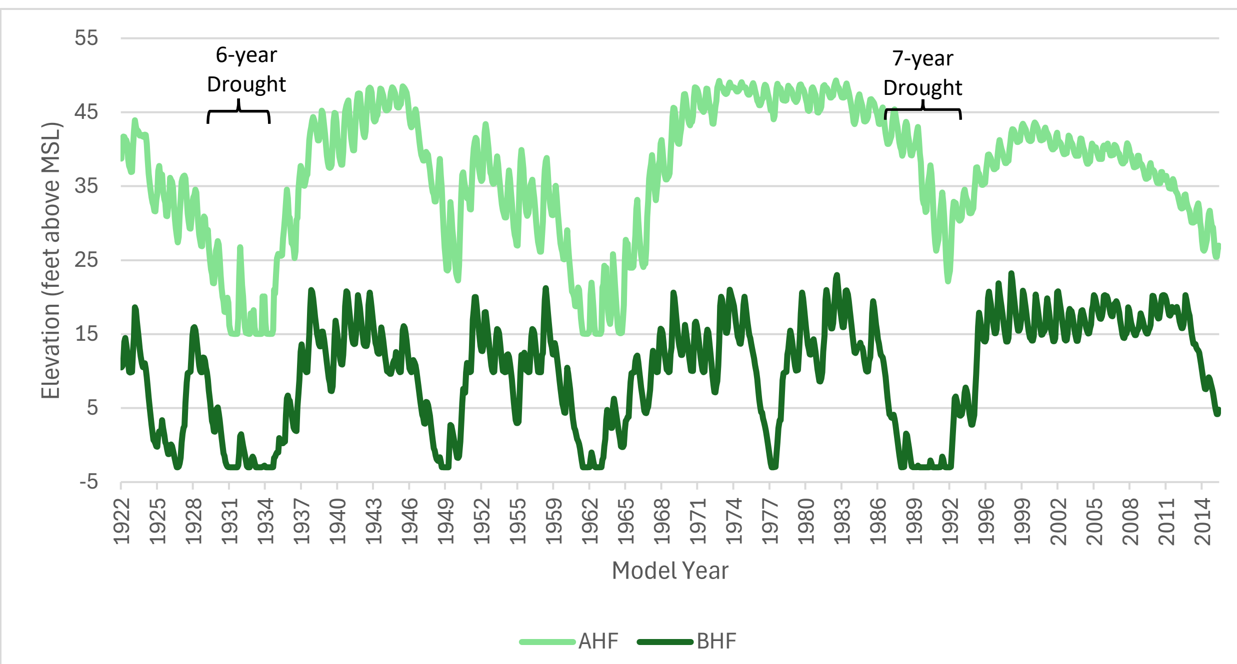
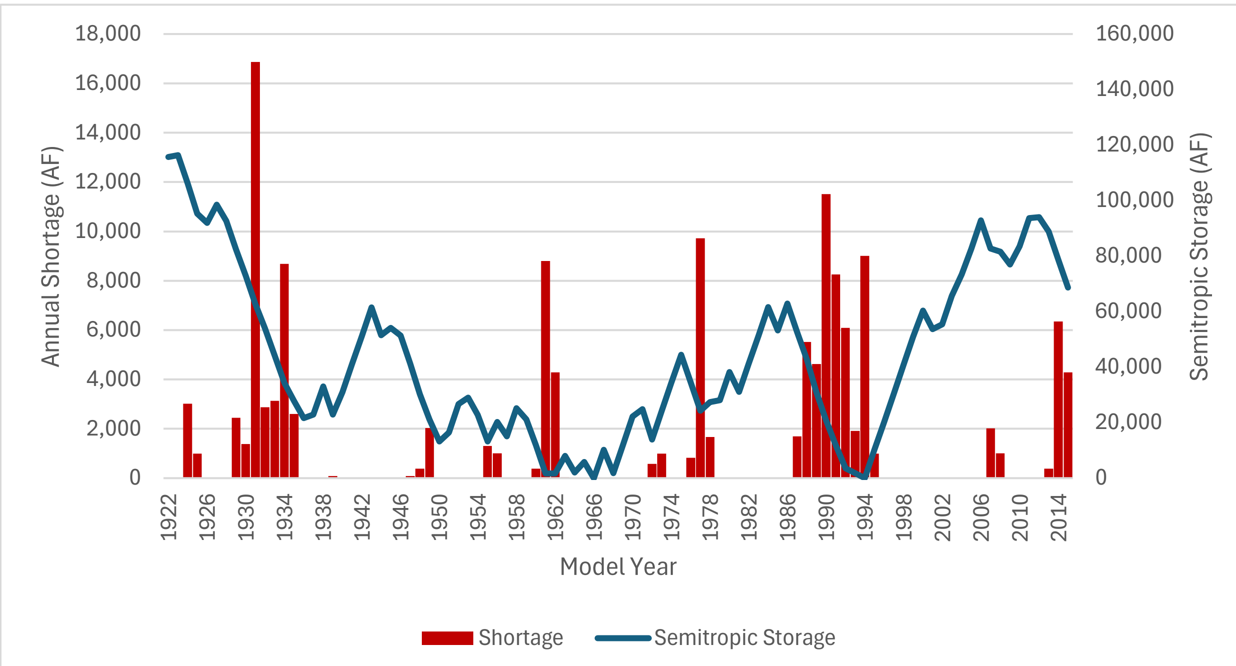


FIGURE 12: SCENARIO C NILES CONE BASIN GROUNDWATER ELEVATIONS



Water Supply shortages are defined as years where annual modeled demands exceed annual supplies. **Figure 13** shows that under Scenario C, the frequency of shortages (red bars) is forecasted to be about 40 percent of the model period. Of those shortages, 11 years (or 11 percent of years) are forecasted to be intense enough to exceed 10 percent of demand, equal to a shortage of 4,450 AF or more, which has historically been ACWD's accepted level of service goal. It should be noted that some shortages occurred in the model despite ACWD having water available in storage at Semitropic, also shown in **Figure 13** as the blue line, indicating that conveyance facility capacities and/or operations are limiting the ability to deliver the stored supply in some shortage years.

FIGURE 13: SCENARIO C ANNUAL SHORTAGE VERSUS SEMITROPIC WATER BANK STORAGE



4.4 Scenario Results Comparison

The results of the three modeled scenarios indicate that assumptions about future climate change and water storage operations can create a large variation in potential future supply availability and supply reliability forecasts. Scenarios A and B resulted in similar shortage frequencies, though Scenario B had shortages of higher magnitude. In contrast, under Scenario C, shortages were more frequent and at a much greater magnitude. For example, as shown in **Table 3**, shortages are significantly higher during Single Year Drought and the first few years of a Multi-Year Drought under Scenario C as compared to Scenarios A and B. Later years of a Multi-Year Drought are more similar between Scenarios B and C. These results indicate that increasing impacts from climate change and reduced ability to retrieve externally stored water may result in larger, more frequent shortages in the future.

TABLE 3: MODELED SHORTAGES

	Scenario A Shortage (AFY)	Scenario B Shortage (AFY)	Scenario C Shortage (AFY)
Single Year Drought (1977)	-2,173	-2,173	-9,717
Multi-Year Drought (1987)	-394	-394	-1,698
Multi-Year Drought (1988)	-2,190	-3,534	-5,524
Multi-Year Drought (1989)	-3,183	-3,662	-4,626
Multi-Year Drought (1990)	-4,550	-6,113	-11,512
Multi-Year Drought (1991)	-3,294	-7,031	-8,255
Multi-Year Drought (1992)	-2,881	-5,467	-6,094
Multiple Dry Year (1993)	Not applicable	Not applicable	-1,914

5. CONCLUSION

Based on the results described above, it is recommended that the "baseline portfolio" align with the supplies and facilities modeled under Scenario B. Under this scenario, supply deliveries and storage are sufficient to meet future demands in average years while not exceeding ACWD's level of service goal during shortages in a significant way.

In addition, it is recommended that Scenario C conditions be used to evaluate the ability of portfolios to respond to more pessimistic conditions. Scenario C assumes more severe impacts in 2050 from climate change and regulatory constraints than current projections, approximating moderate climate assumptions for the year 2075. Accordingly, Scenario C may provide greater insight into differences in portfolio reliability as well as conditions extending into the 50-year planning horizon.

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APPENDIX A: MODEL NETWORK DIAGRAM

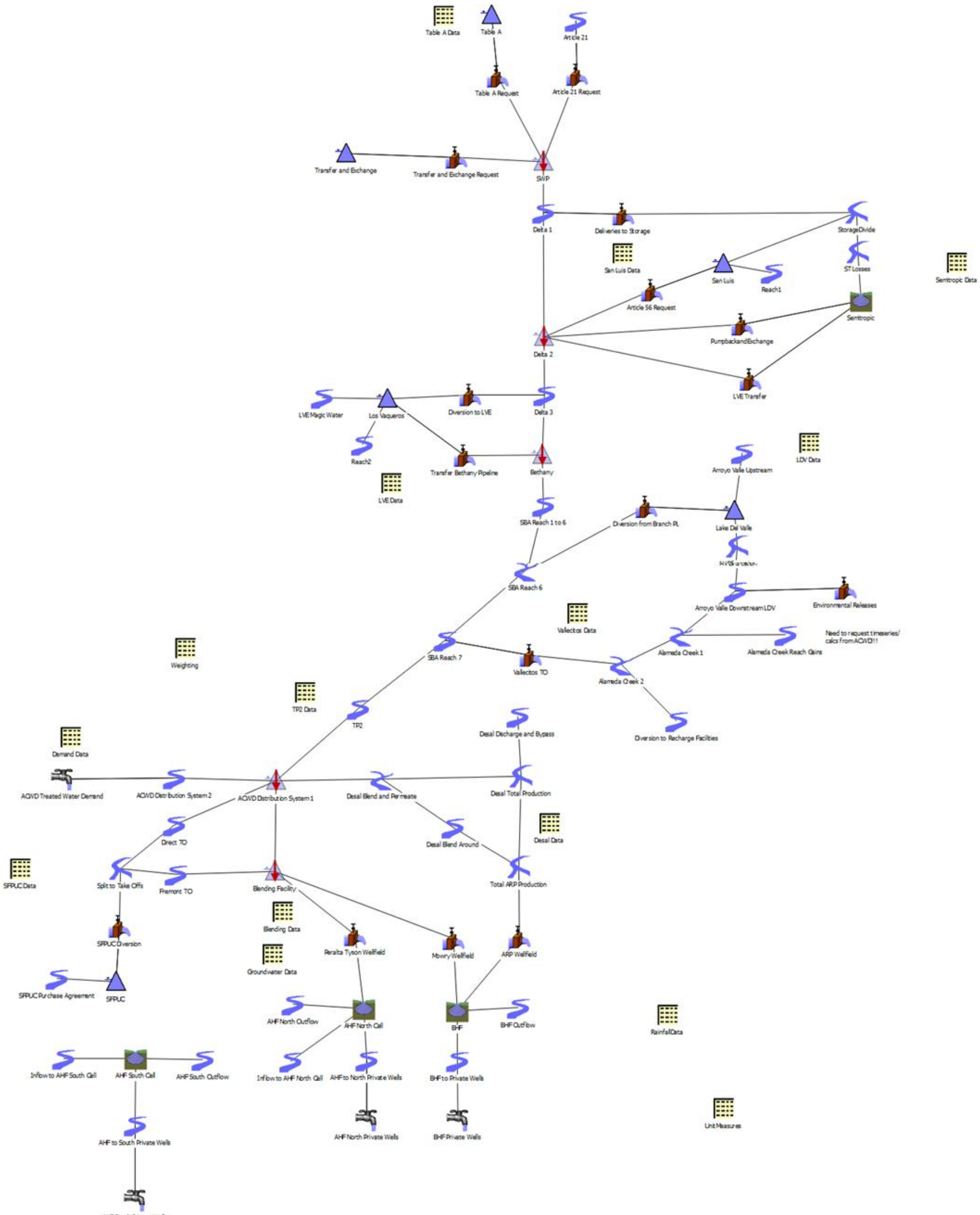
Table A Data
Table A
Article 21
Table A Request
Article 21 Request
Transfer and Exchange
Transfer and Exchange Request
SWP
Delta 1
Deliveries to Storage
StorageDivide
San Luis Data
ST Losses
San Luis
Reach1
Semitropic Data
Article 56 Request
Semitropic
PumpbackandExchange
Delta 2
LVE Transfer
LVE Magic Water
Los Vaqueros
Diversion to LVE
Delta 3
Reach2
Transfer Bethany Pipeline
Bethany
LDV Data
Arroyo Valle Upstream
LVE Data
SBA Reach 1 to 6
Diversion from Branch PL
Lake Del Valle
SBA Reach 6
Arroyo Valle Downstream LDV
Environmental Releases
Vallecitos Data
Weighting
SBA Reach 7
Alameda Creek 1
Alameda Creek Reach Gains
Need to request timeseries/ calcs from ACWD!!!
Vallecitos TO
Alameda Creek 2
TP2 Data
TP2
Diversion to Recharge Facilities
Desal Discharge and Bypass
Demand Data
ACWD Treated Water Demand
ACWD Distribution System 2
ACWD Distribution System 1
Desal Blend and Permeate
Desal Total Production
Desal Data
Direct TO
Desal Blend Around
SFPUC Data
Split to Take Offs
Fremont TO
Blending Facility
Total ARP Production
Blending Data
SFPUC Diversion
Groundwater Data
Peralta Tyson Wellfield
Mowry Wellfield
ARP Wellfield
SFPUC Purchase Agreement
SFPUC
AHF North Outflow
AHF North Cell
BHF
BHF Outflow
RainfallData
Inflow to AHF South Cell
AHF South Cell
AHF South Outflow
Inflow to AHF North Cell
AHF to North Private Wells
BHF to Private Wells
UnitMeasures
AHF North Private Wells
BHF Private Wells
AHF to South Private Wells
AHF South Private Wells

APPENDIX D
WATER SUPPLY OPTIONS AND WATER RESOURCE STRATEGIES

ALAMEDA COUNTY WATER DISTRICT
WATER RESOURCES MASTER PLAN 2050

TECHNICAL MEMORANDUM

TO: Thomas Niesar, Alameda County Water District

PREPARED BY: Max Storms & Max McNally, Woodard & Curran

REVIEWED BY: Dawn Flores, Persephene St. Charles, & Chris Hewes, Woodard & Curran

DATE: February 5, 2026

RE: Water Supply Options and Water Resources Strategies for ACWD's WRMP 2050

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APPENDICES

Appendix A: Water Supply Options Workbook

Appendix B: Initial List of Water Supply Options

ACRONYMS AND ABBREVIATIONS

ACWD	Alameda County Water District
AF	acre-feet
AFY	acre-feet per year
ARP	Aquifer Reclamation Program
AWPF	advanced water purification facility
ENR CCI	Engineering News-Record Construction Cost Index
CCWD	Contra Costa Water District
CE	Community and Equity
CIP	Capital Improvement Program
CVP	Central Valley Project
DM	demand management
DPR	direct potable reuse
DSRSD	Dublin San Ramon Services District
DWR	Department of Water Resources
EBDA	East Bay Discharge Authority
EBMUD	East Bay Municipal Utility District
ft	feet
ft msl	feet above mean sea level
FIRO	Forecast-Informed Reservoir Operations
gpm	gallons per minute
GSP	groundwater sustainability plan
GW	groundwater
IPR	indirect potable reuse
IRP	Integrated Resources Plan
IW	imported water
IX	ion exchange
LW	local surface water
MCL	maximum contaminant level
MF	microfiltration
mgd	million gallons per day
NDF	Newark Desalination Facility
O&M	operations and maintenance
OI	Operational Improvements
OW	Ocean or Bay Water
PFAS	Per- and polyfluoroalkyl substances
PL	Policy and Leadership
PW	purified water
PWFS	Purified Water Feasibility Study
RO	reverse osmosis
SBA	South Bay Aqueduct
SBW	Salinity Barrier Well
SFPUC	San Francisco Public Utilities Commission

SGMA	Sustainable Groundwater Management Act
SWP	State Water Project
TM	technical memorandum
USBR	United States Bureau of Reclamation
USD	Union Sanitary District
UWMP	Urban Water Management Plan
UWUO	Urban Water Use Objective
WCWTP	Walnut Creek Water Treatment Plant
WEMP	Water Efficiency Master Plan
WRMP	Water Resources Master Plan
WS	Watershed Stewardship
WTP1	Mission San Jose Treatment Plant
WTP2	Water Treatment Plant 2
WUE	Water Use Efficiency
WWTP	wastewater treatment plant

1. INTRODUCTION

Alameda County Water District (ACWD or the District) is undertaking an update to its 1995 Integrated Resources Plan (IRP). Since the IRP was adopted nearly 30 years ago, the District has experienced many changes that warrant an updated look at the future of its water supply. The 2050 Water Resources Master Plan (WRMP) will serve as a long-range planning document that outlines the District's water supply strategy and informs other aspects of District planning. The goal of the WRMP is to inform critical decision making on future infrastructure and water supply investments by providing valuable information about the District's future resilience in the face of known uncertainties, such as climate change and changing regulations. This plan will create a roadmap for water supply reliability by analyzing changing conditions and the communities the District serves – now and in the future.

This technical memorandum (TM) details the water supply options and resource strategies that were identified that could potentially help meet the goals established for the WRMP. Water supply options are projects that develop a new water supply for use by ACWD. Water resource strategies are actions or projects that support supply as well as other WRMP goals without directly producing a specific volume of water to meet ACWD demands. The TM is organized as follows:

- **Section 1:** Introduction
- **Section 2**: Water Supply Development Process
- **Section 3**: Water Supply Options
- **Section 4**: Water Resources Strategy Development Process
- **Section 5:** Water Resource Strategies
- **Section 6:** Conclusion

2. WATER SUPPLY DEVELOPMENT PROCESS

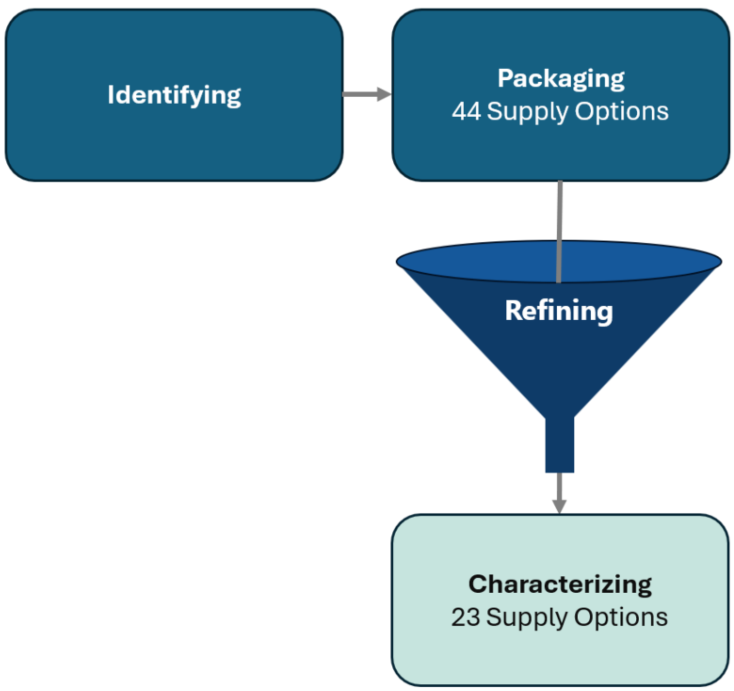
2.1 Water Supply Options Overview

Water supply options are projects that would develop water supply for use by ACWD. Options consider where supply is sourced, how it can be delivered to ACWD, and how ACWD can deliver that supply to its customers. Water supply options seek to build on ACWD's existing water supply portfolio, to offset existing supplies or augment existing supplies. Water supply options address ACWD's WRMP goal to attain a sustainable water supply portfolio that leverages local resources and adapts to climate change.

2.2 Development Methodology

The water supply options presented in **Section 3** for use in the WRMP were developed through a multi-step process as described in **Figure 2-1**, with each step further described in the subsections below.

FIGURE 2-1: OPTIONS DEVELOPMENT PROCESS



Input from ACWD Staff and interested parties was solicited and incorporated throughout each of these steps to ensure the validity of the concept and to articulate the concept according to the most recent and reasonable assumptions.

2.2.1 Identifying

An initial list of previously identified and studied supply option concepts were sourced from a range of planning documents included in **Appendix B**. New concepts and ideas developed by the team and provided through engagement with ACWD staff, ACWD Board of Directors (Board), and other interested parties were also identified.

2.2.2 Packaging

A WRMP water supply option must be a complete concept that considers all five potential elements that could be needed to serve those supplies to ACWD customers. The necessary elements must be packaged together as shown below.

Supply Source + **Conveyance** + **Storage** + **Treatment** + **Distribution**

Many of the supply options identified were incomplete in that they focused on a specific supply source or method of storage but did not yet include one or more of the components necessary in a complete package. To fill gaps, planning level assumptions were assigned to represent the missing but necessary elements. The resulting list of 42 complete supply options were vetted with the Board which resulted in two additional supply options. This listing of 44 complete supply options is provided in **Appendix B**.

2.2.3 Refining

Once completed, some of the 44 supply options revealed overlaps between each other and instances where others could be considered as variations of essentially the same option. These option groupings were refined to further streamline them into a shorter list of unique options. None of the water supply options were removed during this process, but were instead refined in one of three ways:

- One option was selected to represent a group of similar options.

  Example: A go-it-alone San Francisco Bay water desalination project was selected for characterization; in the future, ACWD can evaluate partnerships against a go-it-alone option.

- Options that build on each other in phases were consolidated

  Example: Purified water options to augment recharge and to augment raw water inflows to ACWD's water treatment plants are separate phases of a project recommended in the 2023 Purified Water Feasibility Study (PWFS).

- Options that target the same objective were consolidated

  Example: Groundwater banking opportunities outside the Alameda Creek Watershed are plentiful (e.g., Irvine Ranch Water District, Sacramento Regional Water Bank, High Desert Water Bank, expanded participation in Semitropic's bank). However, the key question is whether ACWD should consider expanding its participation in regional groundwater banks; the specific terms of each bank can be evaluated against ACWD's future need for groundwater banking.

The refinement process resulted in a streamlined list of 22 representative water supply options plus an additional enhanced water use efficiency (i.e., demand management) option that was added as a result of the completion of the District's water use efficiency planning. The resulting list of 23 water supply options was then moved into the characterization step.

2.2.4 Characterizing

A fully characterized supply option includes the articulation of the following estimations and assumptions:

- **Capital Infrastructure:** Any new capital infrastructure needed to convey, store, treat or distribute the supply as well as any necessary upgrades or enhancements to existing infrastructure

- **Operations and Maintenance:** Materials used, or actions taken that are needed to maintain production over the lifecycle of the option
- **Costs:** Any associated costs with the above, including capital, O&M, and water purchase costs
- **Yield:** Volume of water supply provided on an average annual basis
- **Data Needs:** Any data and/or analytical needs as well as key implementation considerations

The methods used to generate the estimates and assumptions are presented below.

Capital Infrastructure

Capital infrastructure needs to implement each water supply option were assessed by considering where new facilities would be sited alongside what facilities would be needed to deliver water supplies to ACWD's customers. This includes reviewing, assessing, and documenting past analyses and studies to assess what water supply options have been considered in the past along with developing a set of capital infrastructure projects for new water supply options.

Operations and Maintenance (O&M)

Operations and maintenance (O&M) needs for each option considered what ACWD would need to do to operate and maintain new infrastructure associated with the water supply option. This included consideration of materials, periodic maintenance, power consumption, any new staffing, and treatment costs. O&M activities were based on past studies where available and were developed for options that where past information was not available. Simplifying assumptions about O&M activities were made where appropriate (e.g., cost of treatment per million gallons per day (mgd), cost of power per kwh).

Costs

Costs presented are Class 5, planning-level cost estimates based on the maturity of the characterized projects. Class 5 estimates represent an order of magnitude estimate and typically have an accuracy of -50% to +100%. Past cost estimates are escalated for space (the San Francisco Bay Area) and time (2025) using the Engineering News-Record Construction Cost Index (ENR CCI). Annualized capital costs assume a 3% discount rate, consistent with the United States Bureau of Reclamation (USBR) Water Resources Planning Rate, and a thirty-year payment period. Detailed cost estimates are provided for each option and are included as **Appendix A**.

Yields

Yields were developed by assessing what volume of supply might be available to develop alongside the size of the facilities needed to develop the supply. In some cases, ACWD might consider phasing a project to develop additional yield over time. Yields considered groundwater volumes available, wastewater flows available for advanced treatment, potential dry-year water supply shortages, and potential pump back volumes. Yields were developed at a planning-level to assess how each water supply option might benefit ACWD in the future; as promising options are further considered, yields may change with more specific information.

Data Needs

Data needs were considered for each water supply option to identify any information gaps or to identify next steps to gather that missing information. For example, if an option requires collaboration with an outside agency, ACWD might need to initiate discussion with that agency about that option. Similarly, if yields are uncertain ACWD may need to conduct more detailed analyses to refine yield estimates.

3. WATER SUPPLY OPTIONS

The final list of water supply options are presented in this section starting with a summary **Table 3-1** that groups and numbers the options by supply sources of groundwater (GW), imported water (IW), local surface water (LW), ocean or San Francisco Bay water (OW), purified water (PW), and demand management (DM). Each of these options are presented with fully characterized descriptions in the sections that follow.

TABLE 3-1: LIST OF WATER SUPPLY OPTIONS

#	Supply Option Title	Description
GW.1	**Groundwater Desalination**	A new groundwater desalination facility can source groundwater from the brackish portion of the Niles Cone Groundwater Basin. Desalinated water will then enter ACWD's distribution system. The facility can be sited in the southern portion of ACWD's service area. Brine disposal to San Francisco Bay may fall under the conditions of the ACWD's existing permit for NDF.
GW.2	**Revise Groundwater Rule Curves in the Niles Cone Groundwater Basin**	ACWD can expand groundwater pumping in the Niles Cone Groundwater Basin and lower annual nominal groundwater levels to bolster the Alameda Creek watershed supply via increased annual capture in above average years and reductions in saline outflow.
GW.3	**Lower Minimum Operating Levels for the Niles Cone Groundwater Basin**	ACWD can expand the extraction of groundwater from the Niles Cone Below Hayward Fault Sub-basin to levels below the current minimum operating level of -5 feet above mean sea level (ft msl) for short durations during critical droughts. Likewise, ACWD can extract groundwater from the Niles Cone Above Hayward Fault Sub-basin to levels below the current minimum operating level of 15-20 ft msl.
GW.4	**Enhanced Groundwater Treatment for PFAS and Hardness**	Enhanced groundwater treatment for per- and polyfluoroalkyl substances (PFAS) and hardness can allow ACWD to use more local groundwater during normal and wet years as ACWD could substantially reduce or possibly replace its dependence on San Francisco Public Utilities Commission (SFPUC) supply for blending to meet water quality objectives. This option could leverage a proposed amendment to the water supply contract with SFPUC to reduce ACWD's minimum purchase requirement.
GW.5	**Optimize Newark Desalination Facility Operations**	Treatment efficiency at Newark Desalination Facility (NDF) might be improved by optimizing plant operations, or through installation of additional infrastructure at NDF. One option includes a brine recirculation program to recover additional potable supply, thereby increasing the overall recovery of total gross Aquifer Reclamation Program (ARP) pumping. Improving treatment efficiency at NDF would then free up groundwater supplies to be produced elsewhere. This option is feasible given that aquifer remediation has advanced to the point that brine discharged from NDF is less saline than the original source when NDF was built.

#	Supply Option Title	Description
GW.6	**Construct Southern Blending Facility**	Constructing groundwater wells and a new blending facility in the southern portion of ACWD's service area near SFPUC takeoffs (i.e., near Warm Springs) can allow for the use of groundwater in the southern portion of the service area in a yet-to-be defined part of the groundwater basin; this part of the basin may result in additional yield not currently available to ACWD.
IW.1	**Groundwater Banking Outside Alameda Creek Watershed**	ACWD can expand its use of groundwater banking via opportunities outside of the Alameda Creek Watershed. This might include expanded participation with Semitropic, participation in a different regional bank (e.g., High Desert, Sacramento Regional Water Bank, or Irvine Ranch Water District), or the creation of an ACWD-controlled groundwater bank in the Central Valley. ACWD could store excess SWP supply or an alternative imported water supply in the selected groundwater bank.
IW.2	**Regional Surface Water Storage**	ACWD can pursue opportunities to store imported water supplies in regional reservoirs. These opportunities might include dedicated storage in Los Vaqueros Reservoir, participation in Sites Reservoir, leased storge in San Luis Reservoir, among others.
IW.3	**New Imported Water Supply (Non-SWP)**	ACWD can pursue alternative imported water supplies to supplement its existing water supply portfolio. Currently, ACWD imports water from the SWP and SFPUC. Alternative imported water supplies might include Central Valley Project (CVP) or Yuba Water Agency, for example.
IW.4	**Sunol Aqueduct**	The currently decommissioned Sunol Aqueduct could be used to convey imported water supplies to ACWD's service area. The Sunol Aqueduct may require substantial rehabilitation or replacement pending results of a thorough condition assessment. Previous assessments have confirmed that the approximately 1000 feet of the original alignment are missing. The Sunol Aqueduct is owned by SFPUC therefore use of the aqueduct would require acquisition of the asset or a leasing arrangement with SFPUC. As a closed channel, use of the Sunol Aqueduct might prevent future regulatory erosion of water supplies currently conveyed via Alameda Creek.
IW.5	**Groundwater Banking Inside Alameda Creek Watershed**	ACWD can pursue local groundwater banking inside the Alameda Creek Watershed to store excess water supplies during wet and normal years for use in dry years. ACWD might partner with Zone 7 Water Agency to operate the proposed Chain of Lakes groundwater bank in the Livermore Valley Basin. ACWD might also bank water in the Niles Cone Groundwater Basin pending the results of hydrogeologic study.
IW.6	**Increase Peak Blending Capacity at Fremont Takeoff**	Increasing blending capacity at the SFPUC-ACWD Fremont Takeoff would allow ACWD to take more SFPUC supplies and produce more groundwater supplies to accommodate water treatment plant outages or interruptions to SWP supply without compromising water quality.

#	Supply Option Title	Description
IW.7	**Pretreatment Facility at EBMUD's Walnut Creek Water Treatment Plant**	ACWD could partner with East Bay Municipal Utility District (EBMUD) to construct a Pretreatment Facility at the existing Walnut Creek Water Treatment Plant (WCWTP) to treat and deliver surface water from the Sacramento River and Los Vaqueros Reservoir to neighboring water agencies, including ACWD. This is a companion project to Los Vaqueros Expansion and would require construction of the Transfer Bethany Pipeline for conveyance.
LW.1	**Augment Wet Year Recharge and Expand ACWD Distribution**	ACWD is not able to use NDF at its full capacity because the zones that NDF can supply do not have sufficient demand to make use of NDF's full capacity during winter months. Expanding the ACWD distribution system to allow for delivery of supplies from NDF to more customers would alleviate this issue. To accommodate this expanded use of groundwater, ACWD would also need to increase the volume of local water it recharges into the Niles Cone Groundwater Basin via Quarry Lakes.
LW.2	**Augment Wet Year Recharge and Construct SFPUC Intertie**	ACWD is currently unable to utilize the full capacity of NDF, particularly during the winter months, due to limited demand in the zone it serves. Constructing an intertie with SFPUC's Bay Division Pipeline would allow NDF supplies to be delivered to SFPUC for sale or possible exchange, allowing for full use of the facility. To support this expanded groundwater use, ACWD would also need to increase local water recharge into the Niles Cone Groundwater Basin via Quarry Lakes.
LW.3	**Optimize and Enhance Del Valle Yields**	ACWD can optimize how it exercises its existing water right to enhance yields at Del Valle Reservoir. ACWD's existing water rights permit up to 60,000 acre-feet per year (AFY) in diversions between January 1 and December 31 while maintaining live-stream flow requirements.
LW.4	**Regional Stormwater Capture**	ACWD can partner with municipalities in its service area to develop centralized and decentralized stormwater infrastructure or policy to enhance the region's capacity to capture and store stormwater flows for recharge or potable use offsets.
OW.1	**Bay Water Desalination**	A new Bay water desalination facility can source saline water supply from San Francisco Bay via slant wells. Desalinated water could then enter ACWD's distribution system from the desalination facility. The facility could be sited in the southern portion of ACWD's service area. Brine can be conveyed to USD's existing wastewater discharge line located at the Alvarado WWTP.
PW.1	**Indirect Potable Reuse with SFPUC Intertie**	Like LW.2, constraints on use of NDF can be alleviated with an intertie with SFPUC's Bay Division Pipeline. Instead of recharging local supplies to accommodate expanded groundwater production, ACWD could instead recharge with purified water.
PW.2	**Indirect Potable Reuse with Expanded ACWD Distribution**	Like LW.1, constraints on use of NDF can be alleviated with an expansion of ACWD's distribution system. Instead of recharging local supplies to accommodate expanded groundwater production, ACWD could instead recharge purified water.

#	Supply Option Title	Description
PW.3	**Indirect Potable Reuse for Groundwater Recharge and Raw Water Augmentation**	The 2023 Purified Water Feasibility Study (PWFS) recommends a multi-phase option to develop purified water supply for indirect potable reuse (IPR). Phase 1 involves recharging advanced treated wastewater from USD at Quarry Lakes, extracting that water at the Mowry wellfield, and further treating it at a new reverse osmosis (RO) treatment facility located at the Blending Facility. Phase 2 involves expanding advanced treatment at USD and conveying a portion to Water Treatment Plant 2 (WTP2) as raw water to replace or augment SWP or local supplies currently treated at WTP2.
PW.4	**Direct Potable Reuse**	Direct potable reuse (DPR) for ACWD would involve treated wastewater flows from USD, with an advanced water purification facility (AWPF) that directly feeds the ACWD distribution system.
DM.1	**Additional Water Use Efficiency**	ACWD is already engaging in numerous existing water use efficiency programs (i.e., incentives, rebates, technical assistance) and expanding them (enhanced programs, policy and enforcement, AMI targeted outreach) to meet the State Urban Water Use Objectives (UWUO). This additional water use efficiency supply option adds Direct Install for Multi-family residential sites and industrial process water reuse projects.

3.1 Groundwater Options

GW.1 – Groundwater Desalination

Description:

ACWD currently provides desalinated groundwater to its customers via Newark Desalination Facility (NDF). A new desalinated groundwater supply option could be pursued in previously unused portions of the Newark Aquifer where brackish groundwater exists. ACWD is currently investigating yield and water quality in these portions of the Newark Aquifer through a groundwater "data gap" project entailing both geologic exploration and groundwater modeling. The results of this analysis will inform the potential siting and yield of new wells to be used for groundwater desalination.

The groundwater desalination option presented here assumes wells would be sited south of the current NDF wells in the southern portion of ACWD's service area. Wells would be sited near a new groundwater desalination facility and produce brackish water for treatment. The facility is assumed to have 75% treatment efficiency (i.e., 25% of the water treatment is discharged as brine). Brine would be disposed via conveyance to Union Sanitary District's (USD) existing wastewater discharge line located at the Alvarado Wastewater Treatment Plant (WWTP) or added to ACWD's existing NDF NPDES permit. The facility's size will be subject to findings from the groundwater data gap project and based on ACWD's overall water supply needs. The project could be phased to build additional capacity over time as ACWD's water supply needs change. The option presented here assumes a 5.3 mgd facility producing 4,480 acre-feet per year (AFY) as an initial phase. General facility sizing assumptions are made for cost estimation purposes and will require additional study to determine appropriate sizing and siting.

Other options for new groundwater desalination include:

- Sourcing water from the Bay Influence Zone of the Newark Aquifer or sourcing water from Salinity Barrier Project wells (SBP) to prevent intrusion of salt water into Niles Cone Groundwater Basin for use at NDF

Capital Infrastructure:

The capital infrastructure needed to develop this water supply option includes:

- Land for extraction wells and desalination facility
- Up to four (4) extraction wells cumulatively producing 4,000 gallons per minute (gpm)
- 5.3 mgd desalination facility
- 1,000 linear feet of 12-inch diameter conveyance from extraction wells to desalination facility
- 1,000 linear feet of 18-inch diameter conveyance from desalination facility to distribution system
- 1,000 linear feet of 8-inch diameter conveyance for brine disposal

O&M Activity:

O&M activity associated with this water supply option includes:

- Treatment associated with operating the new desalination facility
- Operation for new groundwater wells
- Maintenance of new infrastructure
- Brine disposal
- Two full-time employees

Water Supply:

No new water supply would need to be purchased for this option.

Yield:

The facility's size will be subject to findings from the groundwater data gap project and other support analysis (e.g., groundwater modeling) and based on ACWD's overall water supply needs. The project could be phased to build additional capacity over time as ACWD's water supply needs change. The option presented here assumes a 5.3 mgd facility producing 4,480 AFY as an initial phase. This yield is assumed available in all year types. **Table 3-2** summarizes the costs and yield for the water supply option.

TABLE 3-2: GW.1 – GROUNDWATER DESALINATION

	Average Annual Yield (AFY)	Capital Cost	Annual Capital Cost	Water Supply Cost	O&M Cost	Total Annual Cost
GW.1 – Groundwater Desalination	4,480	$178.7M	$9.1M	-	$5.6M	$14.7M

Data Needs & Next Steps:

Additional data needs and next steps for this option include:

- Estimate groundwater yield available to supply a new groundwater desalination facility
- Assess groundwater quality to identify the appropriate treatment needed to produce desalinated water
- Assess the need for PFAS remediation in the concentrate discharge line
- Conduct a siting study for the facility and wells
- Assess alternative brine disposal options
- Run ACWD's basin-scale groundwater model to confirm local yield and assess possible other impacts

GW.2 and GW.3 – Revise Groundwater Rule Curves and Lower Minimum Operating Levels for the Niles Cone Groundwater Basin

Description:

ACWD currently produces groundwater from the Niles Cone Groundwater Basin for potable use via NDF, the Peralta-Tyson Wellfield, and Mowry Wellfield. Groundwater production is limited by ACWD's recharge operations and customer demand for groundwater. Groundwater treated at NDF is distributed directly, while groundwater not treated at NDF is sent to the Blending Facility, where it is treated for per- and polyfluoroalkyl substances (PFAS) and blended with San Francisco Public Utilities Commission (SFPUC) supply to meet water quality objectives.

In many years, ACWD cannot take full advantage of the water it has available for recharge as it cannot produce enough groundwater to make room for additional recharge in the Niles Cone. This is due to downstream constraints at NDF (i.e., there is not enough demand in zones that can be fed by NDF to optimize use of facility) as well as a need to use SFPUC supply for blending. If ACWD had the ability to pump more groundwater for direct use by customers, it could recharge additional supply. This supply option would expand groundwater pumping in the Niles Cone and lower nominal groundwater levels to bolster the Alameda Creek watershed supply via increased annual capture in above average years and reductions in saline outflow (Option GW.2). ACWD's modeling efforts estimate that 1,670 AFY of average annual supply could be captured if ACWD could increase its groundwater production capability and reduce minimum operating levels below -5 ft mean sea level (msl) for short durations during critical droughts in the Below Hayward Fault Sub-basin and 15-20 feet above mean sea level (ft msl) in the Above Hayward Fault Sub-basin (Option GW.3). ACWD will need to confirm if lowering minimum operating levels associated with these options will not affect the sustainability of the basin.

These activities alone do not produce additional supply, as ACWD cannot increase groundwater pumping without added treatment, conveyance, or changes to its existing agreement with SFPUC. The current agreement with SFPUC includes a minimum purchase requirement, which constrains ACWD's ability to offset SFPUC supplies with additional groundwater. Water supply options GW.4, GW.6, LW.1, and LW.2 could enable development of this potential supply volume.

GW.4 – Enhanced Groundwater Treatment for PFAS and Hardness

Option Description:

ACWD cannot directly deliver groundwater produced at the Peralta-Tyson and Mowry wellfields to customers without providing treatment. ACWD relies on high-quality SFPUC supply to blend with groundwater supplies to meet hardness-based water quality objectives as well as PFAS removal to meet regulatory requirements. Enhancing groundwater treatment for PFAS and hardness would allow ACWD to deliver groundwater supplies to customers directly and reduce or potentially avoid the need to use SFPUC supply for blending, depending on the availability of additional groundwater or if coupled with a new recharge source such as purified water. ACWD's current agreement with SFPUC includes a minimum purchase requirement of 8,567 AFY (7.648 mgd), making this option less favorable as ACWD would need to purchase SFPUC water whether or not it is needed for blending. ACWD has negotiated an amendment to the Water Supply Agreement with SFPUC to reduce its minimum purchase requirement to approximately 7,485 AFY (6.682 mgd) in 2025 and to provide a process to evaluate further reductions to minimum purchase requirements every ten years if ACWD can demonstrate further reduced reliance on SFPUC purchases; if this amendment is approved by all the SFPUC wholesale customer agencies and the minimum purchase requirement is lowered, ACWD could avoid purchasing SFPUC supply through enhanced groundwater treatment and this option would be more favorable.

Producing additional groundwater would bolster the Alameda Creek watershed supply via increased annual capture in above-average years as noted in options GW.2 and GW.3. New treatment assumes expanding ion exchange treatment for PFAS and construction of a reverse osmosis (RO) facility to remove hardness near the existing blending facility. Groundwater would be treated prior to entering the existing blending facility for distribution. The option presented here assumes ACWD would treat 4.5 mgd of additional groundwater supply produced at the Peralta-Tyson and Mowry wellfields with 90% treatment efficiency, producing up to 4,480 AFY. RO concentrate waste is assumed to be discharged to the sanitary sewer with no additional treatment, as PFAS may be removed prior to RO treatment. The option assumes the minimum purchase requirement could be reduced to 4.0 mgd. This 4,480 AFY would offset an equivalent volume of SFPUC supply. The project could be phased depending on the terms of the amended agreement with SFPUC. The option also assumes sufficient capacity is available at Peralta-Tyson and Mowry wellfields to produce the additional supply.

ACWD must confirm that the combination of available runoff and recharge facility capacity is sufficient to offset this additional groundwater demand and ensure basin sustainability. If local water is insufficient to support this option, ACWD would need to consider alternative recharge sources such as excess State Water Project (SWP) supply or advanced treated purified water.

Capital Infrastructure:

The capital infrastructure needed to develop this water supply option includes:

- New RO treatment facility for hardness
- Expanded ion exchange (IX) treatment for PFAS
- Conveyance to new treatment
- Conveyance from new treatment to blending facility

O&M Activity:

O&M activity associated with this water supply option includes:

- Treatment associated with operating the expanded IX and new RO facilities
- Additional operation of groundwater wells
- Maintenance for new infrastructure

Water Supply:

No new water supply would need to be purchased for this option, unless there is insufficient local wet year water for recharge to accommodate additional pumping.

Yield:

The yield for this option depends on the updated minimum purchase requirement negotiated with SFPUC. Halving the minimum purchase requirement would enable ACWD to deliver an additional 4,480 AFY of local groundwater supply to customers. This yield would likely be available in most year types, but could potentially not be viable in dry years. **Table 3-3** summarizes the costs and yield for the water supply option.

TABLE 3-3: GW.4 – ENHANCED GROUNDWATER TREATMENT FOR PFAS AND HARDNESS

	Average Annual Yield (AFY)	Capital Cost	Annual Capital Cost	Water Supply Cost	O&M Cost	Total Annual Cost
GW.4 – Enhanced Groundwater Treatment	4,480	$151.2M	$7.7M	-	$6.1M	$13.8M

Data Needs & Next Steps:

Additional data needs and next steps for this option include:

- Finalize the terms of its contract amendment with SFPUC
- Confirm hardness and PFAS treatment technologies (RO and IX, respectively)
- The appropriate level of treatment should be determined based on the volume of SFPUC supply still available for blending

GW.5 – Optimize Newark Desalination Facility Operations

Option Description:

NDF was placed into service in 2003 and expanded in 2010; it treats brackish groundwater from the Niles Cone Groundwater Basin. Efforts to remediate the groundwater basin and prevent saltwater intrusion from San Francisco Bay have been productive. As a result, influent groundwater quality to NDF has improved. This improvement has led to a corresponding improvement in RO concentrate discharge water quality. A 2021 conceptual study by ACWD staff identified three potential opportunities to take advantage of this improvement to better optimize NDF operations:

- Rerouting discharged concentrate back into raw NDF feedwater without exceeding water quality design parameters
- Adding a new RO treatment train to treat the concentrate to current feedwater concentration prior to rerouting the permeate back into the raw NDF feedwater (and discharging the secondary concentrate)
- Adding another RO treatment train to treat the concentrate to potable standards

Rerouting discharged concentrate was identified as the preferred supply option in a 2021 draft staff memorandum. This option would provide up to 2,120 AFY in new supply. This supply would replace some groundwater currently extracted and treated at NDF. Given downstream distribution system constraints at NDF, groundwater supply is not currently maximized. This option would be beneficial if ACWD's groundwater supply were otherwise optimized.

Capital Infrastructure:

The capital infrastructure needed to develop this water supply option includes:

- Modifications to NDF to allow for recirculation (assumes 100 linear feet of 8" pipeline)
- Pumping and instrumentation infrastructure

O&M Activity:

O&M activity associated with this water supply option is assumed to be consistent with ACWD's existing operations at NDF.

Water Supply:

No new water supply would need to be purchased for this option.

Yield:

Up to 2,120 AFY in new supply, if groundwater production at NDF were otherwise maximized. This supply would be available in all year types but would likely vary depending on total NDF production, which can decline during droughts when GW levels are low . **Table 3-4** summarizes the costs and yield for the water supply option.

TABLE 3-4: GW.5 – OPTIMIZE NEWARK DESALTINATION FACILITY OPERATIONS

	Average Annual Yield (AFY)	Capital Cost	Annual Capital Cost	Water Supply Cost	O&M Cost	Total Annual Cost
GW.5 – Optimize NDF	2,120	$390K	$19.9K	-	$2.5K	$22.4K

Data Needs & Next Steps:

Additional data needs and next steps for this option include:

- Review findings of 2021 ACWD Desalination Recirculation Concept Memorandum and conduct recirculation alternatives assessment study
- Conduct feasibility study
- Identify needed modifications to NDF to allow for recirculation
- Evaluate whether there are benefits to implementation prior to maximizing groundwater supply

GW.6 – Construct Southern Blending Facility

Description:

ACWD is investigating under-characterized portions of the Niles Cone Groundwater Basin in the southern portion of its service area, where hydrogeologic data are limited. The investigation is needed to assess whether new groundwater development in this area is feasible.

Currently, ACWD faces challenges in delivering groundwater from its existing northern facilities to southern customers due to distribution system constraints. Locating new production wells in the south could relieve those constraints, expand the portion of the service area that can be supplied with groundwater, and improve overall system resilience.

If the investigation confirms that ACWD's recharge operations sufficiently influence the southern portion of the Nile Cone Basin, ACWD could continue recharge operations at Quarry Lakes and extract groundwater in the south—effectively moving water through the Niles Cone from north to south and increasing long-term average yield off Alameda Creek. New wells would provide direct access to this resource for the southern distribution system. If recharge potential is found to be poor, there remains the possibility of developing new recharge facilities or banking surplus supplies in the southern portion of the Niles Cone.

While results are still pending, the team has envisioned several potential concepts, including:

- Southern wellfield and blending facility, similar to ACWD's existing northern operation. This would require treatment (such as RO) or blending with SFPUC resources to achieve PFAS and hardness standards.
- Brackish desalination facility, if water quality proves to be brackish, modeled after the Newark Desalination Facility (see GW.1 – Groundwater Desalination).
- Recharge and storage options, if recharge is limited but storage potential exists, using either an ASR well or SFPUC surpluses from the nearby Bay Division Pipeline.

For planning purposes, this analysis assumes the Southern Blending Facility includes three new production wells, without addressing detailed siting or treatment requirements at this stage. It is further assumed that the wellfield draws from the northern portion of the Niles Cone and therefore competes for this resource with Mowry and NDF, and raw groundwater is blended with SFPUC water to achieve water quality goals.

Capital Infrastructure:

The capital infrastructure needed to develop this water supply option includes:

- Three (3) 1,000 gpm groundwater extraction wells
- Conveyance from wells to the new blending facility
- Conveyance from existing SFPUC takeoffs to the new blending facility
- New blending facility
- Potentially, groundwater treatment for contaminants that cannot be addressed via blending (not included in costs shown in table below)

O&M Activity:

O&M activity associated with this water supply option includes:

- Operation for new groundwater wells
- Operation for new blending facility
- Maintenance for new infrastructure
- Potentially, operation for groundwater treatment for contaminants that cannot be addressed via blending (not included in costs shown in table below)
- Two full-time employees

Water Supply:

No new water supply would need to be purchased for this option.

Yield:

The option assumes operation of three 1,000 gpm groundwater extraction wells, producing 4,350 AFY. Total yield for the option will need to be confirmed following completion of ACWD's groundwater data gap project. This yield would be available in all year types. **Table 3-5** summarizes the costs and yield for the water supply option.

TABLE 3-5: GW.6 – CONSTRUCT SOUTHERN BLENDING FACILITY

	Average Annual Yield (AFY)	Capital Cost	Annual Capital Cost	Water Supply Cost	O&M Cost	Total Annual Cost
GW.6 – Construct Southern Blending Facility	4,350	$43.9M	$2.2M	$8.4M	$1.5M	$12.1M

Data Needs & Next Steps:

Additional data needs and next steps for this option include:

- Characterize groundwater basin in southern portion of service area
- Assess how groundwater extraction in the southern part of the groundwater basin would impact other parts of the Niles Cone Groundwater Basin utilizing the District's basin-scale groundwater model and other similar tools.
    - Groundwater levels in various aquifers
    - Storage potential and water budget
    - Groundwater quality to identify whether new treatment will be needed
- Distribution system hydraulic modeling

3.2 Imported Surface Water Options

IW.1 – Groundwater Banking Outside Alameda Creek Watershed

Description:

ACWD currently stores excess SWP supply with Semitropic Water Storage District (Semitropic). This partnership allows ACWD to take advantage of annual and seasonal variations in SWP water availability. When excess supplies are available, ACWD sends those supplies to Semitropic via the California Aqueduct for storage in Semitropic's groundwater bank. During dry years, Semitropic extracts stored water for conveyance to SWP contractors in southern California, allowing ACWD to take additional supplies via the South Bay Aqueduct (SBA).

ACWD is limited in the overall volume of water it can store with Semitropic at any given time. It is also limited by the volume of water Semitropic can extract on its behalf during dry years for exchange (a combination of Table A exchange and direct "pump-back capacity"). Expanding its partnership with Semitropic or participating in a separate groundwater bank might allow ACWD to improve dry year reliability. It also might afford ACWD flexibility to use stored water supplies to offset more expensive supplies. Desirable qualities ACWD should target in a groundwater bank include:

- Adequate pump-back capacity to meet dry year shortages
- Adequate storage volume to cover extended drought conditions
- Lowest "leave-behind" terms available
- Located in a basin with an approved Groundwater Sustainability Plan that permits stored water recovery during droughts
- Participation of other partners who are willing and able water transfer partners
- Reduced level of risk due to either enhanced accessibility or lower susceptibility to Delta disruptions

Woodard & Curran's "Baseline Supply Availability Forecast for ACWD's WRMP 2050 (Phase 2, Task 4 – Baseline Supply Availability)" TM (Baseline Supplies TM) details scenarios where ACWD's existing supplies are insufficient to meet future demands. In extended drought periods, the terms of ACWD's storage agreement with Semitropic do not allow for enough pump-back capacity in some scenarios to meet demands. Additionally, ACWD's contract with Semitropic is due to expire in 2035 and will require renegotiations and renewal. Furthermore, Semitropic overlies the Kern County Subbasin, a critically overdrafted groundwater subbasin, which may become subject to limitations to current operations under SGMA. Participation in other groundwater banks should prioritize pump-back capacity to allow ACWD flexibility to access its supplies during critically dry years or during extended drought periods. Alternative groundwater banking opportunities include the Sacramento Regional Water Bank, Irvine Ranch Water District, and High Desert Water Bank. More groundwater banking opportunities are expected to become available as groundwater basins seek ways to comply with SGMA. ACWD would benefit from increased groundwater storage and increased pump-back capacity, either through amending its agreement with Semitropic or by partnering in another bank.

O&M Activity:

O&M activity associated with this water supply option includes:

- Groundwater bank participation costs
- Extraction costs

Water Supply:

ACWD would purchase additional SWP supplies during wet years for storage in a groundwater bank. Unlike San Luis Reservoir, which is subject to spills, a secured groundwater storage option—while potentially subject to some losses—would avoid spillage and improve overall supply reliability.

Yield:

The yield associated with a groundwater banking opportunity considers two factors: the storage volume available to ACWD and the annual pump-back capacity available to ACWD during dry periods. The yield assumed here is based on shortages described in the Baseline Supplies TM, specifically those described in Scenario A and Scenario B. The low-end of the yields described in **Table 3-6** are based on Scenario A; the high-end are based on Scenario B.

TABLE 3-6: IW.1 – GROUNDWATER BANKING OUTSIDE ALAMEDA CREEK WATERSHED

	Pump-Back Capacity (AFY) Storage Volume (AFY)	Capital Cost (Buy-In)	Annual Water Supply Cost	Annual O&M Cost	Total Annual Cost
IW.1 – Groundwater Banking Outside Alameda Creek Watershed	2,192 – 10,680 6,449 – 23,778	$25.3M	$1.9M	$0.8M	$4.0M

Data Needs & Next Steps:

Additional data needs and next steps for this option include:

- Engage with Semitropic to discuss amendments to existing agreement
- Conduct an alternatives analysis to evaluate terms of alternative groundwater banking opportunities

IW.2 – Regional Surface Water Storage

Description:

ACWD is currently able to store carryover SWP supplies in San Luis Reservoir. ACWD's access to this supply is limited by the State's ability to recover the supply. Participation in alternative, regional surface water storage projects may improve ACWD's reliability during dry years when access to carryover supplies stored in San Luis Reservoir is limited. Potential regional surface water storage opportunities include:

- Dedicated storage in Los Vaqueros Reservoir
- Leasing storage from another SWP contractor in San Luis Reservoir
- Participation in the Sites Reservoir Project

Los Vaqueros Reservoir is a 160,000 acre-feet (AF) off-stream surface water storage reservoir in Contra Costa County. Contra Costa Water District (CCWD) manages the reservoir. The reservoir stores water pumped directly from the Delta when surplus supply is available. Expansion to 275,000 AF has been considered in the past, but is not moving forward at this time. Securing dedicated storage in Los Vaqueros would require ACWD to purchase storage capacity from an existing user.

San Luis Reservoir is a joint-use reservoir co-managed by the California Department of Water Resources (DWR) and the USBR. The reservoir stores water from the SWP and Central Valley Project (CVP). ACWD could lease storage from another SWP contractor in San Luis Reservoir. This would require finding a partner with excess storage capacity in the reservoir. During wet years, there is a chance for "spilling" at San Luis, where water is intentionally released to avoid overfilling the reservoir. Spilling can result in a loss of stored water for some agencies with storage capacity.

Sites Reservoir is a proposed, off-stream storage project in northern California that would target excess water from storms. Participation in the Sites Reservoir project might increase the volume of imported water supply available to ACWD. The Sites Reservoir project is not currently seeking new partners; however, ACWD might be able to join the project if another partner elects to withdraw, or if more storage is made available.

Expanded participation in any regional surface water storage would also improve ACWD's ability to exchange water with other agencies who participate in that reservoir. Similar to groundwater storage, regional surface water storage would improve ACWD's reliability during extended drought periods, or during critically dry years.

O&M Activity:

O&M activity associated with this water supply option includes:

- Surface storage participation
- Conveyance from storage to ACWD's service area

Water Supply Costs:

ACWD might purchase additional SWP supplies during wet years for storage. In the case of Sites Reservoir, ACWD would purchase new water supply made available by Sites Reservoir

Yield:

The yield associated with a regional surface storage opportunity considers two factors: the storage volume available to ACWD and the annual delivery available to ACWD during dry periods. The yield assumed here is based on shortages described in the Baseline Supplies TM, specifically those described in Scenario A and Scenario B. Yields assume that Semitropic remains in place as described in the Baseline Supplies TM. The low-end of the yields described in **Table 3-7** are based on Scenario A; the high-end are based on Scenario B.

TABLE 3-7: IW.2 – REGIONAL SURFACE WATER STORAGE

	Delivery Capacity (AFY)	Total Storage Volume (AF)	Annual Water Supply Cost	Annual O&M Cost	Total Annual Cost
IW.2 – Regional Surface Water Storage	2,192 – 10,680	6,449 – 23,778	$5M	-	$5M

Data Needs & Next Steps:

Additional data needs and next steps for this option include:

- Engage with Santa Clara Valley Water District (Valley Water) about leasing storage in San Luis Reservoir
- Assess delivery capabilities for regional surface storage projects; assess whether additional deliveries could be treated at WTP2
- Continue to monitor opportunities to partner in regional surface water storage projects

IW.3 – New Imported Water Supply (Non-SWP)

Description:

ACWD imports water via the SWP and SFPUC. Augmenting imported water through alternative imported sources is a potential water supply option. Potential alternative sources include the Yuba Water Agency (Yuba Water) or neighboring water agencies such as East Bay Municipal Utility District (EBMUD; see Option IW.7). Imported water could be used to augment or offset existing water supplies and would increase the number of potential water transfer partners available to ACWD.

As a non-signatory to the Yuba Accord, ACWD could partner with Yuba Water to receive supplies that are reserved outside the Accord and only available in certain drought years. Alternatively, ACWD could join the existing Yuba Accord. The Yuba Accord is proposed to be renewed for the period of 2026 to 2050 and would allow ACWD expanded access to Yuba Water's supplies in most other year types.

O&M activity:

O&M Activity associated with this water supply option includes:

- Fees and costs associated with Yuba Water
- Water supply delivery costs (typically included with water rates)
- Added treatment plant runtime (if not offsetting SWP supplies)

Water Supply Costs:

Water supply costs for this option will include purchases from Yuba Water.

Yield:

Imported water supplies are typically allocated based on annual variations in hydrology. ACWD would work with an imported water supplier (e.g., Yuba Water) to assess what water supplies might be available for purchase. The yield could be sized to meet ACWD's future water supply needs. For purposes of this analysis, the new imported water is assumed to be purchased from Yuba Water to meet single dry-year shortages identified in the Baseline Supplies TM. **Table 3-8** summarizes the yield and costs associated with this option.

TABLE 3-8: IW.3 – NEW IMPORTED WATER SUPPLY

	Dry-Year Yield (AFY)	Average Annual Yield (AFY)	Water Supply Cost	O&M Cost	Total Annual Cost
IW.3 – New Imported Water Supply –Yuba Water	500	500	$500K	-	$500K

Data Needs & Next Steps:

Additional data needs and next steps for this option include:

- Engage with Yuba Water to discuss potential agreements

IW.4 – Sunol Aqueduct

Description:

The Sunol Aqueduct is a disused piece of conveyance infrastructure. It was a part of the Spring Valley Water system, constructed in the 1920s to convey water from the Alameda Creek watershed to San Francisco. It was purchased by San Francisco and remained a part of the Hetch Hetchy Regional Water System as late as the 1990s.

ACWD currently uses Alameda Creek to convey SWP supplies to Quarry Lakes for recharge. Future use of Alameda Creek may be limited by environmental regulations. The Sunol Aqueduct is a closed conduit and thus would not be sensitive to this risk. Discharges of SWP supply into Alameda Creek may face scrutiny in the future; water quality degradation or temperature concerns surrounding SWP supply may limit ACWD's ability to use Alameda Creek for conveyance. Using Sunol Aqueduct would allow ACWD to recharge SWP supply at Quarry Lakes if discharges into Alameda Creek were limited.

Due to its extensive state of disrepair, repurposing Sunol Aqueduct would require inspection of the existing 7.5-mile alignment, reconstruction of approximately 1,000 feet of the aqueduct known to have been previously removed, repair of any additional missing or damaged sections that would prevent conveyance, obtaining permissions from SFPUC, determining if the aqueduct alignment crosses under private property and necessitates a property acquisition, connection from the SBA, and connection to Quarry Lakes. Plans to convert the Sunol Aqueduct into a regional walking trail have also been discussed by Alameda County. While access to the Sunol Aqueduct is not public, the alignment has been used as a hiking trail in the past.

Options for repurposing Sunol Aqueduct do not create water supply in the short-term. The Sunol Aqueduct would serve as conveyance for imported supplies instead of Alameda Creek. Use of the Sunol Aqueduct may also prevent losses that occur along Alameda Creek; however, many of these losses return to the Niles Cone Groundwater Basin for future groundwater use.

Capital Infrastructure:

The capital infrastructure needed to develop this water supply option includes:

- Repair or replacement of existing Sunol Aqueduct
- Conveyance from SBA to Sunol Aqueduct
- Conveyance from Sunol Aqueduct to Quarry Lakes

O&M Activity:

O&M activity associated with this water supply option includes:

- Operation for any diversion facilities
- Maintenance for new infrastructure
- Maintenance for existing Sunol Aqueduct infrastructure

Water Supply:

No new water supply would need to be purchased for this option.

Yield:

Repurposing Sunol Aqueduct to convey water from SBA to Quarry Lakes would not create new water supply for ACWD. It would replace the use of Alameda Creek for this purpose and protect against future regulations that might impact ACWD's use of the creek. **Table 3-9** illustrates the costs for this water supply option.

TABLE 3-9: IW.4 – SUNOL AQUEDUCT

	Average Annual Yield (AFY)	Capital Cost	Annual Capital Cost	Water Supply Cost	O&M Cost	Total Annual Cost
IW.4 – Sunol Aqueduct	0	$32.8M	$1.7M	-	$200K	$1.9M

Data Needs & Next Steps:

Additional data needs and next steps for this option include:

- Discuss potential agreements to use the Sunol Aqueduct with SFPUC
- Assess Sunol Aqueduct condition to determine areas that need repair or replacement
- Assess how use of Sunol Aqueduct would impact existing water rights on Alameda Creek

IW.5 – Groundwater Banking Inside Alameda Creek Watershed

Description:

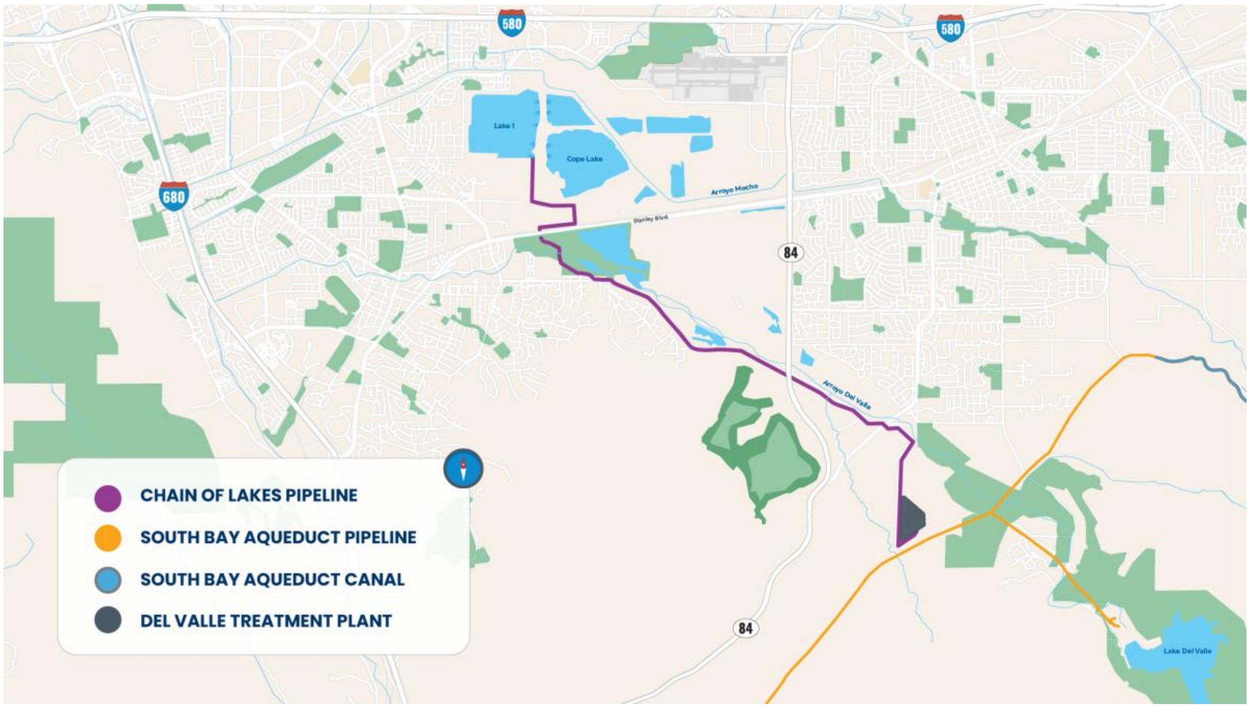
The Chain of Lakes Conveyance System is a water supply infrastructure project under consideration by Zone 7 Water Agency (Zone 7) to convert retired gravel quarries into lakes for water storage. The System would include a pipeline connecting the SBA to the lakes, enabling delivery and storage of water. This System would transfer available water into the lakes for storage during wet periods, allowing it to be accessed during dry periods. Stored water would be recovered directly by pumping to Del Valle Water Treatment Plant. The water delivered to Del Valle Water Treatment Plant would receive PFAS treatment. The System is located adjacent to Arroyo Valle and would include a direct connection to the SBA (see **Figure 3-1**). The operational model is akin to a surface reservoir due to its full integration with Zone 7's distribution system, allowing the ability to adjust surface water production to meet system demands.

The System could be used to manage Zone 7 and potential partners' available SWP supplies and local water rights through surface storage. The SBA connection enables physical delivery and storage of water delivered via the SWP, allowing for both storage and withdrawal of water through standard exchanges. The System would be developed and managed by Zone 7. Zone 7 is currently in the planning phase for this project and will seek the Zone 7 Board's approval for the project in mid 2026 or early 2027.

The Chain of Lakes Conveyance System is currently planned to utilize Zone 7-owned lakes with a combined storage capacity of approximately 30,000 AF. Over the coming years, additional quarries are slated to be transferred to Zone 7, and these future lakes are expected to be integrated into the project. As a result, additional storage or other multi-benefit opportunities may become available. Zone 7 is exploring potential regional partnerships that could enable partner agencies to store and recover their surplus water in developed lakes through an exchange arrangement. Development will proceed in phases, tied to the schedule of quarry completions and transfers to Zone 7's possession. The initial phase targets approximately 30,000 AF of storage in quarries currently in Zone 7's possession, which may be feasible to support a partner(s) requiring additional storage through exchange.

Planning and design for Phase 1 is expected to begin by the end of 2026 or early 2027, with a 10-year implementation horizon. In the longer term, the project offers significant potential as more quarries are handed over to Zone 7. Future phases could be developed incrementally and would benefit from a more visionary, multi-benefit approach which integrates habitat, recreation, and flood management.

FIGURE 3-1: PROPOSED CHAIN OF LAKES CONVEYANCE SYSTEM



Source: Zone 7; https://www.zone7waterca.gov/post/chain-lakes-conveyance-system-project

Capital Infrastructure:

The capital infrastructure needed to develop this water supply option includes:

- Approximately 7 miles of 42" conveyance pipeline
- A new pump station
- PFAS treatment

O&M Activity:

O&M activity associated with this water supply option includes:

- Operation for new treatment
- Maintenance for new infrastructure

Water Supply Costs:

ACWD could bank SWP supplies, local supplies, or SFPUC supplies inside the Alameda Creek Watershed. Water supply costs would vary based on which supplies were stored.

Yield:

Potential water supply sources to store in the Chain of Lakes Conveyance System include spills from Lake Del Valle and San Luis Reservoir as well as capturing surplus SWP supply. Net yield from this concept is to be determined as the project progresses. For high-level planning purposes, ACWD has assumed an average of 1,150 AFY of surplus water capture. **Table 3-10** describes total storage volume and project costs.

TABLE 3-10: IW.5 – GROUNDWATER BANKING INSIDE ALAMEDA CREEK WATERSHED

	Average Annual Yield (AFY)	Capital Cost	Annual Capital Cost	Water Supply Cost	O&M Cost	Total Annual Cost
IW.5 – Groundwater Banking Inside Alameda Creek Watershed	1,150	$251.1M	$12.8M	$1.2M	$2.7M	$16.7M

Data Needs & Next Steps:

Additional data needs and next steps for this option include:

- Discuss potential cost share with Zone 7
- Evaluate water supplies available for storage

IW.6 – Increase Peak Blending Capacity at Fremont Takeoff

Description:

ACWD blends SFPUC supplies with groundwater produced at the Peralta-Tyson and Mowry wellfields at its blending facility near the SFPUC-ACWD Fremont Takeoff. Increasing blending capacity at the Fremont Takeoff would allow ACWD to take more SFPUC supplies and produce more groundwater supplies to accommodate water treatment plant outages or interruptions to SWP supply without compromising water quality.

The blending facility is limited by several factors, including hydraulics, water quality objectives for hardness, and distribution pressures. Recent regulations establishing maximum contaminant levels (MCLs) for PFAS also limit the facility's output. The sustainable output from the blending facility is 26 mgd. The Fremont Takeoff, which supplies the blending facility with water from SFPUC, has a sustainable capacity of 13 mgd. Increasing the capacity of the Fremont Takeoff to 25 mgd would allow ACWD to use more SFPUC supply without exceeding water quality objectives for hardness or exceeding MCLs for PFAS.

Capital Infrastructure:

The capital infrastructure needed to develop this water supply option includes:

- Fremont Takeoff modifications
- Modifications to blending facility to operate at higher capacity

O&M Activity:

O&M activity associated with this water supply option includes:

- Additional blending facility runtime
- Operating costs for expanded turnout
- Maintenance costs for new infrastructure

Water Supply Costs:

Water supply costs for this option include additional purchases from SFPUC.

Yield:

Increasing the capacity of the Fremont Takeoff may not provide additional annual yield; it provides emergency yield in the form of additional SFPUC supplies in the event of an extended disruption to SWP supply or outage at ACWD's water treatment plants. Enhancing SFPUC yield may allow ACWD to further optimize or enhance use of its groundwater supplies, however further study would be needed to confirm the potential impact on groundwater supplies. For this analysis, it is assumed the excess capacity would be used once in 10 years, for an average annual yield of 1,600 AFY. **Table 3-11** describes costs and yield for this option.

TABLE 3-11: IW.6 – INCREASE PEAK BLENDING CAPACITY AT FREMONT TAKEOFF

	Average Annual Yield (AFY)	Capital Cost	Annual Capital Cost	Water Supply Cost	O&M Cost	Total Annual Cost
IW.6 – Increase Peak Blending Capacity at Fremont Takeoff	1,600	$144.6M	$7.4M	$3.1M	$1.1M	$11.6M

Data Needs & Next Steps:

Additional data needs and next steps for this option include:

- Confirm hardness goals for long-term outages (currently 165 ppm)
- Assess ability to take additional SFPUC supplies during emergencies

IW.7 – Pretreatment Facility at EBMUD's Walnut Creek Water Treatment Plant

Description:

EBMUD's Walnut Creek Water Treatment Plant (WCWTP) treats high-quality raw water from Pardee and Briones reservoirs, which hold low-turbidity supply from the Mokelumne River. The WCWTP lacks capability to treat high-turbidity or high-total organic carbon raw water (i.e., any surface water supply that is not the Mokelumne River). Wildfire and landslides in EBMUD's watershed can also impact raw water quality.

Installing pre-treatment at WCWTP would give EBMUD flexibility to use raw water from other sources (e.g., the Sacramento River) to supply WCWTP. It would also allow EBMUD to treat Mokelumne River supplies when water quality is impacted by wildfire or landslides. EBMUD could deliver water treated at WCWTP to neighboring agencies, including ACWD. The implementation of this project would rely on Los Vaqueros Expansion project and construction of the Transfer-Bethany Pipeline. The Los Vaqueros Expansion project is currently on hold due to lack of institutional support.

Capital Infrastructure:

The capital infrastructure needed to develop this water supply option includes:

- New pre-treatment facility at WCWTP
- Los Vaqueros Expansion
- Transfer-Bethany Pipeline

O&M Activity:

O&M activity associated with this water supply option includes:

- Operating costs for new pre-treatment facility
- Costs to convey water
- Maintenance costs for new infrastructure

Water Supply Costs:

Capital and O&M costs for this option would likely be passed onto agencies who make use of water supply generated from the project in the form of water supply purchases.

Yield:

The total yield for this project is estimated to be 128,800 AFY. ACWD could make use of some of this yield, depending on their agreements with EBMUD. This option is unlikely to move forward without Los Vaqueros Expansion or construction of the Transfer-Bethany Pipeline.

Data Needs & Next Steps:

Additional data needs and next steps for this option include:

- Engage with EBMUD and other regional partners to assess whether there is still interest in this project absent Los Vaqueros Expansion
- Assess whether water could be delivered to ACWD without the Transfer-Bethany Pipeline

3.3 Local Surface Water Options

LW.1 – Augment Wet Year Recharge and Expand ACWD Distribution

Option Description:

ACWD's NDF does not operate at maximum capacity throughout the year. NDF is limited by the demand in zones where it can hydraulically deliver water during the winter months, demand is not high enough for NDF to operate at its full capacity. Improvements to ACWD's distribution system would allow NDF to supply additional customers and zones, alleviating this constraint, and allowing NDF to operate at its full capacity year-round. This would allow ACWD to produce more groundwater to feed NDF and allow for more capture of Alameda Creek Watershed supplies as described in options GW.2 and GW. 3. This improved connectivity would enable ACWD to capitalize on existing production capacity (currently not used) at NDF and take advantage of surplus local groundwater during above average and wet years. Improvements to ACWD's distribution system are necessary to accommodate expanded operation of NDF.

Capital Infrastructure:

The capital infrastructure needed to develop this water supply option includes:

- Distribution system improvements

O&M Activity:

O&M activity associated with this water supply option includes:

- Additional groundwater pumping costs to feed NDF
- Additional runtime at NDF (e.g., more frequent chemical cleanings and membrane replacements)
- Maintenance costs for new infrastructure
- Power costs for conveyance

Yield:

The total yield of this supply option is anticipated to be 4 mgd, or 4,480 AFY in wet years. This yield assumes NDF's current operating capacity could be increased by up to 4.0 mgd if downstream constraints were removed. It also assumes that additional recharge water would be available to feed NDF in normal and wet years, or 7-in-10 years, for an average annual yield of 3,100 AFY. **Table 3-12** summarizes the costs and yield for the water supply option.

TABLE 3-12: LW.1 – AUGMENT WET YEAR RECHARGE AND EXPAND DISTRIBUTION

	Average Annual Yield (AFY)	Capital Cost	Annual Capital Cost	Water Supply Cost	O&M Cost	Total Annual Cost
LW.1 – Augment Wet Year Recharge and Expand Distribution	3,100	$13.6M	$0.7M	-	$0.9M	$1.6M

Data Needs & Next Steps:

Additional data needs and next steps for this option include:

- Confirm improvements needed to allow for full operation of NDF
- Confirm increased pumping will result in sufficient additional recharge

LW.2 – Augment Wet Year Recharge and Construct SFPUC Intertie

Description:

As an alternative to the expanded distribution system noted in LW.1, ACWD could alleviate constraints at NDF by constructing an intertie pipeline between NDF and SFPUC's Bay Division Pipeline. The Bay Division Pipelines deliver water from SFPUC's Hetch Hetchy Reservoir to the Bay Area. Bay Division Pipelines 1 and 2 run near ACWD's service area. ACWD could operate NDF at full capacity and send excess treated water to SFPUC via the intertie when its demands downstream from NDF are not sufficient to utilize the full capacity. ACWD and SFPUC could then participate in a water transfer wherein ACWD could take SFPUC supplies from its existing takeoffs in exchange for the excess supply generated at NDF. This supply option would construct an intertie between ACWD's NDF and SFPUC's Bay Division Pipeline. This would create opportunities for water transfers and emergency supplies. This is similar to option LW.1 but would have ACWD exchange excess capacity at NDF with other partners via SFPUC.

Capital Infrastructure:

The capital infrastructure needed to develop this water supply option includes:

- Up to two (2) new Aquifer Reclamation Program (ARP) wells
- 20-inch, 1,200-linear foot bi-directional intertie from ACWD's NDF to SFPUC's Bay Division Pipeline

O&M Activity:

O&M activity associated with this water supply option includes:

- Operation for new well production
- Additional runtime at NDF (e.g., more frequent chemical cleanings and membrane replacements)
- Maintenance for new infrastructure
- Pumping water from NDF to the Bay Division Pipeline

Yield:

The total yield of this supply option is anticipated to be 4 mgd, or 4,480 AFY in wet years. This yield assumes NDF's current operating capacity could be increased by up to 4.0 mgd if downstream constraints were removed. It assumes that additional recharge water would be available to feed NDF in normal and wet years, or 7-in-10 years, for an average annual yield of 3,100. **Table 3-13** summarizes the costs and yield for the water supply option.

TABLE 3-13: LW.2 – AUGMENT WET YEAR RECHARGE AND CONSTRUCT ACWD-SFPUC INTERTIE

	Average Annual Yield (AFY)	Capital Cost	Annual Capital Cost	Water Supply Cost	O&M Cost	Total Annual Cost
LW.2 – Augment Wet Year Recharge and Construct Intertie	3,100	$32.9M	$1.7M	-	$1.3M	$3.0M

Data Needs & Next Steps:

Additional data needs and next steps for this option include:

- Discuss terms of water transfer with SFPUC
- Assess opportunities for exchanges with other SFPUC wholesale customers
- Discuss viability of intertie project with SFPUC

LW.3 – Optimize and Enhance Del Valle Yields

Description:

ACWD and Zone 7 share equal rights to divert water from the Arroyo Del Valle (ADV) for storage in Lake Del Valle (Del Valle). Currently, DWR makes a total of 15,000 AF of space available to ACWD and Zone 7 for storage of water diverted under the ADV water right, resulting in 7,500 AF of storage space available to ACWD. ACWD's and Zone 7's combined, existing water rights permits up to 60,000 AFY in diversions between January 1 and December 31 while maintaining live-stream flow requirements. ACWD has several options available to develop additional water supply at Del Valle. These include:

- Modifying Forecast-Informed Reservoir Operations (FIRO) rules at the reservoir; this could increase storage space available to ACWD and Zone 7 by 35,000 AF.
- Lowering surface water treatment plant intakes and boat ramps to accommodate lower nominal water levels to capture additional runoff in wet and above average years.
- Optimizing use of the existing water right permit volume.

Modifying FIRO rules and nominal water levels will require coordination with Zone 7, Alameda County Flood Control District, and DWR. In contrast, ACWD has control over how it exercises its existing water right permit volume.

Capital Infrastructure:

Capital infrastructure associated with this option might include:

- Modifying boat ramps and surface water treatment plant intakes

O&M Activity:

O&M activity associated with this water supply option is expected to be consistent with ACWD's existing operations.

Yield:

Modifying FIRO rules and lowering nominal water levels require outside agency collaboration. ACWD might be able to enhance its existing yields from Del Valle through optimization of its existing water right permit volume. For this analysis, it is assumed that ACWD could develop an additional 300 AFY through optimization of its existing water right permit volume. This is assumed to be a no cost alternative, as it would require ACWD to continue normal operations, with minor modifications to operating strategy. **Table 3-14** summarizes the costs and yield for the water supply option.

TABLE 3-14: LW.3 – OPTIMIZE AND ENHANCE DEL VALLE YIELDS

	Average Annual Yield (AFY)	Capital Cost	Annual Capital Cost	Water Supply Cost	O&M Cost	Total Annual Cost
LW.3 – Optimize and Enhance Del Valle Yields	300	$5.8M - $21.1M	$300K - $1.1M	-	-	$300K - $1.1M

Data Needs & Next Steps:

Additional data needs and next steps for this option include:

- Assess whether modifying FIRO rules or lowering minimum operating levels is acceptable to other agencies with rights at Del Valle including Valley Water and Zone 7
- Review existing operations to identify opportunities to optimize existing water right permit volume
- Coordinate with East Bay Regional Parks District, United States Army Corps of Engineers, and DWR

LW.4 – Regional Stormwater Capture

Description:

ACWD currently captures local runoff in the Alameda Creek watershed and stores it in the Niles Cone Groundwater Basin via its recharge complex at Quarry Lakes and rubber dams located in Alameda Creek. Augmenting stormwater capture through centralized or decentralized infrastructure may allow ACWD to capture more supply (which currently flows to San Francisco Bay). Centralized stormwater projects would require coordination with municipalities inside ACWD's service area and might include redirecting storm sewers or treating stormwater for use at Quarry Lakes. Decentralized stormwater projects might encourage customers to capture stormwater in cisterns or incentivize developers to use permeable pavements. These projects may also involve collaborating with municipalities to enhance low-impact development in the area.

Capital Infrastructure:

Capital infrastructure associated with this option might include:

- New diversion structures
- Stormwater treatment facilities
- Stormwater detention facilities

O&M Activity:

O&M activity associated with this water supply option includes:

- Operation for new stormwater infrastructure
- Maintenance for new stormwater infrastructure

Water Supply Costs:

Local stormwater would not incur any water supply purchase costs.

Yield:

Stormwater capture yields are difficult to quantify. Much of the available stormwater is made available to ACWD via Alameda Creek or natural percolation into the groundwater basin. For this analysis, it is assumed local stormwater capture could result in 500 AF of supply during normal and wet years (7-in-10) and no additional supply during dry years, for an average annual supply of 350 AFY. Stormwater costs are estimated at $1,240/AF, based on estimates from the Pacific Institute.

Data Needs & Next Steps:

Additional data needs and next steps for this option include:

- Discuss stormwater capture options with local municipalities
- Assess potential for additional capture of stormwater via groundwater recharge

3.4 Ocean or San Francisco Bay Water Options

OW.1 – Bay Water Desalination

Option Description:

A new Bay water desalination facility can source saline water supply from San Francisco Bay via slant wells. Desalinated water could then enter ACWD's distribution system from the desalination facility. The facility could be sited in the southern portion of ACWD's service area. Brine might be conveyed to USD's existing wastewater discharge line located at the Alvarado WWTP. This option is functionally similar to GW.1; however, the source of the supply would be San Francisco Bay instead of a brackish aquifer.

The water supply option presented here assumes the facility would be sited in the southern portion of the service area and would be constructed and operated by ACWD alone. Other options for Bay water desalination include partnering with regional partners on a 25 mgd brackish water desalination facility at CCWD's Mallard Slough Pump station or partnering with Valley Water to construct a desalination facility and receive water via a pipeline to ACWD's service area or via exchange with Valley Water through the SBA. The Mallard Slough project would require an opening for partnership.

A go-it-alone desalination option is described in ACWD's 2023 PWFS; the option presented here matches that project description. The project sources water from the Bay via slant wells for treatment at an RO facility. Brine would be discharged via conveyance to USD's existing wastewater discharge line located at the Alvarado WWTP.

Capital Infrastructure:

The capital infrastructure needed to develop this water supply option includes:

- Intake wells
- RO treatment facility
- Conveyance from slant wells to RO treatment
- Conveyance from RO treatment to ACWD's existing distribution system
- Brine disposal line

O&M Activity:

O&M activity associated with this water supply option includes:

- Operation for the new treatment plant
- Operation for new wells
- Brine disposal
- Pumping from the facility to ACWD's distribution system
- Maintenance for new infrastructure
- Two full-time employees

Yield:

A Bay water desalination facility could be any size; a phased approach to construction might allow ACWD to scale the project to meet its needs. The water supply option presented here assumes a 9.5 mgd facility producing 8,000 AFY, consistent with what is presented in the 2023 PWFS. **Table 3-15** summarizes the costs and yield for the water supply option.

TABLE 3-15: OW.1 – BAY WATER DESALINATION

	Average Annual Yield (AFY)	Capital Cost	Annual Capital Cost	Water Supply Cost	O&M Cost	Total Annual Cost
OW.1 – Bay Water Desalination	8,000	$660M	$33.7M	-	$16.0M	$49.7M

Data Needs & Next Steps:

Additional data needs and next steps for this option include:

- Assess whether opportunities exist to partner in the Mallard Slough project
- Engage with Valley Water to assess opportunities for partnership
- Investigate Bay water quality parameters to further refine and identify necessary treatment technologies
- Conduct a siting study for the treatment facility
- Confirm seasonal brine discharge capacity in USD's EBDA line and associated treatment capacity
- Assess alternative brine disposal methods

3.5 Purified Water Options

PW.1 – Indirect Potable Reuse with SFPUC Intertie

Description:

Similar to option LW.2, this supply option would pursue an intertie between ACWD's NDF and SFPUC's Bay Division Pipeline. Unlike LW.2, this option would utilize purified water from an advanced water purification facility (AWPF) to recharge the Niles Cone Groundwater Basin via Quarry Lakes. Purified water could be treated effluent from USD or Dublin San Ramon Services District (DSRSD). For the purposes of this study, it is assumed that treated effluent would be sourced from USD's Alvarado WWTP and infrastructure included herein is based upon this assumption. Added recharge would allow ACWD to extract more groundwater from the Basin for treatment at NDF and the intertie would enable NDF to operate at full capacity year-round and would create opportunities for water transfers with SFPUC and other Bay Area Water Supply and Conservation Agency agencies. This option might also provide emergency supply and increased system resiliency via improved connectivity between ACWD and SFPUC.

Capital Infrastructure:

The capital infrastructure needed to develop this water supply option includes:

- Conveyance pipeline from USD's Alvarado WWTP to AWPF
- Site work to prepare Pit 2 for AWPF construction or land acquisition for new AWPF
- AWPF treatment train
- Conveyance pipeline of microfiltration (MF) waste to USD's collection system
- Conveyance pipeline of RO waste to East Bay Discharge Authority (EBDA) outfall
- Conveyance pipeline of purified water from AWPF to Quarry
- Bi-directional intertie from ACWD's NDF to SFPUC's Bay Division Pipeline

O&M activity:

O&M activity associated with this water supply option includes:

- Additional operation for wells
- Additional runtime at NDF
- Operation for new treatment
- Operation for new conveyance (i.e., consumables and power)
- Maintenance for new infrastructure
- Two full-time employees

Water Supply Costs:

Water supply costs are assumed to be $0. This project would reroute wastewater flows that would otherwise be treated discharged to San Francisco Bay. USD has previously expressed interest in partnering on a purified water project, so long as it was cost-neutral to the agency. If additional operational or capital costs are to be borne by USD, then revenue from wastewater flows conveyed to ACWD would be required to offset costs.

Yield:

Under this option, approximately 7.1 mgd of secondary effluent flows would be conveyed via a newly constructed 7.1-mile pipeline from USD's Alvarado WWTP to ACWD's newly constructed AWPF located at the rehabilitated Pit 2. Through the treatment processes at the AWPF, some water (25%) is rejected as MF waste and RO concentrate and sent for disposal while the majority (75%) is recovered as purified water. After treatment, approximately 5.3 mgd of purified water would be conveyed via a newly constructed 2.2-mile pipeline to Quarry Lakes for groundwater recharge. Next, ACWD would extract an equivalent volume of brackish groundwater for desalination at NDF. Subsequently, desalinated water would be conveyed via a newly constructed 1,200-linear foot bi-directional intertie from NDF to SFPUC's Bay Division Pipeline, enabling water transfers and emergency supplies between ACWD and SFPUC. The total yield of this supply option is anticipated to be 4.0 mgd, or 4,480 AFY (based on an assumed 75% recovery at NDF of the 5.3 mgd recharged). This yield assumes NDF's current operating capacity could be increased by up to 4.0 mgd if downstream constraints were removed.

TABLE 3-16: PW.1 – INDIRECT POTABLE REUSE WITH SFPUC INTERTIE

	Average Annual Yield (AFY)	Capital Cost	Annual Capital Cost	Water Supply Cost	O&M Cost	Total Annual Cost
PW.1 – Indirect Potable Reuse with SFPUC Intertie	4,480	$225.7M - $428M	$11.5M - $21.8M	-	$6.6M - 9.6M	$18.1M - 31.4M

Data Needs & Next Steps:

Additional data needs and next steps for this option include:

- Engage with USD and DSRSD to assess availability of wastewater for treatment
- Engage with SFPUC to assess viability of an intertie with the Bay Division Pipeline

PW.2 – Indirect Potable Reuse with Expanded ACWD Distribution

Description:

Similar to LW.1, ACWD could improve operations and make use of full capacity at NDF by improving its distribution system. Unlike LW.1, this option would utilize purified water from an AWPF to recharge the Niles Cone Groundwater Basin via Quarry Lakes. Purified water could be sourced from either DSRSD or USD. For the purposes of this study, it is assumed that treated effluent would be sourced from USD and infrastructure included herein is based around USD's Alvarado WWTP as the source of treated effluent. Recharged water would be recovered via wells that feed NDF. This option could include expanding the ACWD distribution system to allow for higher production at NDF during off-peak months. An improved distribution system might also allow ACWD to operate its system more flexibly to accommodate outages or disruptions to supply at its other water production facilities.

Capital Infrastructure:

The capital infrastructure needed to develop this water supply option includes:

- Conveyance pipeline from USD's Alvarado WWTP to AWPF (Alignment 1 from 2023 PWFS)
- Site work to prepare Pit 2 for AWPF construction
- AWPF Treatment Train
- Conveyance pipeline of MF waste to USD's collection system (Alignment 2 from 2023 PWFS)
- Conveyance pipeline of RO waste to EBDA outfall (Alignment 4 from 2023 PWFS)
- Conveyance pipeline of purified water from AWPF to Quarry Lakes (Alignment 5 from 2023 PWFS)
- ACWD distribution system enhancements
- Up to two (2) new ARP wells

O&M activity:

O&M activity associated with this water supply option includes:

- Additional operation for wells
- Additional runtime at NDF
- Operation for new treatment
- Operation for new conveyance (consumables and power)
- Maintenance for new infrastructure
- Two full-time employees

Water Supply Costs:

Water supply costs are assumed to be $0. This project would reroute wastewater flows that would otherwise be treated discharged to San Francisco Bay. USD has previously expressed interest in partnering on a purified water project, so long as it was cost-neutral to the agency. If additional operational or capital costs are to be borne by USD, then revenue from wastewater flows conveyed to ACWD would be required to offset costs.

Yield:

Under this option, approximately 7.1 mgd of secondary effluent flows would be conveyed via a newly constructed 7.1-mile pipeline from USD's Alvarado WWTP to ACWD's newly constructed AWPF located at the rehabilitated Pit 2. Through the treatment processes at the AWPF, some water (25%) is rejected as MF waste and RO concentrate and sent for disposal while the majority (75%) is recovered as purified water. After treatment, approximately 5.3 mgd of purified water would be conveyed via a newly constructed 2.2-mile pipeline to Quarry Lakes for groundwater recharge. Next, ACWD would extract an equivalent volume of brackish groundwater for desalination at NDF. Subsequently, improvements to ACWD's distribution system would remove hydraulic constraints on NDF and enable the District to convey the desalinated water directly to its customers. The total yield of this supply option is anticipated to be 4.0 mgd, or 4,480 AFY (based on an assumed 75% recovery at NDF of the 5.3 mgd recharged). This yield assumes NDF's current operating capacity could be increased by up to 4.0 mgd if downstream constraints were removed.

TABLE 3-17: PW.2 – INDIRECT POTABLE REUSE WITH EXPANDED DISTRIBUTION

	Average Annual Yield (AFY)	Capital Cost	Annual Capital Cost	Water Supply Cost	O&M Cost	Total Annual Cost
PW.2 – Indirect Potable Reuse with Expanded ACWD Distribution	4,480	$405.8M	$20M	-	$9.1M	$29.1M

Data Needs & Next Steps:

Additional data needs and the next steps for this option include:

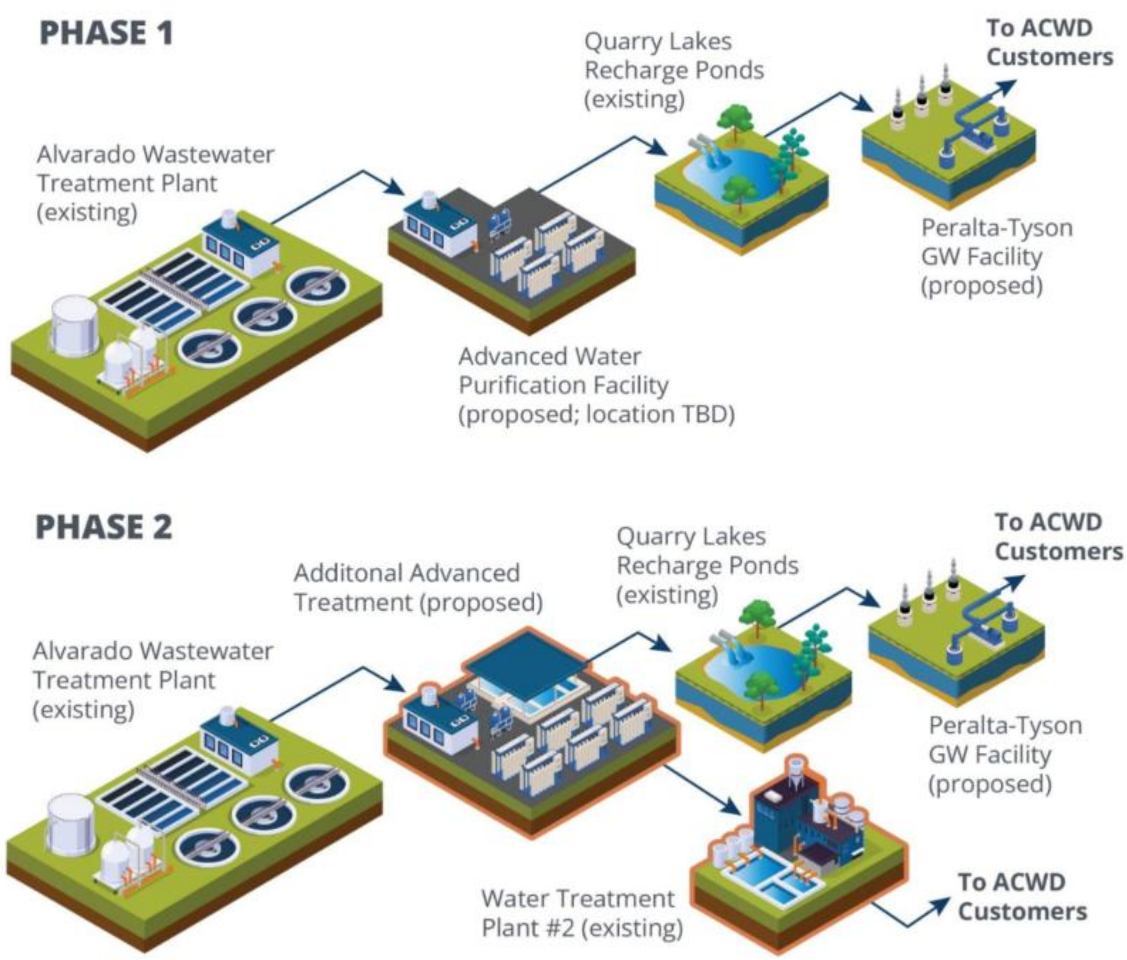
- Engage with USD and DSRSD to assess availability of wastewater for treatment

PW.3 – Indirect Potable Reuse for Groundwater Recharge and Raw Water Augmentation

Description:

This supply option would have ACWD pursue purified water for groundwater recharge (IPR) and raw water augmentation (DPR) via phased implementation. During Phase 1, identified as PW.3a, ACWD would construct an AWPF designed to receive and treat wastewater flows from USD. The AWPF's treated effluent would then be conveyed to Quarry Lakes for groundwater recharge and a new RO groundwater treatment facility would be constructed in the Peralta-Tyson wellfield. This option would enable ACWD to utilize additional groundwater and reduce use of SFPUC imported supply. During Phase 2, referred to as PW.3b, ACWD would expand the capacity of the AWPF completed in Phase 1 to treat larger volumes of wastewater flows from USD and convey purified water to Water Treatment Plant 2 (WTP2) for additional treatment and distribution to customers. This option would enable ACWD to offset SWP supplies. Both Phase 1 and Phase 2 are depicted below in **Figure 3-2.** The combined phases are described as PW.3c.

FIGURE 3-2: PHASES FOR PW.3



Capital Infrastructure:

The capital infrastructure needed to develop this water supply option includes:

- 36-inch, 7.1-mile conveyance pipeline from USD’s Alvarado WWTP to AWPF
- Site work to prepare Pit 2 for AWPF construction
- Phase 1 AWPF Treatment Train
- 8-inch, 0.5-mile conveyance pipeline of MF waste to USD’s collection system
- 18-inch, 6.8-mile conveyance pipeline of RO waste to EBDA outfall
- 28-inch, 2.2-mile conveyance pipeline of purified water from AWPF to Quarry Lakes
- Peralta-Tyson Groundwater Treatment Facility (i.e., RO demineralization)

Capital infrastructure for Phase 2 would include:

- Phase 2 Combined AWPF Treatment Train
- 24-inch, 5.1-mile conveyance pipeline of purified water to WTP2

O&M Activity:

O&M activity associated with this water supply option includes:

- Operation for new treatment
- Operation for new conveyance (consumables and power)
- Maintenance for new infrastructure
- Two full-time employees

Water Supply Costs:

Water supply costs are assumed to be $0. This project would reroute wastewater flows that would otherwise be treated discharged to San Francisco Bay. USD has previously expressed interest in partnering on a purified water project, so long as it was cost-neutral to the agency. If additional operational or capital costs are to be borne by USD, then revenue from wastewater flows conveyed to ACWD would be required to offset costs.

Yield:

During Phase 1, 9 mgd of secondary effluent flows would be conveyed from USD’s Alvarado WWTP to the newly constructed AWPF. Through the treatment processes at the AWPF, some water (25%) is rejected as MF waste and RO concentrate and sent for disposal while the majority (75%) is recovered as purified water. After treatment, approximately 6.8 mgd of purified water would be conveyed to Quarry Lakes for groundwater recharge. Assuming an 80% recovery rate, the newly constructed groundwater facility at the Peralta-Tyson wellfield will be capable of producing 5.4 mgd, or 6,048 AFY. During Phase 2, an additional 6.5 mgd of secondary effluent would be conveyed from USD’s Alvarado WWTP to the enlarged AWPF previously constructed during Phase 1. However, in addition to conveying purified water to Quarry Lakes for recharge, the AWPF would have an enhanced treatment train capable of producing high-quality purified water that would then be conveyed to ACWD’s existing WTP2. At WTP2, purified water would be treated, blended, and conveyed directly to ACWD customers, offsetting SWP supplies. The addition of Phase 2 would add an additional 4.9 MGD of production, bringing the combined total of Phases 1 and 2 to 10.3 mgd, or 11,536 AFY.

TABLE 3-18: PW.3 – INDIRECT POTABLE REUSE FOR GROUNDWATER RECHARGE AND RAW WATER AUGMENTATION

	Average Annual Yield (AFY)	Capital Cost	Annual Capital Cost	Water Supply Cost	O&M Cost	Total Annual Cost
PW.3a – Indirect Potable Reuse for Groundwater Recharge (Phase 1)	6,048	$556.5M	$27.5M	-	$11.9M	$39.4M
PW.3b – Indirect Potable Reuse for Raw Water Augmentation (Phase 2)	5,488	$192.6M	$9.5M	-	$3.5M	$13M
PW. 3c – Indirect Potable Reuse for Groundwater Recharge and Raw Water Augmentation (Phase 1 + Phase 2)	11,536	$749.1M	$37M	-	$15.4M	$52.4M

Data Needs & Next Steps:

Additional data needs and next steps for this option include:

- Engage with USD to assess availability of wastewater for treatment
- Assess public sentiment on DPR

PW.4 – Direct Potable Reuse

Description:

Instead of groundwater recharge (IPR), ACWD could pursue DPR only with treated wastewater flows from USD. ACWD would construct an AWPF designed to receive and treat wastewater flows from USD and would then convey purified water to WTP2 for additional treatment and distribution to customers. This is distinct from IPR, as described in Options PW.1, PW.2, and PW.3a, where water is provided an environmental buffer prior to being treated for potable use. DPR foregoes this buffer, relying on advanced treatment to produce water of sufficient quality to be used as source water for conventional water treatment.

Capital Infrastructure:

The capital infrastructure needed to develop this water supply option includes:

- 36-inch, 7.1-mile conveyance pipeline from USD's Alvarado WWTP to AWPF
- Site work to prepare Pit 2 for AWPF construction
- AWPF Treatment Train for DPR only
- 8-inch, 0.5-mile conveyance pipeline of MF waste to USD's collection system
- 18-inch, 6.8-mile conveyance pipeline of RO waste to EBDA outfall
- 36-inch, 5.1-mile conveyance pipeline of purified water to WTP2

O&M Activity:

O&M activity associated with this water supply option includes:

- Operation for new treatment
- Operation for new conveyance (consumables and power)
- Maintenance for new infrastructure
- Four full-time employees

Water Supply Elements:

Water supply costs are assumed to be $0. This project would reroute wastewater flows that would otherwise be treated discharged to San Francisco Bay. USD has previously expressed interest in partnering on a purified water project, so long as it was cost-neutral to the agency. If additional operational or capital costs are to be borne by USD, then revenue from wastewater flows conveyed to ACWD would be required to offset costs.

Yield:

Operationally, 15.5 mgd of secondary effluent flows would be conveyed from USD's Alvarado WWTP to the newly constructed AWPF. Through the treatment processes at the AWPF, some water (25%) is rejected as MF waste and RO concentrate and sent for disposal while the majority (75%) is recovered as purified water. However, the AWPF would have an enhanced treatment train capable of producing high-quality purified water that would then be conveyed to ACWD's existing WTP2. Additionally, since PW.4 does not include a groundwater recharge element, treated effluent from the AWPF is not subject to the assumed 80% recovery rate, enhancing potential yields. At WTP2, purified water would be treated, blended, and conveyed directly to ACWD customers, offsetting SWP supplies. The estimated yield would be 11.7 mgd, or 13,104 AFY.

TABLE 3-19: PW.4 – DIRECT POTABLE REUSE

	Average Annual Yield (AFY)	Capital Cost	Annual Capital Cost	Water Supply Cost	O&M Cost	Total Annual Cost
PW.4 - Direct Potable Reuse	13,104	$676.5M	$33.4M	-	$13M	$46.4M

Data Needs & Next Steps:

Additional data needs and next steps for this option include:

- Engage with USD to assess availability of wastewater for treatment
- Assess public sentiment on DPR

3.6 Demand Management Options

DM.1 – Additional Water Use Efficiency

Description:

For decades, ACWD has implemented a water use efficiency program aimed at increasing customer water use efficiency to reduce customer demand. In 2018, the State established new Urban Water Use Objectives (UWUOs) through Senate Bill 606 and Assembly Bill 1668. The legislation sets long-term urban water use efficiency standards for certain water uses. Urban retail water suppliers must meet UWUOs based on those standards which, along with other water uses excluded from the long-term standards, will exceed the previous statewide water conservation targets required pursuant to SB X7-7.

Woodard & Curran's "Demand Forecasting for ACWD's Water Resources Master Plan 2050 (Phase 2, Task 3 - Demand Forecasting)" TM describes ACWD's water use efficiency plan to reduce future demands in order to meet the UWUOs. In fact, ACWD's demand forecast is set at meeting the UWUOs. This water supply option is focused on additional water use efficiency efforts that go beyond planned efforts to meet the UWUOs.

ACWD's additional water use efficiency efforts are assumed to include all existing and planned efforts to meet UWUOs along with higher targets for: industrial process water reuse projects, UHET incentives, UHET direct installations for income-qualified customers, outdoor and indoor residential surveys, turf removal, irrigation devices, and other water efficient devices. Moreover, efforts will include adopting policies and regulations to reduce indoor and outdoor uses, accelerating water waste enforcement, and implementing new programs such as direct installation of toilets in multi-family residential properties. Optionally, the supply option could include implementation of either budget-based rates or other tiered rates to align highest-cost water supplies with the highest or least efficient water using customers whose use requires production of those water supplies.

O&M Activity:

O&M activity associated with this water supply option includes:

- Implementing the additional water use efficiency program activities (beyond what is already planned for compliance with the UWUO)
    - Two years of planning and acquiring resources (i.e., staff and contractors)
    - Two full-time employees

Yield:

ACWD estimates additional water use efficiency efforts can save up to 910 AFY without implementing tiered rates, and up to 982 AFY if budget-based or tiered rates are implemented. **Table 3-20** summarizes the yield of the enhanced efforts along with program costs. Water use efficiency savings will take approximately 11 to 12 years to reach full potential.

TABLE 3-20: DM.1 – ADDITIONAL WATER USE EFFICIENCY

	Average Annual Yield (AFY)	Capital Cost	Annual Capital Cost	Water Supply Cost	O&M Cost	Total Annual Cost
DM.1 – Additional Water Use Efficiency (without Tiered Rates	910	$0	$0	$0	$1.25M	$1.25M
DM. 1 – Additional Water Use Efficiency (with Tiered Rates)	982	$0	$0	$0	$2.2M	$2.2M

Data Needs & Next Steps:

Additional data needs and next steps for this option include:

- Assess possibilities for implementing tiered rates

4. WATER RESOURCES STRATEGY DEVELOPMENT PROCESS

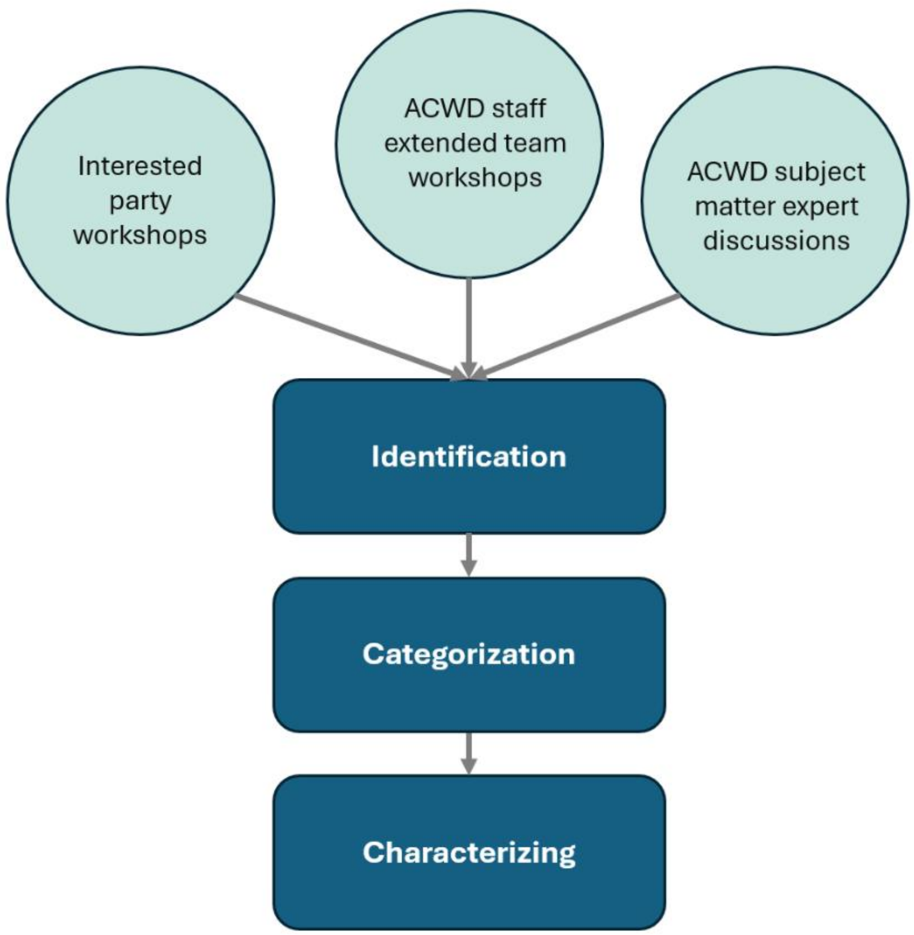
4.1 Water Resources Strategy Overview

Water resources strategies are potential actions that ACWD could take to achieve the additional goals of the WRMP beyond the yields of the water supply options discussed in **Section 3**. Specifically, the water resources strategies are designed to address the WRMP 2050 goals aiming to promote affordable and equitable water for all customers, a resilient and optimized water distribution system, healthy watersheds and aquifers, and regional leadership in water management. Each water resource strategy is characterized in **Section 5**.

4.2 Development Methodology

Water resources strategies were developed using the steps shown in **Figure 4-1**, described further in the subsections below.

FIGURE 4-1: STRATEGIES DEVELOPMENT METHODOLOGY



Identification

Water resource strategies were developed from several sources, including workshops with Interested Parties which included representatives from relevant agencies and organizations identified in the WRMP Communication and Engagement Plan and throughout the subsequent planning process. The workshop topics are listed below:

- Water Conservation (2/10/2025)
- Watershed Stewardship (2/10/2025)
- Community/Equity (2/20/2025)

Water resource strategies were also developed through discussions with ACWD staff in conjunction with other meetings and discussions as part of the WRMP development process, including extended team workshops and one-on-one conversations with subject matter experts.

Categorization

Water resource strategies were grouped into the following four categories to facilitate review and selection for inclusion in portfolios in the next stages of the WRMP development process.

- **Section 5.1** - Operational Improvements
- **Section 5.2** - Watershed Stewardship
- **Section 5.3** - Community and Equity
- **Section 5.4** - Water Use Efficiency, Policy, and Leadership

Characterizing

Water resource strategies are designed to be added to portfolios in conjunction with the water supply options to address the WRMP 2050 goals, but do not provide a specific water supply yield on their own. Water resource strategies are often conceptualized at a higher level and may not have costs that are well defined since they do not produce water and often take the form of an action that provides multiple benefits in partnership with other entities. Where possible, costs or a range of costs have been estimated.

5. WATER RESOURCE STRATEGIES

5.1 Operational Improvements

ACWD's current distribution system is impacted by significant hydraulic constraints that have historically impeded the District's ability to move water from the northern to southern end of its service area. Water resources strategies under the Operational Improvements (OI) category seek to improve ACWD's ability to distribute water equitably throughout its service area, enhance long-term system reliability, and expand operational resilience.

OI.1 – Distribution System Improvements

As part of ACWD's Capital Improvement Program (CIP), this strategy would improve connectivity between the north and south ends of the service area to remove existing hydraulic constraints at NDF and provide greater flexibility in utilizing current and potential water supplies. This option would be included in ACWD's CIP and would likely involve the installation of larger diameter distribution mains.

Costs are still under development while a hydraulic analysis is conducted as part of a separate engineering analysis. For purpose of the WRMP, a $44 million estimated cost was provided by ACWD.

OI.2 – Mission San Jose Treatment Plant (WTP1) Rehabilitation

Closed in 2015 due to insufficient demands, ACWD could undertake a rehabilitation of the Mission San Jose Treatment Plant (WTP1). Historically, WTP1 was used to treat imported water supplied by the SBA. Increased production at WTP1 could enable ACWD to provide larger volumes of water to customers in the southern service area, negating the need for the substantial distribution system improvements outlined in Strategy OI.1.

The cost to recommission and upgrade WTP1 is included in the 2024 Interim Engineering Report as project PJ01.55 and is approximately $26.4 million. O&M costs are estimated to be similar to the O&M costs for WTP2.

OI.3 – Resilience and/or Emergency Response Plan

This strategy would have ACWD develop a Resilience Plan or Emergency Response Plan that would study and document areas of risk and develop response plans for ACWD's current water infrastructure system, as well as develop response plans to address risk. It would also identify areas where future planned water supply projects could be developed in such a way to mitigate or reduce that identified risk.

This would include studying which supply sources are most susceptible to emergency outage, and to understand the impact of those outages on ACWD's operations. The study should explicitly consider the costs to recover the supply and include an assessment of reasonable timelines for returns to service. For example, in the event of an emergency, ACWD may not be the only water purveyor experiencing an outage. This may significantly delay procurement of materials and labor to make system repairs. The study would recommend mitigation measures, potentially in the form of new Capital Improvement Projects or ACWD policies, that would reduce costs of such an outage or the duration of such an outage.

The cost will vary depending on the level of detail and the number of outage scenarios, but is on the order of $200,000 - $500,000.

5.2 Watershed Stewardship

This set of strategies aims to help ensure the long-term health of the Alameda Creek Watershed. ACWD has a long history of being a vocal advocate for protecting the Alameda Creek Watershed and has recently demonstrated leadership in the reintroduction of steelhead trout. Under the umbrella of Watershed Stewardship (WS), there are a variety of direct, continued, and supportive actions ACWD can undertake to achieve the WRMP goal of healthy watersheds.

WS.1 – Establish Multi-Benefit Land Trust

This strategy would have ACWD purchase land in the Upper Alameda Creek Watershed with the intent of establishing a land trust that protects both the quality of Alameda Creek's headwaters as well as species and habitats of concern. One permutation would involve the acquisition of large amounts of property in the Upper Alameda Creek Watershed, such as the N3 Cattle Ranch, to widely protect the Alameda Creek's headwater quality. Another iteration of this strategy could involve ACWD purchasing approximately 10,000 linear feet by 50 feet of property adjacent to the Vallecitos Channel and establishing the Vallecitos Channel Mitigation Bank. This project would protect the quality of ACWD surface water supplies being delivered from the SBA to Alameda Creek via the Vallecitos Channel and would generate habitat credits that could be sold to generate revenue for the District.

Costs will vary depending on the land trust area, for example:

- Upper Alameda Creek Watershed Land Trust:
  - $1,250 per acre for property acquisition in the Upper Alameda Creek Watershed
  - O&M costs
- Vallecitos Channel Land Trust:
  - $1,036,000 in capital costs
  - $3,600,000 for land trust endowment
  - $144,000 in Annual O&M (covered by endowment)

WS.2 – Reduce Sediment Loading at Quarry Lakes

This strategy would have ACWD partner with local cities or Alameda County on a project aiming to reduce sediment loading at Quarry Lakes. Potential actions could include a dredging program Quarry Lakes or the installation of green infrastructure, such as bioswales, along stormwater channels and inlets flowing into Quarry Lakes.

The cost of a dredging program can vary depending on the dredging method, volume of material to be removed, and other factors, resulting in a range from $25 per cubic yard to $100 per cubic yard. Based on Quarry Lakes having 360 acres of water bodies, it's estimated that dredging could cost from $25M to $100M, assuming one foot of sediment depth to be removed.

The cost of green infrastructure, such as bioswales, will depend on the area to be converted, and is estimated at $20 per square foot. If bioswales were installed where diversion points are located, and assuming they're built at 100 feet long and 30 feet wide, the cost of each would be approximately $140,000 per bioswale to construct, in addition to maintenance costs of approximately $1,000 per year per bioswale.

WS.3 – Enhance Trash Screening at Quarry Lakes

ACWD currently has a trash screening mechanism installed at an existing storm drain inlet to Lago Los Osos that is designed to capture refuse in Alameda Creek before it enters Quarry Lakes. However, the mechanism is currently disused. This strategy would have ACWD rehabilitate the mechanism and potentially expand the facility to enhance screening of local stormwater entering Quarry Lakes.

Exact rehabilitation has not thoroughly documented, but is expected to take the form of grouting on the existing apron, with application of shotcrete at the toe. A placeholder estimate of $1M is estimated for this strategy.

WS.4 – Reduce Algal Blooms and Prevent Golden Mussels at Quarry Lakes

This strategy would have ACWD collaborate with East Bay Regional Park District to enact more restrictions on recreation at Quarry Lakes in response to the invasive Golden mussel. Moreover, ACWD may seek to determine what forms of recreation would be permissible at Quarry Lakes if Golden mussels did become an issue. As part of this effort, ACWD could also pursue programing aiming to control algal blooms at Quarry Lakes.

There are no new costs associated with this strategy.

WS.5 – Expand Sampling Program at Quarry Lakes

ACWD currently runs a water quality sampling program intended to monitor nutrients loads at Quarry Lakes (see WS.9). This strategy would have ACWD expand sampling operations at Quarry Lakes to include monitoring of other pollutants and contaminants of emerging concern.

Costs to monitor additional contaminants would include costs for collection materials and lab costs, and would depend on the frequency and constituents to be tested. For example, costs to test for VOCs can range from $100 to $150 per sample while cost to test for PFAS can range from $300 to $600 per sample. Assuming that each of the major lakes and ponds (12 sites) are sampled twice per year for these constituents, this equates to between $10,000 to $18,000 in lab costs per year, in addition to materials, shipping, and staff costs. ACWD estimates that such a testing program for an expanded list of 15 constituents would have a cost of about $250,000 annually with an additional $25,000 in initial training costs.

WS.6 – Adaptive Management of Alameda Creek Bypass Flow Requirements

When ACWD developed its fisheries program, it established bypass flow requirements for Alameda Creek to ensure sufficient volume for fish populations. However, this initial bypass volume and flow schedule was developed at the outset of the program, before any fish had returned to the Creek. Therefore, this strategy would have ACWD continue to monitor data for the next 10-15 years, as the fishery matures, to determine the optimal times and volumes for scheduling bypass flows. This alteration of flow schedule will not result in a net decrease in volumes, but merely an adaptive approach to managing alterations from Alameda Creek.

Potential costs are estimated to be $1 million for a one-time study.

WS.7 – Continue Water Quality Monitoring in the Upper Alameda Creek Watershed

ACWD currently collaborates with wastewater agencies in the Upper Alameda Creek Watershed to engage in ongoing water quality monitoring activities. This strategy would have ACWD continue this monitoring program.

There are no new costs associated with this strategy.

WS.8 – Continue Studying Benefits of Ecosystem Enhancements

This strategy would have ACWD continue its support of organizations, such as the Alameda Creek Alliance and CalTrout, studying ecosystem benefits, such as the reintroduction of beavers to the Alameda Creek Watershed.

There are no new costs associated with this strategy.

WS.9 – Continue Nutrient Sampling at Quarry Lakes

ACWD currently runs a water quality sampling program designed to monitor nutrient loads at Quarry Lakes. This strategy would have ACWD continue this monitoring program as-is. This strategy could be treated as a standalone supportive action in a suite of strategies as part of a portfolio, or paired in tandem with WS.5 which would expand sampling operations at Quarry Lakes to include monitoring of other pollutants and contaminants of emerging concern beyond just nutrients.

There are no new costs associated with this strategy.

WS.10 – Support Use of FIRO to Inform Reservoir Releases

In recent years, ACWD has been vocally supportive of pursuing Forecast-Informed Reservoir Operations (FIRO) and reoperation at Lake Del Valle and this strategy would see ACWD continue to advocate for such change. Under this program, ACWD would support minor deviations from flood control operations in dry years and would prefer a slower release schedule to enhance recharge and reduce runoff to the San Francisco Bay.

There are no costs associated with this strategy.

WS.11 – Support Wetland Restoration in the Alameda Creek Watershed

Historically, ACWD has been vocally supportive of efforts to restore the naturally occurring wetlands at the mouth of Alameda Creek. This strategy would have ACWD maintain this supportive action and continue to join others advocating for ecological restoration programs in the Lower Alameda Creek Watershed.

There are no costs associated with this strategy.

5.3 Community and Equity

Community and equity (CE) strategies aim to address the WRMP 2050 goal of affordable and equitable supply for all direct and indirect customers.

CE.1 – Expand Partnerships with Schools

ACWD currently partners with local schools to provide educational presentations about the importance of water efficiency and other topics to local students. This strategy would have ACWD continue this partnership and look to expand to other schools in the area.

There are no capital costs or significant operational costs associated with this strategy, though some limited funding for materials development and staff time would be required.

CE.2 – Identify New Revenue Streams to Fund Affordability Programs

This strategy would have ACWD identify and pursue alternative revenue streams in order to fund water affordability programs for low-income customers. Potential actions include but are not limited to, leasing District-owned land, implementing renewable energy programs, and pursuing third party donations.

Costs are yet to be determined but will include the cost of a feasibility study as well as implementation costs.

CE.3 – Conduct Public Outreach on Drinking Water Quality

This strategy would have ACWD expand the frequency and reach of its public outreach campaigns conducted by ACWD's Public Affairs division. This strategy would enable ACWD to annually determine which issues are of the greatest interest to the District and customers. Likewise, the financial resources associated with this strategy could also be used to support the implementation of projects associated with the WRMP throughout the 25-year planning period.

Costs include $206,000 annually to support a full-time employee and additional campaign costs

CE.4 – Construct Water Filling Stations

This strategy would have ACWD construct and maintain water filling stations within its service area to provide drinking water to low income and unhoused populations. These filling stations would be accessed from outside district facilities without needing to access a hydrant and be operated automatically around the clock without disruption to ACWD staff. To comply with requirements of Proposition 218, ACWD would be required to partner with a community organization to pay for the water supplied via the filling stations.

Stand-alone station costs may vary based on the level of automation, existing site conditions, and design. Construction costs may range from $5,000 to $20,000.

5.4 Water Use Efficiency, Policy, and Leadership

The Water Use Efficiency (WUE), Policy, and Leadership (PL) strategy categories address several WRMP 2050 goals both directly and indirectly through strategies that use policy and/or collaborative leadership to facilitate efficient regional water use and management.

PL.1 – Use Flow Restrictors In-Lieu of Water Shut-Offs

Since the COVID-19 pandemic, ACWD has not engaged in water shut-offs for customers with unpaid water bills. Instead of resuming shut-offs in instances of chronic nonpayment, ACWD could instead install flow restrictors on delinquent customer meters. Flow restrictors are devices that limit the flow of water entering a residence while still allowing for critical water uses such as drinking, cooking, bathing, and flushing a toilet.

There are no new costs associated with this strategy (assumed to be implemented using existing staff, while hardware costs are assumed to be minimal).

PL.2 – Develop an ACWD Affordability Plan

This strategy would have ACWD staff draft and implement an Affordability Plan which formulates policies designed to enhance the affordability of water for all direct and indirect customers.

There are no new costs associated with this strategy.

PL.3 – Establish Bay Area Water Market Partnerships

This strategy would see ACWD partner with local water agencies to establish a regional water market aiming to provide both short-term interagency exchanges or transfers as well as long-term resiliency and flexibility to respond to emergency conditions or events.

Several water supply options previously discussed in this TM would improve ACWD's ability to exchange water with other Bay Area water agencies and participate in a Bay Area Water Market. These include:

- IW.2 – Regional Surface Water Storage
- IW.5 – Groundwater Banking Inside Alameda Creek Watershed
- IW.7 – Pretreatment Facility at EBMUD's WCWTP
- LW.2 – Augment Wet Year Recharge and Construct ACWD-SFPUC Intertie
- PW.1 – Indirect Potable Reuse with SFPUC Intertie

A support tool would be developed to guide future water exchanges and transfers between partnering agencies. There are no initial costs associated with this strategy.

PL.4 – Establish SWP Water Market Partnerships

This strategy would use the flexibility of the SWP's Water Management Tools Amendment to establish partnerships with other SWP agencies to further optimize wet year storage and trading for dry year water.

Under the recent water management tools amendment to the SWP contract, ACWD can enter into agreements with other SWP contractors or agencies who have access to SWP supplies to exchange or transfer water. The amendment confirms criteria for exchanges and defines the maximum compensation allowable for exchanges. It also provides exchange ratios and allows for exchanges to be completed over and up to a ten-year period. For transfers, the amendment permits single- or multiple-year transfers in addition to permanent transfers of Table A contract rights.

With this amendment, the exchange and transfer of SWP supplies is more accessible. ACWD could engage in one-time exchanges or transfers, or seek to form longer-term, multi-agency agreements to exchange and transfer SWP water. Several water supply options included in this TM would help facilitate transfers and exchanges, including:

- IW.1 – Groundwater Banking Outside Alameda Creek Watershed

- IW.2 – Regional Surface Water Storage
- IW.5 – Groundwater Banking Inside Alameda Creek Watershed

A support tool or framework could be developed to identify promising partnerships for transfer or exchange between SWP contractors.

There are no initial costs associated with this strategy.

WUE.1 – Partner with Cities and Community Groups on Water Use Efficiency Programing

Effective as of January 1, 2025, the "Making Conservation a California Way of Life" regulations require all urban water suppliers to adhere to set UWUO established by the State Water Resources Control Board. Although ACWD already plans to meet its UWUO through an extensive set of water use efficiency efforts, there are many components of planned efforts that could be focused in different ways. This strategy would involve greater regional collaboration whereby the District would partner with local cities and community groups to pursue water efficiency programming.

There are no new costs associated with this strategy.

WUE.2 – Implement Water Efficiency Master Plan to Meet Urban Water Use Objectives

This strategy is ongoing as ACWD is already implementing its Water Efficiency Master Plan (WEMP) to meet UWUOs. See more background on the UWUOs and a water supply option for additional water use efficiency beyond the UWUOs in **Section 3.6**. The demand forecast used for the WRMP assumes that ACWD's demands will meet UWUOs. Without implementation of this strategy WUE.2, projected demands are expected to exceed UWUOs in 2050.

6. CONCLUSION

ACWD's existing water supply portfolio includes local water from the Alameda Creek Watershed and the Niles Cone Groundwater Basin as well as imported water from the SWP and SFPUC. The findings from the Baseline Supplies TM indicate that these existing water supplies will be sufficient to meet future demand under optimistic forecasted future conditions, with increasing levels of shortage in certain dry years under more pessimistic future conditions. This TM details the many water supply options and water resource strategies that ACWD has available to augment or offset its existing water supplies.

Water supply options range from optimizing local supplies to replacing imported water supplies to enhancing water storage. Water resource strategies range from improving operational reliability to enhancing stewardship to ensuring equity and affordability of water supply. The next step in the WRMP process is evaluating varying portfolios of water supply options and water resource strategies. The portfolios will package options and strategies together to best meet the goals ACWD established for the WRMP. Those goals are:

1. Sustainable water supply portfolio that leverages local resources and adapts to climate change.
2. Affordable and equitable supply for all direct and indirect customers.
3. Resilient and optimized water service infrastructure system and operations.
4. Healthy watersheds and aquifers that are managed to provide multiple benefits.
5. Collaborative leadership to facilitate regional water management.

Twenty-three water supply options and twenty-four water resource strategies were identified and characterized in this TM for further consideration and analysis in the portfolio evaluation process. The combination of existing reliability and multitude of options allows ACWD to be thoughtful as the agency considers its water supply future.

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Additional references used in the development of cost estimates for supply options are noted throughout Appendix A.

APPENDIX A: WATER SUPPLY OPTIONS WORKBOOK

Introduction	
Project Name	ACWD Water Resources Master Plan Phase 2
Client	Alameda County Water District
Workbook Title	Water Supply Options Characterization
Workbook Description	Workbook provides an overview of assumptions made in the development and characterization of water supply options.
Workbook Author	Max Storms & Max McNally
Workbook Reviewer	Dawn Flores
Last Updated	2/3/2026
Estimate Location	San Francisco
Estimate Date	1/1/2025

Common Assumptions	
Discount Rate (%)	3.00%
Financing Period (years)	30
Discount rate is nominal interest rate less inflation. Based on USBR's Water Resources Planning Rate.	

Tab Summary	
Introduction	Provides general project information and a description of the workbook.
Summary	A summary table of characterized water supply options.
XW.#	Detailed cost estimates and identification of yields for water supply options. Each water supply option is assigned a number, in the XW.# format, as noted in the summary table.
Capital Costs	Assumptions and cost basis for capital costs.
O&M Costs	Assumptions and cost basis for O&M costs.
Fixed O&M Assumptions	Assumptions for fixed O&M costs as a percentage of capital costs
Water Supply Costs	Assumptions and cost basis for water supply costs.
ENR CCI	Engineering News & Record Construction Cost Index data. Used for escalating costs.

Woodard & Curran

No.	Supply Option Title	Supply Source	Supply Frequency	Dry Year Supply Volume (AFY)	Average Annual Supply Volume (AFY)	Capital Cost ($)	Annualized Capital Cost ($/year)	Water Supply Cost ($/year)	O&M Cost ($/year)	Total Annual Cost ($/year)	Unit Cost without Capital ($/AF)	Unit Cost ($/AF)
GW.1	Groundwater Desalination	Niles Cone Groundwater Basin	Annual	4,480	4,480	$178,700,000	$9,100,000	$0	$5,600,000	$14,700,000	$1,250	$3,280
GW.2 + GW.3	Revise Groundwater Rule Curves & Lower Minimum Operating Levels in the Niles Cone Groundwater Basin	Niles Cone Groundwater Basin	Annual	1,670	1,670	$0	$0	$0	$200,000	$200,000	$120	$120
GW.4	Enhanced Groundwater Treatment for PFAS and Hardness	Niles Cone Groundwater Basin	Annual	4,480	4,480	$151,200,000	$7,700,000	$0	$6,100,000	$13,800,000	$1,362	$3,080
GW.5	Optimize Newark Desalination Facility Operations	Niles Cone Groundwater Basin	Annual	2,120	2,120	$390,000	$19,900	$0	$2,500	$22,400	$1	$11
GW.6	Construct Southern Blending Facility	Niles Cone Groundwater Basin + SFPUC	Annual	4,350	4,350	$43,900,000	$2,200,000	$8,400,000	$1,500,000	$12,100,000	$2,276	$2,780
IW.1	Groundwater Banking Outside Alameda Creek Watershed	Imported Water	Dry Year	10,680	2,378	$32,100,000	$1,600,000	$2,300,000	$1,000,000	$4,900,000	$1,388	$2,060
IW.2	Regional Surface Water Storage	Imported Water	Dry Year	10,680	2,378	$0	$0	$5,000,000	$0	$5,000,000	$2,103	$2,100
IW.3	New Imported Water Supply (non-SWP)	Imported Water	Dry Year	10,218	1,874	$0	$0	$1,400,000	$0	$1,400,000	$747	$750
IW.4	Sunol Aqueduct	State Water Project	No Immediate Supply	N/A	N/A	$32,800,000	$1,700,000	$0	$200,000	$1,900,000	#VALUE!	N/A
IW.5	Groundwater Banking Inside Alameda Creek Watershed	State Water Project	Dry Year	1,150	1,150	$251,100,000	$12,800,000	$1,200,000	$2,700,000	$16,700,000	$3,391	$14,520
IW.6	Increase Peak Blending Capacity at Fremont Turnout	SFPUC	Emergency	0	1,600	$144,600,000	$7,400,000	$3,100,000	$1,100,000	$11,600,000	$2,625	$7,250
IW.7	Pretreatment Facility at EBMUD's Walnut Creek Water Treatment Plant	Sacramento River	Emergency	0	6,440	$279,400,000	$14,300,000	$0	$2,600,000	$16,900,000	$404	$2,620
LW.1	Augment Wet Year Recharge and Expand ACWD Distribution	Alameda Creek Watershed	Normal & Wet Year	0	3,100	$25,900,000	$1,300,000	$0	$1,000,000	$2,300,000	$323	$740
LW.2	Augment Wet Year Recharge and Construct SFPUC Intertie	Alameda Creek Watershed	Normal & Wet Year	0	3,136	$32,900,000	$1,700,000	$0	$1,300,000	$3,000,000	$415	$960
W.3 - High End Co	Optimize and Enhance Del Valle Yields	Alameda Creek Watershed	Annual	300	300	$21,100,000	$1,100,000	$0	$0	$1,100,000	$0	$3,670
LW.4	Regional Stormwater Capture	Alameda Creek Watershed	Wet Year	0	350	$0	$0	$434,000	$0	$434,000	$1,240	$1,240
OW.1	Bay Water Desalination	San Francisco Bay	Annual	8,000	8,000	$660,000,000	$33,700,000	$0	$16,000,000	$49,700,000	$2,000	$6,210
PW.1	Indirect Potable Reuse with SFPUC Intertie	USD	Annual	4,480	4,480	$428,000,000	$21,800,000	$0	$9,600,000	$31,400,000	$2,143	$7,010
PW.2	Indirect Potable Reuse with Expanded ACWD Distribution	USD	Annual	4,480	4,480	$446,700,000	$22,800,000	$0	$9,800,000	$32,600,000	$2,188	$7,280
PW.3a	Indirect Potable Reuse for Groundwater Recharge (Phase 1)	USD	Annual	6,048	6,048	$585,000,000	$29,800,000	$0	$12,500,000	$42,300,000	$2,067	$6,990
PW.3b	Indirect Potable Reuse for Raw Water Augmentation (Phase 2)	USD	Annual	5,488	5,488	$209,700,000	$10,700,000	$0	$4,100,000	$14,800,000	$747	$2,700
PW.3c	Indirect Potable Reuse for Groundwater Recharge & Raw Water Augmentation (Phase 1 + Phase 2)	USD	Annual	11,536	11,536	$794,700,000	$40,500,000	$0	$16,700,000	$57,200,000	$1,448	$4,960
PW.4	Direct Potable Reuse	USD	Annual	13,104	13,104	$722,100,000	$36,800,000	$0	$14,300,000	$51,100,000	$1,091	$3,900

Water Supply Option Overview		
Water Supply Option No.	Water Supply Option Title	Water Supply Source
GW.1	Groundwater Desalination	Niles Cone Groundwater Basin

Water Supply Option Yield					
Supply Frequency	Supply Availability Frequency (0.0 to 1.0) (e.g., 3-in-10 years = 0.3)	Supply Volume	Dry Year Supply Volume	Average Annual Supply Volume	Basis for Yield Assumptions
Annual	1.0	4,480	4,480	4,480	Assumes 4.0 mgd effluent

Water Supply Option Costs					
Capital Cost	Annualized Capital Cost	Water Supply Cost	O&M Cost	Total Annual Cost	Average Unit Cost
$178,700,000	$9,100,000	$0	$5,600,000	$14,700,000	$3,280

Capital Costs					
Item	**Quantity**	**Units**	**Unit Cost**	**Total Cost**	**Notes**
Extraction Well	4	LS	$3,100,000	$12,400,000	
Brackish Water Desalination Treatment Facility	5.3	MGD	$16,200,000	$85,860,000	
12" Conveyance Pipeline	1,000	LF	$690	$690,000	From wells to facility
18" Conveyance Pipeline	1,000	LF	$880	$880,000	From facility to distribution system
8" Conveyance Pipeline	1,000	LF	$500	$500,000	Brine disposal line
Land Acquisition	2.5	acres	$5,700,000	$14,250,000	
			Raw Construction Cost	**$114,580,000**	
Contingency			*20%*	*$22,916,000*	
			Total Construction Cost	**$137,496,000**	
Implementation Cost			*30%*	*$41,248,800*	
			Total Capital Cost	***$178,700,000***	*Does not include land acquisition*
O&M Costs					
Item	**Quantity**	**Units**	**Unit Cost**	**Total Cost**	**Notes**
Extraction Well O&M	5,600	AF	$130	$728,000	
Pipelines	1%			$20,700	
Local Desalination Facility - O&M	5	MGD	$700,000	$3,710,000	
ACWD Full-time Employee	2	EA	$321,400	$642,800	
GW.1 - Treatment to Distribution	1,147,055	kwh	$0.40	$458,822	*Assumes 200-feet of lift*
			Total O&M Cost	***$5,600,000***	
Water Supply Costs					
Item	**Quantity**	**Units**	**Unit Cost**	**Total Cost**	**Notes**
		0	$0	$0	
			Total Water Supply Cost	***$0***	

Water Supply Option Overview		
Water Supply Option No.	Water Supply Option Title	Water Supply Source
GW.2 + GW.3	Revise Groundwater Rule Curves & Lower Minimum Operating Levels in the Niles Cone Groundwater Basin	Niles Cone Groundwater Basin

Water Supply Option Yield					
Supply Frequency	Supply Availability Frequency (0.0 to 1.0) (e.g., 3-in-10 years = 0.3)	Supply Volume	Dry Year Supply Volume	Average Annual Supply Volume	Basis for Yield Assumptions
Annual	1.0	1,670	1,670	1,670	Based on Tan's modeling

Water Supply Option Costs					
Capital Cost	Annualized Capital Cost	Water Supply Cost	O&M Cost	Total Annual Cost	Average Unit Cost
$0	$0	$0	$200,000	$200,000	$120

Capital Costs					
Item	Quantity	Units	Unit Cost	Total Cost	Notes
			Raw Construction Cost	**$0**	
Contingency			*20%*	*$0*	
			Total Construction Cost	**$0**	
Implementation Cost			*30%*	*$0*	
			Total Capital Cost	***$0***	
O&M Costs					
Item	**Quantity**	**Units**	**Unit Cost**	**Total Cost**	**Notes**
Extraction Well O&M	1,670	AF	$130	$217,100	
			Total O&M Cost	***$200,000***	
Water Supply Costs					
Item	**Quantity**	**Units**	**Unit Cost**	**Total Cost**	**Notes**
			Total Water Supply Cost	***$0***	

Water Supply Option Overview		
Water Supply Option No.	Water Supply Option Title	Water Supply Source
GW.4	Enhanced Groundwater Treatment for PFAS and Hardness	Niles Cone Groundwater Basin

Water Supply Option Yield					
Supply Frequency	Supply Availability Frequency (0.0 to 1.0) (e.g., 3-in-10 years = 0.3)	Supply Volume	Dry Year Supply Volume	Average Annual Supply Volume	Basis for Yield Assumptions
Annual	1.0	4,480	4,480	4,480	Assumes SFPUC could be reduced from 8.0 mgd to 4.0 mgd if MPR were removed.

Water Supply Option Costs					
Capital Cost	Annualized Capital Cost	Water Supply Cost	O&M Cost	Total Annual Cost	Average Unit Cost
$151,200,000	$7,700,000	$0	$6,100,000	$13,800,000	$3,080

Capital Costs					
Item	**Quantity**	**Units**	**Unit Cost**	**Total Cost**	**Notes**
Peralta Tyson Groundwater Treatment Facility (RO)	6.0	MGD	$9,800,000	$58,800,000	From 2023 PFWS; sized at 6.0 MGD to account for plant efficiency / downtime
PFAS Treatment (IX) Facility Expansion	9.0	MGD	$1,700,000	$15,300,000	From 2024 Interim Engineering Report
Land Acquisition	4	acres	$5,700,000	$22,800,000	
			Raw Construction Cost	**$96,900,000**	
Contingency			*20%*	*$19,380,000*	
			Total Construction Cost	**$116,280,000**	
Implementation Cost			*30%*	*$34,884,000*	
			Total Capital Cost	***$151,200,000***	
O&M Costs					
Item	**Quantity**	**Units**	**Unit Cost**	**Total Cost**	**Notes**
Peralta Tyson Groundwater Treatment Facility - O&M	6.0	MGD	$369,000	$2,200,000	From 2023 PFWS
ACWD Full-time Employee	2.0	EA	$321,400	$600,000	
PFAS Treatment Costs	9.0	MGD	$240,000	$2,200,000	
Extraction Well O&M	5,914	AF	$130	$800,000	Assumes 80% treatment efficiency and 90% runtime
Treatment	2%			$306,000	
			Total O&M Cost	***$6,100,000***	
Water Supply Costs					
Item	**Quantity**	**Units**	**Unit Cost**	**Total Cost**	**Notes**
		0	$0	$0	
			Total Water Supply Cost	***$0***	

Water Supply Option Overview		
Water Supply Option No.	**Water Supply Option Title**	**Water Supply Source**
GW.5	Optimize Newark Desalination Facility Operations	Niles Cone Groundwater Basin

Water Supply Option Yield					
Supply Frequency	**Supply Availability Frequency (0.0 to 1.0) (e.g., 3-in-10 years = 0.3)**	**Supply Volume**	**Dry Year Supply Volume**	**Average Annual Supply Volume**	**Basis for Yield Assumptions**
Annual	1.0	2,120	2,120	2,120	Based on ACWD recirculation concept memo, Option 1

Water Supply Option Costs					
Capital Cost	**Annualized Capital Cost**	**Water Supply Cost**	**O&M Cost**	**Total Annual Cost**	**Average Unit Cost**
$390,000	$19,900	$0	$2,500	$22,400	$10.57

Capital Costs					
Item	**Quantity**	**Units**	**Unit Cost**	**Total Cost**	**Notes**
8" Conveyance Pipeline	500	LF	$500	$250,000	May be no capital cost; depends on existing plant piping
			Raw Construction Cost	**$250,000**	
Contingency			*20%*	*$50,000*	
			Total Construction Cost	**$300,000**	
Implementation Cost			*30%*	*$90,000*	
			Total Capital Cost	***$390,000***	
O&M Costs					
Item	**Quantity**	**Units**	**Unit Cost**	**Total Cost**	**Notes**
Pipelines	1%		$2,500	$2,500	
			Total O&M Cost	***$2,500***	*Does not include power costs associated with pump station use*
Water Supply Costs					
Item	**Quantity**	**Units**	**Unit Cost**	**Total Cost**	**Notes**
		0	$0	$0	
			Total Water Supply Cost	***$0***	

Water Supply Option Overview		
Water Supply Option No.	Water Supply Option Title	Water Supply Source
GW.6	Construct Southern Blending Facility	Niles Cone Groundwater Basin + SFPUC

Water Supply Option Yield					
Supply Frequency	Supply Availability Frequency (0.0 to 1.0) (e.g., 3-in-10 years = 0.3)	Supply Volume	Dry Year Supply Volume	Average Annual Supply Volume	Basis for Yield Assumptions
Annual	1.0	4,350	4,350	4,350	Assumes 3 wells producing ~1,000 gpm

Water Supply Option Costs					
Capital Cost	Annualized Capital Cost	Water Supply Cost	O&M Cost	Total Annual Cost	Average Unit Cost
$43,900,000	$2,200,000	$8,400,000	$1,500,000	$12,100,000	$2,780

Capital Costs					
Item	Quantity	Units	Unit Cost	Total Cost	Notes
Extraction Well	3	LS	$3,100,000	$9,300,000	
8" Conveyance Pipeline	3,000	LF	$500	$1,500,000	Conveyance from wells to blending facility
12" Conveyance Pipeline	1,000	LF	$690	$690,000	Conveyance from SFPUC takeoffs to blending facility
18" Conveyance Pipeline	1,000	LF	$880	$880,000	Conveyance from blending facility to distribution
Blending Facility	1	LS	$1,500,000	$1,500,000	
Land Acquisition	2.5	acres	$5,700,000	$14,250,000	
			Raw Construction Cost	**$28,120,000**	
Contingency			*20%*	*$5,624,000*	
			Total Construction Cost	**$33,744,000**	
Implementation Cost			*30%*	*$10,123,200*	
			Total Capital Cost	***$43,900,000***	
O&M Costs					
Item	Quantity	Units	Unit Cost	Total Cost	Notes
Extraction Well O&M	4,350	AF	$130	$565,500	
ACWD Full-time Employee	2	EA	$321,400	$642,800	
GW.6 - Southern Blending Facility to Distribution	556,885	kwh	$0.40	$222,754	*Assumes 100 feet of lift*
Pipelines	1%			$30,700	
Blending Facility	1%			$15,000	
			Total O&M Cost	***$1,500,000***	*Does not include power costs associated with pump station use*
Water Supply Costs					
Item	Quantity	Units	Unit Cost	Total Cost	Notes
SFPUC Water Supply	4,350	AF	$1,940	$8,439,000	Assumes 1:1 blend would be required
			Total Water Supply Cost	***$8,400,000***	

Water Supply Option Overview		
Water Supply Option No.	Water Supply Option Title	Water Supply Source
IW.1	Groundwater Banking Outside Alameda Creek Watershed	Imported Water

Water Supply Option Yield					
Supply Frequency	Supply Availability Frequency (0.0 to 1.0) (e.g., 3-in-10 years = 0.3)	Supply Volume	Dry Year Supply Volume	Average Annual Supply Volume	Basis for Yield Assumptions
Dry Year	0.3	7,926	10,680	2,378	Assumes storage would be used 3-in-10 years in response to drought or reduced imported water allocations.

Water Supply Option Costs					
Capital Cost	Annualized Capital Cost	Water Supply Cost	O&M Cost	Total Annual Cost	Average Unit Cost
$32,100,000	$1,600,000	$2,300,000	$1,000,000	$4,900,000	$2,060

Capital Costs					
Item	**Quantity**	**Units**	**Unit Cost**	**Total Cost**	**Notes**
Water Bank buy-in	7,926	share	$2,600	$20,607,600	One share is equal to 3 AF of storage
			Raw Construction Cost	**$20,607,600**	
Contingency			*20%*	*$4,121,520*	
			Total Construction Cost	**$24,729,120**	
Implementation Cost			*30%*	*$7,418,736*	
			Total Capital Cost	***$32,100,000***	
O&M Costs					
Item	**Quantity**	**Units**	**Unit Cost**	**Total Cost**	**Notes**
Semitropic Management Fee	23,778	AF	$9	$214,002	Assumption is that other external storage banks will have similar fees to Semitropic; also allows ACWD to compare opportunities to expanding Semitropic participation.
Semitropic Maintenance Fee	23,778	AF	$11	$261,558	
Semitropic Recharge Fee - Area B	2,616	AF	$29	$75,852	
Semitropic Recovery Fee - Area B	2,616	AF	$175	$457,727	
			Total O&M Cost	***$1,000,000***	
Water Supply Costs					
Item	**Quantity**	**Units**	**Unit Cost**	**Total Cost**	**Notes**
SWP Water Supply	2,616	AF	$690	$1,804,750	*Assumes 10% leave behind*
SWP Water Supply Conveyance	2,062	AF	$250	$515,500	
			Total Water Supply Cost	***$2,300,000***	

Water Supply Option Overview		
Water Supply Option No.	**Water Supply Option Title**	**Water Supply Source**
IW.2	Regional Surface Water Storage	Imported Water

Water Supply Option Yield					
Supply Frequency	**Supply Availability Frequency (0.0 to 1.0) (e.g., 3-in-10 years = 0.3)**	**Supply Volume**	**Dry Year Supply Volume**	**Average Annual Supply Volume**	**Basis for Yield Assumptions**
Dry Year	0.3	7,926	10,680	2,378	Assumes storage would be used 3-in-10 years in response to drought or reduced imported water allocations.

Water Supply Option Costs					
Capital Cost	**Annualized Capital Cost**	**Water Supply Cost**	**O&M Cost**	**Total Annual Cost**	**Average Unit Cost**
$0	$0	$5,000,000	$0	$5,000,000	$2,100

Capital Costs					
Item	**Quantity**	**Units**	**Unit Cost**	**Total Cost**	**Notes**
			Raw Construction Cost	**$0**	
Contingency			*20%*	*$0*	
			Total Construction Cost	**$0**	
Implementation Cost			*30%*	*$0*	
			Total Capital Cost	***$0***	
O&M Costs					
Item	**Quantity**	**Units**	**Unit Cost**	**Total Cost**	**Notes**
				$0	Existing conveyance and treatment facilities will be used.
			Total O&M Cost	***$0***	
Water Supply Costs					
Item	**Quantity**	**Units**	**Unit Cost**	**Total Cost**	**Notes**
Sites Reservoir Water Supply	3,210	AF	$1,310	$4,205,139	*Assumes 35% carriage losses*
SWP Water Supply Conveyance	3,210	AF	$250	$802,508	
			Total Water Supply Cost	***$5,000,000***	

Water Supply Option Overview		
Water Supply Option No.	**Water Supply Option Title**	**Water Supply Source**
IW.3	New Imported Water Supply (non-SWP)	Imported Water

Water Supply Option Yield					
Supply Frequency	**Supply Availability Frequency (0.0 to 1.0) (e.g., 3-in-10 years = 0.3)**	**Supply Volume**	**Dry Year Supply Volume**	**Average Annual Supply Volume**	**Basis for Yield Assumptions**
Dry Year	0.3	6,247	10,218	1,874	Assumes water would be purchased in response to drought conditions or water shortages.

Water Supply Option Costs					
Capital Cost	**Annualized Capital Cost**	**Water Supply Cost**	**O&M Cost**	**Total Annual Cost**	**Average Unit Cost**
$0	$0	$1,400,000	$0	$1,400,000	$750

Capital Costs					
Item	**Quantity**	**Units**	**Unit Cost**	**Total Cost**	**Notes**
			Raw Construction Cost	**$0**	
Contingency			*20%*	*$0*	
			Total Construction Cost	**$0**	
Implementation Cost			*30%*	*$0*	
			Total Capital Cost	***$0***	
O&M Costs					
Item	**Quantity**	**Units**	**Unit Cost**	**Total Cost**	**Notes**
		0	$0	$0	
			Total O&M Cost	***$0***	
Water Supply Costs					
Item	**Quantity**	**Units**	**Unit Cost**	**Total Cost**	**Notes**
Yuba Water (Dry Years)	2,530	AF	$530	$1,340,847	*Assumes 35% losses*
SWP Water Supply Conveyance	250	AF	$250	$62,500	
			Total Water Supply Cost	***$1,400,000***	

Water Supply Option Overview		
Water Supply Option No.	**Water Supply Option Title**	**Water Supply Source**
IW.4	Sunol Aqueduct	State Water Project

Water Supply Option Yield					
Supply Frequency	**Supply Availability Frequency (0.0 to 1.0) (e.g., 3-in-10 years = 0.3)**	**Supply Volume**	**Dry Year Supply Volume**	**Average Annual Supply Volume**	**Basis for Yield Assumptions**
No Immediate Supply	0.0	N/A	N/A	N/A	

Water Supply Option Costs					
Capital Cost	**Annualized Capital Cost**	**Water Supply Cost**	**O&M Cost**	**Total Annual Cost**	**Average Unit Cost**
$32,800,000	$1,700,000	$0	$200,000	$1,900,000	N/A

Capital Costs					
Item	**Quantity**	**Units**	**Unit Cost**	**Total Cost**	**Notes**
CCTV Inspection	39,600	LF	$10	$396,000	Aqueduct alignment is 7.5 miles long; 5.6 is underground
6' x 6' Box Culvert	9,900	LF	$1,000	$9,900,000	Assumes 25% of the aqueduct will require extensive repair or replacement
6' x 6' Box Culvert	10,560	LF	$1,000	$10,560,000	Connection to SBA; Assumes ACWD Option 1A is selected
Niles Weir Improvements	1	LS	$200,000	$200,000	Assumes ACWD Option 1A is selected
			Raw Construction Cost	**$21,056,000**	
Contingency			*20%*	*$4,211,200*	
			Total Construction Cost	**$25,267,200**	
Implementation Cost			*30%*	*$7,580,160*	
			Total Capital Cost	***$32,800,000***	
O&M Costs					
Item	**Quantity**	**Units**	**Unit Cost**	**Total Cost**	**Notes**
Pipelines	1%			$205,000	
			Total O&M Cost	***$200,000***	
Water Supply Costs					
Item	**Quantity**	**Units**	**Unit Cost**	**Total Cost**	**Notes**
		0	$0	$0	
			Total Water Supply Cost	***$0***	

Water Supply Option Overview		
Water Supply Option No.	**Water Supply Option Title**	**Water Supply Source**
IW.5	Groundwater Banking Inside Alameda Creek Watershed	State Water Project

Water Supply Option Yield					
Supply Frequency	**Supply Availability Frequency (0.0 to 1.0) (e.g., 3-in-10 years = 0.3)**	**Supply Volume**	**Dry Year Supply Volume**	**Average Annual Supply Volume**	**Basis for Yield Assumptions**
Dry Year	1.0	1,150	1,150	1,150	Based on modeling results (Average surplus water capture: 1150 AFY = 450 AF LD + 700 AF Art 21)

Water Supply Option Costs					
Capital Cost	**Annualized Capital Cost**	**Water Supply Cost**	**O&M Cost**	**Total Annual Cost**	**Average Unit Cost**
$251,100,000	$12,800,000	$1,200,000	$2,700,000	$16,700,000	$14,520

Capital Costs					
Item	**Quantity**	**Units**	**Unit Cost**	**Total Cost**	**Notes**
42" Conveyance Pipeline	36,960	LF	$3,130	$115,684,800	Facility assumption provided by ACWD
400 hp Booster Pump Station	2.0	LS	$3,100,000	$6,200,000	Facility assumption provided by ACWD
PFAS Treatment (IX)	7.1	MGD	$3,900,000	$27,690,000	Based on ACWD's reported cost for new 6.0 mgd PFAS treatment facility; assumes up to 7,500 AF could be recharged / recovered in a single year
Land Acquisition	2	acres	$5,700,000	$11,400,000	Based on PS#4 from 2024 Interim Engineering Report
			Raw Construction Cost	**$160,974,800**	
Contingency			*20%*	*$32,194,960*	
			Total Construction Cost	**$193,169,760**	
Implementation Cost			*30%*	*$57,950,928*	
			Total Capital Cost	***$251,100,000***	
O&M Costs					
Item	**Quantity**	**Units**	**Unit Cost**	**Total Cost**	**Notes**
Pipelines	1%			$1,157,000	
Pump Stations	3%			$186,000	
IW.5 - Chain of Lakes Conveyance	588,890	kwh	$0.40	$235,556	*Assumes 400 feet of lift*
ACWD Full-time Employee	2	EA	$321,400	$600,000	
Treatment	2%			$553,800	
			Total O&M Cost	***$2,700,000***	
Water Supply Costs					
Item	**Quantity**	**Units**	**Unit Cost**	**Total Cost**	**Notes**
SWP Water Supply	1,265	AF	$690	$872,850	*Assumes 10% leave behind*
SWP Water Supply Conveyance	1,265	AF	$250	$316,250	
			Total Water Supply Cost	***$1,200,000***	

Water Supply Option Overview		
Water Supply Option No.	**Water Supply Option Title**	**Water Supply Source**
IW.6	Increase Peak Blending Capacity at Fremont Turnout	SFPUC

Water Supply Option Yield					
Supply Frequency	**Supply Availability Frequency (0.0 to 1.0) (e.g., 3-in-10 years = 0.3)**	**Supply Volume**	**Dry Year Supply Volume**	**Average Annual Supply Volume**	**Basis for Yield Assumptions**
Emergency	0.1	16,000	0	1,600	Assumes TP#2 outages 1-in-10 years

Water Supply Option Costs					
Capital Cost	**Annualized Capital Cost**	**Water Supply Cost**	**O&M Cost**	**Total Annual Cost**	**Average Unit Cost**
$144,600,000	$7,400,000	$3,100,000	$1,100,000	$11,600,000	$7,250

Capital Costs					
Item	**Quantity**	**Units**	**Unit Cost**	**Total Cost**	**Notes**
24" Conveyance Pipeline	1,660	LF	$1,100	$1,826,000	Based on PS#4 from 2024 Interim Engineering Report
30" Conveyance Pipeline	20	LF	$1,350	$27,000	Based on PS#4 from 2024 Interim Engineering Report
54" Conveyance Pipeline	109	LF	$5,070	$552,630	Based on PS#4 from 2024 Interim Engineering Report
48" Conveyance Pipeline	18,549	LF	$4,510	$83,655,990	Based on PS#4 from 2024 Interim Engineering Report
Whitfield Pump Station Improvements	1	LS	$6,300,000	$6,300,000	Based on PS#4 from 2024 Interim Engineering Report
36" Throttling Valve	1	EA	$300,000	$300,000	Based on PS#4 from 2024 Interim Engineering Report
			Raw Construction Cost	**$92,661,620**	
Contingency			*20%*	*$18,532,324*	
			Total Construction Cost	**$111,193,944**	
Implementation Cost			*30%*	*$33,358,183*	
			Total Capital Cost	***$144,600,000***	
O&M Costs					
Item	**Quantity**	**Units**	**Unit Cost**	**Total Cost**	**Notes**
Pipelines	1%			$864,000	
Pump Stations	3%			$189,000	
			Total O&M Cost	***$1,100,000***	*Does not include power costs associated with pump station use*
Water Supply Costs					
Item	**Quantity**	**Units**	**Unit Cost**	**Total Cost**	**Notes**
SFPUC Water Supply	1,600	AF	$1,940	$3,104,000	
			Total Water Supply Cost	***$3,100,000***	

Water Supply Option Overview		
Water Supply Option No.	**Water Supply Option Title**	**Water Supply Source**
IW.7	Pretreatment Facility at EBMUD's Walnut Creek Water Treatment Plant	Sacramento River

Water Supply Option Yield					
Supply Frequency	**Supply Availability Frequency (0.0 to 1.0) (e.g., 3-in-10 years = 0.3)**	**Supply Volume**	**Dry Year Supply Volume**	**Average Annual Supply Volume**	**Basis for Yield Assumptions**
Emergency	0.05	128,800	0	6,440	Assumes high-turbidity events happen 1-in-20 years

Water Supply Option Costs					
Capital Cost	**Annualized Capital Cost**	**Water Supply Cost**	**O&M Cost**	**Total Annual Cost**	**Average Unit Cost**
$279,400,000	$14,300,000	$0	$2,600,000	$16,900,000	$2,620

Capital Costs					
Item	**Quantity**	**Units**	**Unit Cost**	**Total Cost**	**Notes**
Walnut Creek WTP Pre-Treatment Facility	1	LS	$77,300,000	$77,300,000	Placeholder - waiting for details from Hazen Sawyer analysis
Transfer Bethany Pipeline	1	LS	$101,800,000	$101,800,000	Placeholder - waiting for details from Hazen Sawyer analysis
			Raw Construction Cost	**$179,100,000**	
Contingency			*20%*	*$35,820,000*	
			Total Construction Cost	**$214,920,000**	
Implementation Cost			*30%*	*$64,476,000*	
			Total Capital Cost	***$279,400,000***	
O&M Costs					
Item	**Quantity**	**Units**	**Unit Cost**	**Total Cost**	**Notes**
Treatment Facility	2%			$1,546,000	
Pipelines	1%			$1,018,000	
			Total O&M Cost	***$2,600,000***	*Does not include power costs associated with pump station or treatment plant use*

Water Supply Option Overview		
Water Supply Option No.	Water Supply Option Title	Water Supply Source
LW.1	Augment Wet Year Recharge and Expand ACWD Distribution	Alameda Creek Watershed

Water Supply Option Yield					
Supply Frequency	Supply Availability Frequency (0.0 to 1.0) (e.g., 3-in-10 years = 0.3)	Supply Volume	Dry Year Supply Volume	Average Annual Supply Volume	Basis for Yield Assumptions
Normal & Wet Year	0.7	4,480	0	3,100	Assumes production capacity at NDF could increase from 8.0 mgd (average) to 12.0 mgd (average) during normal and wet years.

Water Supply Option Costs					
Capital Cost	Annualized Capital Cost	Water Supply Cost	O&M Cost	Total Annual Cost	Average Unit Cost
$25,900,000	$1,300,000	$0	$1,000,000	$2,300,000	$740

Capital Costs					
Item	Quantity	Units	Unit Cost	Total Cost	Notes
24" Conveyance Pipeline	10,560	LF	$1,100	$11,616,000	Placeholder pending details from future analysis. OI.1 also describes distribution system enhancements.
250 hp Booster Pump Station	2	LS	$2,500,000	$5,000,000	Placeholder pending details from future analysis. OI.1 also describes distribution system enhancements.
			Raw Construction Cost	**$16,616,000**	
Contingency			*20%*	*$3,323,200*	
			Total Construction Cost	**$19,939,200**	
Implementation Cost			*30%*	*$5,981,760*	
			Total Capital Cost	***$25,900,000***	
O&M Costs					
Item	**Quantity**	**Units**	**Unit Cost**	**Total Cost**	**Notes**
Extraction Well O&M	3,136	AF	$130	$400,000	
LW.1 - Conveyance from NDF to Distribution	793,721	kwh	$0.40	$317,488	*Assumes 200 feet of lift*
Pipelines	1%			$116,000	
Pump Stations	3%			$150,000	
			Total O&M Cost	***$1,000,000***	*Does not include power costs associated with pump station use*

Water Supply Option Overview		
Water Supply Option No.	**Water Supply Option Title**	**Water Supply Source**
LW.2	Augment Wet Year Recharge and Construct SFPUC Intertie	Alameda Creek Watershed

Water Supply Option Yield					
Supply Frequency	**Supply Availability Frequency (0.0 to 1.0) (e.g., 3-in-10 years = 0.3)**	**Supply Volume**	**Dry Year Supply Volume**	**Average Annual Supply Volume**	**Basis for Yield Assumptions**
Normal & Wet Year	0.7	4,480	0	3,136	Assumes production capacity at NDF could increase from 8.0 mgd (average) to 12.0 mgd (average) during normal and wet years.

Water Supply Option Costs					
Capital Cost	**Annualized Capital Cost**	**Water Supply Cost**	**O&M Cost**	**Total Annual Cost**	**Average Unit Cost**
$32,900,000	$1,700,000	$0	$1,300,000	$3,000,000	$960

Capital Costs					
Item	**Quantity**	**Units**	**Unit Cost**	**Total Cost**	**Notes**
ACWD - SFPUC Intertie	1.0	LS	$9,900,000	$9,900,000	Based on costs from 2017 BARR Study; includes intertie, 1200 LF of conveyance, and a pump station
Adjustment	1	EA	$5,000,000	$5,000,000	Adjustment based on feedback from ACWD staff
ARP Wells	2	EA	$3,100,000	$6,200,000	
			Raw Construction Cost	**$21,100,000**	
Contingency			*20%*	*$4,220,000*	
			Total Construction Cost	**$25,320,000**	
Implementation Cost			*30%*	*$7,596,000*	
			Total Capital Cost	***$32,900,000***	
O&M Costs					
Item	**Quantity**	**Units**	**Unit Cost**	**Total Cost**	**Notes**
Extraction Well O&M	3,136	AF	$130	$400,000	
LW.2 - ACWD-SFPUC Intertie	595,291	kwh	$0.40	$238,116	*Assumes 150 feet of lift*
ACWD - SFPUC Intertie O&M	2%			$700,000	
			Total O&M Cost	***$1,300,000***	*Does not include power costs associated with pump station use*

Water Supply Option Overview		
Water Supply Option No.	Water Supply Option Title	Water Supply Source
LW.3 - Low End Cost	Optimize and Enhance Del Valle Yields	Alameda Creek Watershed

Water Supply Option Yield					
Supply Frequency	Supply Availability Frequency (0.0 to 1.0) (e.g., 3-in-10 years = 0.3)	Supply Volume	Dry Year Supply Volume	Average Annual Supply Volume	Basis for Yield Assumptions
Annual	1.0	300	300	300	ACWD

Water Supply Option Costs					
Capital Cost	Annualized Capital Cost	Water Supply Cost	O&M Cost	Total Annual Cost	Average Unit Cost
$5,800,000	$300,000	$0	$0	$300,000	$1,000

Capital Costs					
Item	**Quantity**	**Units**	**Unit Cost**	**Total Cost**	**Notes**
Lower Intakes at Del Valle	1.0	LS	$3,700,000	$3,700,000	
			Raw Construction Cost	**$3,700,000**	
Contingency			*20%*	*$740,000*	
			Total Construction Cost	**$4,440,000**	
Implementation Cost			*30%*	*$1,332,000*	
			Total Capital Cost	***$5,800,000***	
O&M Costs					
Item	**Quantity**	**Units**	**Unit Cost**	**Total Cost**	**Notes**
		0	$0	$0	
				$0	
			Total O&M Cost	***$0***	

Water Supply Option Overview		
Water Supply Option No.	**Water Supply Option Title**	**Water Supply Source**
LW.3 - High End Cost	Optimize and Enhance Del Valle Yields	Alameda Creek Watershed

Water Supply Option Yield					
Supply Frequency	**Supply Availability Frequency (0.0 to 1.0) (e.g., 3-in-10 years = 0.3)**	**Supply Volume**	**Dry Year Supply Volume**	**Average Annual Supply Volume**	**Basis for Yield Assumptions**
Annual	1.0	300	300	300	ACWD

Water Supply Option Costs					
Capital Cost	**Annualized Capital Cost**	**Water Supply Cost**	**O&M Cost**	**Total Annual Cost**	**Average Unit Cost**
$21,100,000	$1,100,000	$0	$0	$1,100,000	$3,670

Capital Costs					
Item	**Quantity**	**Units**	**Unit Cost**	**Total Cost**	**Notes**
Lower Intakes at Del Valle + modify Boat Ramps	1.0	LS	$13,500,000	$13,500,000	
			Raw Construction Cost	**$13,500,000**	
Contingency			*20%*	*$2,700,000*	
			Total Construction Cost	**$16,200,000**	
Implementation Cost			*30%*	*$4,860,000*	
			Total Capital Cost	***$21,100,000***	
O&M Costs					
Item	**Quantity**	**Units**	**Unit Cost**	**Total Cost**	**Notes**
		0	$0	$0	
				$0	
			Total O&M Cost	***$0***	

Water Supply Option Overview		
Water Supply Option No.	**Water Supply Option Title**	**Water Supply Source**
LW.4	Regional Stormwater Capture	Alameda Creek Watershed

Water Supply Option Yield					
Supply Frequency	**Supply Availability Frequency (0.0 to 1.0) (e.g., 3-in-10 years = 0.3)**	**Supply Volume**	**Dry Year Supply Volume**	**Average Annual Supply Volume**	**Basis for Yield Assumptions**
Wet Year	0.7	500	0	350	Estimated

Water Supply Option Costs					
Capital Cost	**Annualized Capital Cost**	**Water Supply Cost**	**O&M Cost**	**Total Annual Cost**	**Average Unit Cost**
$0	$0	$434,000	$0	$434,000	$1,240

Capital Costs					
Item	**Quantity**	**Units**	**Unit Cost**	**Total Cost**	**Notes**
		0	$0	$0	
			Raw Construction Cost	**$0**	
Contingency			*20%*	*$0*	
			Total Construction Cost	**$0**	
Implementation Cost			*30%*	*$0*	
			Total Capital Cost	***$0***	
O&M Costs					
Item	**Quantity**	**Units**	**Unit Cost**	**Total Cost**	**Notes**
		0	$0	$0	
				$0	
			Total O&M Cost	***$0***	
Water Supply Costs					
Item	**Quantity**	**Units**	**Unit Cost**	**Total Cost**	**Notes**
Stormswater Capture	350	AF	$1,240	$434,000	*Assumes 10% leave behind*
			Total Water Supply Cost	***$434,000***	

Water Supply Option Overview		
Water Supply Option No.	Water Supply Option Title	Water Supply Source
OW.1	Bay Water Desalination	San Francisco Bay

Water Supply Option Yield					
Supply Frequency	Supply Availability Frequency (0.0 to 1.0) (e.g., 3-in-10 years = 0.3)	Supply Volume	Dry Year Supply Volume	Average Annual Supply Volume	Basis for Yield Assumptions
Annual	1.0	8,000	8,000	8,000	2023 Purified Water Feasibility Study

Water Supply Option Costs					
Capital Cost	Annualized Capital Cost	Water Supply Cost	O&M Cost	Total Annual Cost	Average Unit Cost
$660,000,000	$33,700,000	$0	$16,000,000	$49,700,000	$6,210

Capital Costs					
Item	Quantity	Units	Unit Cost	Total Cost	Notes
Local Desalination Treatment Facility	22.0	MGD	$30,000,000	$660,000,000	Assumes operation 8 months per year (due to limitations for EBDA outfall
			Raw Construction Cost	**$660,000,000**	
Contingency			*20%*		*PFWS already accounts for implementation and contingency costs.*
			Total Construction Cost	**$660,000,000**	
Implementation Cost			*30%*		*PFWS already accounts for implementation and contingency costs.*
			Total Capital Cost	***$660,000,000***	
O&M Costs					
Item	**Quantity**	**Units**	**Unit Cost**	**Total Cost**	**Notes**
Local Desalination Facility - O&M	22.0	MGD	$700,000	$15,400,000	
ACWD Full-time Employee	2.0	EA	$321,400	$600,000	

Water Supply Option Overview		
Water Supply Option No.	Water Supply Option Title	Water Supply Source
PW.1 - Low End Cost	Indirect Potable Reuse with SFPUC Intertie	USD

Water Supply Option Yield					
Supply Frequency	Supply Availability Frequency (0.0 to 1.0) (e.g., 3-in-10 years = 0.3)	Supply Volume	Dry Year Supply Volume	Average Annual Supply Volume	Basis for Yield Assumptions
Annual	1.0	4,480	4,480	4,480	Assumes production capacity at NDF could increase from 8.0 mgd (average) to 12.0 mgd (average). Recycled water supply would be available for recharge each year. Assumes 75% treatment efficienty at AWPF and NDF.

Water Supply Option Costs					
Capital Cost	Annualized Capital Cost	Water Supply Cost	O&M Cost	Total Annual Cost	Average Unit Cost
$225,700,000	$11,500,000	$0	$6,600,000	$18,100,000	$4,040

Capital Costs					
Item	Quantity	Units	Unit Cost	Total Cost	Notes
Phase 1 - Advanced Water Purification Facility Treatment Train	7.1	MGD	$20,300,000	$144,130,000	Assumes same treatment train as for Phase 1 in 2023 Purified Water Feasibility Study (PWFS); adjusted for size (7.1 MGD vs. 9 MGD)
Land Acquisition	4	acres	$5,700,000	$22,800,000	Assumes siting for AWPF near Alvarado WWTP
24" Conveyance Pipeline	5000	LF	$1,100	$5,500,000	Conveyance from WWTP to AWPF
8" Conveyance Pipeline	2500	LF	$500	$1,250,000	MF waste pipeline
12" Conveyance Pipeline	5000	LF	$690	$3,450,000	RO waste to EBDA pipeline
18" Conveyance Pipeline	15000	LF	$880	$13,200,000	Purified Water to Rock Pond
ACWD - SFPUC Intertie	1	LS	$9,900,000	$9,900,000	Based on costs from 2017 BARR Study; includes intertie, 1200 LF of conveyance, and a pump station
Land Acquisition	3.5	acres	$5,700,000	$19,950,000	
			Raw Construction Cost	**$220,180,000**	
Contingency			*20%*	*$1,980,000*	*Only applied to ACWD - SFPUC Intertie Cost; PFWS already accounts for implementation and contingency costs.*
			Total Construction Cost	**$222,160,000**	
Implementation Cost			*30%*	*$3,564,000*	*Only applied to ACWD - SFPUC Intertie Cost; PFWS already accounts for implementation and contingency costs.*
			Total Capital Cost	***$225,700,000***	
O&M Costs					
Item	**Quantity**	**Units**	**Unit Cost**	**Total Cost**	**Notes**

Phase 1 - Advanced Water Purification Facility Treatment Train - O&M	7.1	MGD	$621,000	$4,400,000	Assumes same treatment train as for Phase 1 in 2023 Purified Water Feasibility Study (PWFS); adjusted for size (7.1 MGD vs. 9 MGD)
Pipelines	1%			$234,000	Assumes same alignment as noted for Phase 1 in 2023 PWFS; cost reduced based on size of AWPF (7.1 MGD vs. 9 MGD)
Extraction Well O&M	5,975	AF	$130	$800,000	Assumes wells would produce additional yield; includes power and O&M costs for well extraction; assumes 5,975 AF would be treated to produce 4,480
RW.1 - ACWD-SFPUC Intertie	860,291	kwh	$0.40	$344,117	*Assumes 150 feet of lift*
ACWD Full-time Employee	2	EA	$321,400	$600,000	
ACWD - SFPUC Intertie O&M	2%			$200,000	
			Total O&M Cost	***$6,600,000***	*Does not include power costs associated with pump station use*

Water Supply Option Overview		
Water Supply Option No.	Water Supply Option Title	Water Supply Source
PW.1	Indirect Potable Reuse with SFPUC Intertie	USD

Water Supply Option Yield					
Supply Frequency	Supply Availability Frequency (0.0 to 1.0) (e.g., 3-in-10 years = 0.3)	Supply Volume	Dry Year Supply Volume	Average Annual Supply Volume	Basis for Yield Assumptions
Annual	1.0	4,480	4,480	4,480	Assumes production capacity at NDF could increase from 8.0 mgd (average) to 12.0 mgd (average). Recycled water supply would be available for recharge each year. Assumes 75% treatment efficiency at AWPF and NDF.

Water Supply Option Costs					
Capital Cost	Annualized Capital Cost	Water Supply Cost	O&M Cost	Total Annual Cost	Average Unit Cost
$428,000,000	$21,800,000	$0	$9,600,000	$31,400,000	$7,010

Capital Costs					
Item	Quantity	Units	Unit Cost	Total Cost	Notes
Phase 1 - Advanced Water Purification Facility Treatment Train	7.1	MGD	$20,300,000	$144,130,000	Assumes same treatment train as for Phase 1 in 2023 Purified Water Feasibility Study (PWFS); adjusted for size (7.1 MGD vs. 9 MGD)
Pit 2 Site Work for Purified Water Project	7.1	MGD	$4,600,000	$32,660,000	Assumes siting for AWPF at Pit #2; footprint scaled down for smaller plant (7.1 MGD vs. 9 MGD)
Conveyance from Alvarado WWTP to AWPF - Phase 1	7.1	MGD	$14,400,000	$102,240,000	Assumes same alignment as noted for Phase 1 in 2023 PWFS; cost reduced based on size of AWPF (7.1 MGD vs. 9 MGD)
Conveyance for MF waste from AWPF to USD Collection System - Phase 1	7.1	MGD	$1,100,000	$7,810,000	Assumes same alignment as noted for Phase 1 in 2023 PWFS; cost reduced based on size of AWPF (7.1 MGD vs. 9 MGD) and actual conveyance would be sized for less than 7.1 MGD.
Conveyance for RO waste from AWPF to EBDA Outfall - Phase 1	7.1	MGD	$9,300,000	$66,030,000	Assumes same alignment as noted for Phase 1 in 2023 PWFS; cost reduced based on size of AWPF (7.1 MGD vs. 9 MGD) and actual conveyance would be sized for less than 7.1 MGD.
Conveyance for Purified Water from AWPF to Rock Pond for Recharge - Phase 1	7.1	MGD	$5,600,000	$39,760,000	Assumes same alignment as noted for Phase 1 in 2023 PWFS; cost reduced based on size of AWPF (7.1 MGD vs. 9 MGD) and actual conveyance would be sized for less than 7.1 MGD.
ACWD - SFPUC Intertie	1	LS	$9,900,000	$9,900,000	Based on costs from 2017 BARR Study; includes intertie, 1200 LF of conveyance, and a pump station
Land Acquisition	3.5	acres	$5,700,000	$19,950,000	
			Raw Construction Cost	**$422,480,000**	

Contingency			*20%*	*$1,980,000*	*Only applied to ACWD - SFPUC Intertie Cost; PFWS already accounts for implementation and contingency costs.*
			Total Construction Cost	**$424,460,000**	
Implementation Cost			*30%*	*$3,564,000*	*Only applied to ACWD - SFPUC Intertie Cost; PFWS already accounts for implementation and contingency costs.*
			Total Capital Cost	***$428,000,000***	
O&M Costs					
Item	**Quantity**	**Units**	**Unit Cost**	**Total Cost**	**Notes**
Phase 1 - Advanced Water Purification Facility Treatment Train - O&M	7.1	MGD	$621,000	$4,400,000	Assumes same treatment train as for Phase 1 in 2023 Purified Water Feasibility Study (PWFS); adjusted for size (7.1 MGD vs. 9 MGD)
Conveyance from Alvarado WWTP to AWPF - Phase 1 - O&M	7.1	MGD	$248,000	$1,800,000	Assumes same alignment as noted for Phase 1 in 2023 PWFS; cost reduced based on size of AWPF (7.1 MGD vs. 9 MGD)
Conveyance for MF waste from AWPF to USD Collection System - Phase 1 - O&M	7.1	MGD	$14,000	$100,000	Assumes same alignment as noted for Phase 1 in 2023 PWFS; cost reduced based on size of AWPF (7.1 MGD vs. 9 MGD)
Conveyance for RO waste from AWPF to EBDA Outfall - Phase 1 - O&M	7.1	MGD	$121,000	$900,000	Assumes same alignment as noted for Phase 1 in 2023 PWFS; cost reduced based on size of AWPF (7.1 MGD vs. 9 MGD)
Conveyance for Purified Water from AWPF to Rock Pond for Recharge - Phase 1 - O&M	7.1	MGD	$73,000	$500,000	Assumes same alignment as noted for Phase 1 in 2023 PWFS; cost reduced based on size of AWPF (7.1 MGD vs. 9 MGD)
Extraction Well O&M	5,975	AF	$130	$800,000	Assumes wells would produce additional yield; includes power and O&M costs for well extraction; assumes 5,975 AF would be treated to produce 4,480
RW.1 - ACWD-SFPUC Intertie	860,291	kwh	$0.40	$344,117	*Assumes 150 feet of lift*
ACWD Full-time Employee	2	EA	$321,400	$600,000	
ACWD - SFPUC Intertie O&M	2%			$200,000	
			Total O&M Cost	***$9,600,000***	*Does not include power costs associated with pump station use*

Water Supply Option Overview		
Water Supply Option No.	**Water Supply Option Title**	**Water Supply Source**
PW.2	Indirect Potable Reuse with Expanded ACWD Distribution	USD

Water Supply Option Yield					
Supply Frequency	**Supply Availability Frequency (0.0 to 1.0) (e.g., 3-in-10 years = 0.3)**	**Supply Volume**	**Dry Year Supply Volume**	**Average Annual Supply Volume**	**Basis for Yield Assumptions**
Annual	1.0	4,480	4,480	4,480	Assumes production capacity at NDF could increase from 8.0 mgd (average) to 12.0 mgd (average). Recycled water supply would be available for recharge each year. Assumes 75% treatment efficiency at AWPF and NDF.

Water Supply Option Costs					
Capital Cost	**Annualized Capital Cost**	**Water Supply Cost**	**O&M Cost**	**Total Annual Cost**	**Average Unit Cost**
$446,700,000	$22,800,000	$0	$9,800,000	$32,600,000	$7,280

Capital Costs					
Item	**Quantity**	**Units**	**Unit Cost**	**Total Cost**	**Notes**
Phase 1 - Advanced Water Purification Facility Treatment Train	7.1	MGD	$20,300,000	$144,130,000	Assumes same treatment train as for Phase 1 in 2023 Purified Water Feasibility Study (PWFS); adjusted for size (7.1 MGD vs. 9 MGD)
Pit 2 Site Work for Purified Water Project	7.1	MGD	$4,600,000	$32,660,000	Assumes siting for AWPF at Pit #2; footprint scaled down for smaller plant (7.1 MGD vs. 9 MGD)
Conveyance from Alvarado WWTP to AWPF - Phase 1	7.1	MGD	$14,400,000	$102,240,000	Assumes same alignment as noted for Phase 1 in 2023 PWFS; cost reduced based on size of AWPF (7.1 MGD vs. 9 MGD)
Conveyance for MF waste from AWPF to USD Collection System - Phase 1	7.1	MGD	$1,100,000	$7,810,000	Assumes same alignment as noted for Phase 1 in 2023 PWFS; cost reduced based on size of AWPF (7.1 MGD vs. 9 MGD) and actual conveyance would be sized for less than 7.1 MGD.
Conveyance for RO waste from AWPF to EBDA Outfall - Phase 1	7.1	MGD	$9,300,000	$66,030,000	Assumes same alignment as noted for Phase 1 in 2023 PWFS; cost reduced based on size of AWPF (7.1 MGD vs. 9 MGD) and actual conveyance would be sized for less than 7.1 MGD.
Conveyance for Purified Water from AWPF to Rock Pond for Recharge - Phase 1	7.1	MGD	$5,600,000	$39,760,000	Assumes same alignment as noted for Phase 1 in 2023 PWFS; cost reduced based on size of AWPF (7.1 MGD vs. 9 MGD) and actual conveyance would be sized for less than 7.1 MGD.

24" Conveyance Pipeline	10,560	LF	$1,100	$11,616,000	Placeholder pending details from future analysis. OI.1 also describes distribution system enhancements.
250 hp Booster Pump Station	2	LS	$2,500,000	$5,000,000	Placeholder pending details from future analysis. OI.1 also describes distribution system enhancements.
Land Acquisition	3.5	acres	$5,700,000	$19,950,000	
ARP Wells	2	LS	$3,100,000	$6,200,000	
			Raw Construction Cost	**$435,396,000**	
Contingency			*20%*	*$3,323,200*	*Only applied to distribution system expansion; PFWS already accounts for implementation and contingency costs.*
			Total Construction Cost	**$438,719,200**	
Implementation Cost			*30%*	*$7,966,560*	*Only applied to distribution system expansion; PFWS already accounts for implementation and contingency costs.*
			Total Capital Cost	***$446,700,000***	
O&M Costs					
Item	**Quantity**	**Units**	**Unit Cost**	**Total Cost**	**Notes**
Phase 1 - Advanced Water Purification Facility Treatment Train - O&M	7.1	MGD	$621,000	$4,400,000	Assumes same treatment train as for Phase 1 in 2023 Purified Water Feasibility Study (PWFS); adjusted for size (7.1 MGD vs. 9 MGD)
Conveyance from Alvarado WWTP to AWPF - Phase 1 - O&M	7.1	MGD	$248,000	$1,800,000	Assumes same alignment as noted for Phase 1 in 2023 PWFS; cost reduced based on size of AWPF (7.1 MGD vs. 9 MGD)
Conveyance for MF waste from AWPF to USD Collection System - Phase 1 - O&M	7.1	MGD	$14,000	$100,000	Assumes same alignment as noted for Phase 1 in 2023 PWFS; cost reduced based on size of AWPF (7.1 MGD vs. 9 MGD)
Conveyance for RO waste from AWPF to EBDA Outfall - Phase 1 - O&M	7.1	MGD	$121,000	$900,000	Assumes same alignment as noted for Phase 1 in 2023 PWFS; cost reduced based on size of AWPF (7.1 MGD vs. 9 MGD)
Conveyance for Purified Water from AWPF to Rock Pond for Recharge - Phase 1 - O&M	7.1	MGD	$73,000	$500,000	Assumes same alignment as noted for Phase 1 in 2023 PWFS; cost reduced based on size of AWPF (7.1 MGD vs. 9 MGD)
ACWD Full-time Employee	2	EA	$321,400	$600,000	
Extraction Well O&M	5,975	AF	$130	$800,000	Assumes wells would produce additional yield; includes power and O&M costs for well extraction; assumes 5,975 AF would be treated to produce 4,480
RW.2 - Conveyance from NDF to Distribution	1,147,055	kwh	$0.40	$458,822	*Assumes 200 feet of lift*
Distribution System Expansion - Pipelines - O&M	1%			$116,000	
Distribution System Expansion - Pump Stations - O&M	3%			$150,000	

			Total O&M Cost	***$9,800,000***	*Does not include power costs associated with pump station use*

Water Supply Option Overview		
Water Supply Option No.	Water Supply Option Title	Water Supply Source
PW.3a	Indirect Potable Reuse for Groundwater Recharge (Phase 1)	USD

Water Supply Option Yield					
Supply Frequency	Supply Availability Frequency (0.0 to 1.0) (e.g., 3-in-10 years = 0.3)	Supply Volume	Dry Year Supply Volume	Average Annual Supply Volume	Basis for Yield Assumptions
Annual	1.0	6,048	6,048	6,048	2023 Purified Water Feasibility Study

Water Supply Option Costs					
Capital Cost	Annualized Capital Cost	Water Supply Cost	O&M Cost	Total Annual Cost	Average Unit Cost
$585,000,000	$29,800,000	$0	$12,500,000	$42,300,000	$6,990

Capital Costs					
Item	Quantity	Units	Unit Cost	Total Cost	Notes
Phase 1 - Advanced Water Purification Facility Treatment Train	9.0	MGD	$20,300,000	$182,700,000	Assumes same treatment train as for Phase 1 in 2023 Purified Water Feasibility Study (PWFS)
Pit 2 Site Work for Purified Water Project	9.0	MGD	$4,600,000	$41,400,000	Assumes siting for AWPF at Pit #2
Conveyance from Alvarado WWTP to AWPF - Phase 1	9.0	MGD	$14,400,000	$129,600,000	Assumes same alignment as noted for Phase 1 in 2023 PWFS
Conveyance for MF waste from AWPF to USD Collection System - Phase 1	9.0	MGD	$1,100,000	$9,900,000	Assumes same alignment as noted for Phase 1 in 2023 PWFS
Conveyance for RO waste from AWPF to EBDA Outfall - Phase 1	9.0	MGD	$9,300,000	$83,700,000	Assumes same alignment as noted for Phase 1 in 2023 PWFS
Conveyance for Purified Water from AWPF to Rock Pond for Recharge - Phase 1	9.0	MGD	$5,600,000	$50,400,000	Assumes same alignment as noted for Phase 1 in 2023 PWFS
Peralta Tyson Groundwater Treatment Facility (RO)	6.0	MGD	$9,800,000	$58,800,000	Assumes same treatment facility as noted for Phase 1 in 2023 PWFS
Land Acquisition	5	acres	$5,700,000	$28,500,000	
			Raw Construction Cost	**$585,000,000**	
Contingency			*20%*		*PFWS already accounts for implementation and contingency costs.*
			Total Construction Cost	**$585,000,000**	
Implementation Cost			*30%*		*PFWS already accounts for implementation and contingency costs.*

			Total Capital Cost	***$585,000,000***	
O&M Costs					
Item	**Quantity**	**Units**	**Unit Cost**	**Total Cost**	**Notes**
Phase 1 - Advanced Water Purification Facility Treatment Train - O&M	9.0	MGD	$621,000	$5,600,000	Assumes same treatment train as for Phase 1 in 2023 Purified Water Feasibility Study (PWFS)
Conveyance from Alvarado WWTP to AWPF - Phase 1 - O&M	9.0	MGD	$248,000	$2,200,000	Assumes same alignment as noted for Phase 1 in 2023 PWFS
Conveyance for MF waste from AWPF to USD Collection System - Phase 1 - O&M	9.0	MGD	$14,000	$100,000	Assumes same alignment as noted for Phase 1 in 2023 PWFS
Conveyance for RO waste from AWPF to EBDA Outfall - Phase 1 - O&M	9.0	MGD	$121,000	$1,100,000	Assumes same alignment as noted for Phase 1 in 2023 PWFS
Conveyance for Purified Water from AWPF to Rock Pond for Recharge - Phase 1 - O&M	9.0	MGD	$73,000	$700,000	Assumes same alignment as noted for Phase 1 in 2023 PWFS
Peralta Tyson Groundwater Treatment Facility - O&M	6.0	MGD	$369,000	$2,200,000	Assumes same treatment facility as noted in 2023 PWFS
ACWD Full-time Employee	2	EA	$321,400	$600,000	
			Total O&M Cost	***$12,500,000***	

Water Supply Option Overview		
Water Supply Option No.	Water Supply Option Title	Water Supply Source
PW.3b	Indirect Potable Reuse for Raw Water Augmentation (Phase 2)	USD

Water Supply Option Yield					
Supply Frequency	Supply Availability Frequency (0.0 to 1.0) (e.g., 3-in-10 years = 0.3)	Supply Volume	Dry Year Supply Volume	Average Annual Supply Volume	Basis for Yield Assumptions
Annual	1.0	5,488	5,488	5,488	2023 Purified Water Feasibility Study

Water Supply Option Costs					
Capital Cost	Annualized Capital Cost	Water Supply Cost	O&M Cost	Total Annual Cost	Average Unit Cost
$209,700,000	$10,700,000	$0	$4,100,000	$14,800,000	$2,700
					Note that this is not a realistic standalone unit cost as this supply option requires Phase to be implemented.

Capital Costs					
Item	Quantity	Units	Unit Cost	Total Cost	Notes
Phase 2 - Advanced Water Purification Facility Treatment Train	6.0	MGD	$22,000,000	$132,000,000	Assumes same treatment train as for Phase 2 in 2023 Purified Water Feasibility Study (PWFS)
Conveyance for Purified Water from AWPF to TP#2 - Phase 2	6.0	MGD	$10,100,000	$60,600,000	Assumes same alignment as noted in 2023 PWFS
Land Acquisition	3	acres	$5,700,000	$17,100,000	Assumes same alignment as noted for Phase 1 in 2023 PWFS
			Raw Construction Cost	**$209,700,000**	
Contingency			*20%*		*PFWS already accounts for implementation and contingency costs.*
			Total Construction Cost	**$209,700,000**	
Implementation Cost			*30%*		*PFWS already accounts for implementation and contingency costs.*
			Total Capital Cost	***$209,700,000***	
O&M Costs					
Item	**Quantity**	**Units**	**Unit Cost**	**Total Cost**	**Notes**
Phase 2 - Advanced Water Purification Facility Treatment Train - O&M	6.0	MGD	$378,000	$2,300,000	Assumes same treatment train as for Phase 2 in 2023 Purified Water Feasibility Study (PWFS)
Conveyance for Purified Water from AWPF to TP#2 - Phase 2 - O&M	6.0	MGD	$194,000	$1,200,000	Assumes same alignment as noted for Phase 2 in 2023 PWFS
ACWD Full-time Employee	2	EA	$321,400	$600,000	

			Total O&M Cost	***$4,100,000***	

Water Supply Option Overview		
Water Supply Option No.	**Water Supply Option Title**	**Water Supply Source**
PW.3c	Indirect Potable Reuse for Groundwater Recharge & Raw Water Augmentation (Phase 1 + Phase 2)	USD

Water Supply Option Yield					
Supply Frequency	**Supply Availability Frequency (0.0 to 1.0) (e.g., 3-in-10 years = 0.3)**	**Supply Volume**	**Dry Year Supply Volume**	**Average Annual Supply Volume**	**Basis for Yield Assumptions**
Annual	1.0	11,536	11,536	11,536	2023 Purified Water Feasibility Study

Water Supply Option Costs					
Capital Cost	**Annualized Capital Cost**	**Water Supply Cost**	**O&M Cost**	**Total Annual Cost**	**Average Unit Cost**
$794,700,000	$40,500,000	$0	$16,700,000	$57,200,000	$4,960

Capital Costs					
Item	**Quantity**	**Units**	**Unit Cost**	**Total Cost**	**Notes**
Phase 1 - Advanced Water Purification Facility Treatment Train	9.0	MGD	$20,300,000	$182,700,000	Assumes same treatment train as for Phase 1 in 2023 Purified Water Feasibility Study (PWFS)
Pit 2 Site Work for Purified Water Project	9.0	MGD	$4,600,000	$41,400,000	Assumes siting for AWPF at Pit #2
Conveyance from Alvarado WWTP to AWPF - Phase 1	9.0	MGD	$14,400,000	$129,600,000	Assumes same alignment as noted for Phase 1 in 2023 PWFS
Conveyance for MF waste from AWPF to USD Collection System - Phase 1	9.0	MGD	$1,100,000	$9,900,000	Assumes same alignment as noted for Phase 1 in 2023 PWFS
Conveyance for RO waste from AWPF to EBDA Outfall - Phase 1	9.0	MGD	$9,300,000	$83,700,000	Assumes same alignment as noted for Phase 1 in 2023 PWFS
Conveyance for Purified Water from AWPF to Rock Pond for Recharge - Phase 1	9.0	MGD	$5,600,000	$50,400,000	Assumes same alignment as noted for Phase 1 in 2023 PWFS
Peralta Tyson Groundwater Treatment Facility (RO)	6.0	MGD	$9,800,000	$58,800,000	Assumes same treatment facility as noted for Phase 1 in 2023 PWFS
Phase 2 - Advanced Water Purification Facility Treatment Train	6.0	MGD	$22,000,000	$132,000,000	Assumes same treatment train as for Phase 2 in 2023 Purified Water Feasibility Study (PWFS)
Conveyance for Purified Water from AWPF to TP#2 - Phase 2	6	MGD	$10,100,000	$60,600,000	Assumes same alignment as noted in 2023 PWFS
Land Acquisition	8	acres	$5,700,000	$45,600,000	

			Raw Construction Cost	**$794,700,000**	
Contingency			*20%*		*PFWS already accounts for implementation and contingency costs.*
			Total Construction Cost	**$794,700,000**	
Implementation Cost			*30%*		*PFWS already accounts for implementation and contingency costs.*
			Total Capital Cost	***$794,700,000***	
O&M Costs					
Item	**Quantity**	**Units**	**Unit Cost**	**Total Cost**	**Notes**
Phase 1 - Advanced Water Purification Facility Treatment Train - O&M	9.0	MGD	$621,000	$5,600,000	Assumes same treatment train as for Phase 1 in 2023 Purified Water Feasibility Study (PWFS)
Conveyance from Alvarado WWTP to AWPF - Phase 1 - O&M	9.0	MGD	$248,000	$2,200,000	Assumes same alignment as noted for Phase 1 in 2023 PWFS
Conveyance for MF waste from AWPF to USD Collection System - Phase 1 - O&M	9.0	MGD	$14,000	$100,000	Assumes same alignment as noted for Phase 1 in 2023 PWFS
Conveyance for RO waste from AWPF to EBDA Outfall - Phase 1 - O&M	9.0	MGD	$121,000	$1,100,000	Assumes same alignment as noted for Phase 1 in 2023 PWFS
Conveyance for Purified Water from AWPF to Rock Pond for Recharge - Phase 1 - O&M	9.0	MGD	$73,000	$700,000	Assumes same alignment as noted for Phase 1 in 2023 PWFS
Peralta Tyson Groundwater Treatment Facility - O&M	6.0	MGD	$369,000	$2,200,000	Assumes same treatment facility as noted in 2023 PWFS
Phase 2 - Advanced Water Purification Facility Treatment Train - O&M	6.0	MGD	$378,000	$2,300,000	Assumes same treatment train as for Phase 2 in 2023 Purified Water Feasibility Study (PWFS)
Conveyance for Purified Water from AWPF to TP#2 - Phase 2 - O&M	6.0	MGD	$194,000	$1,200,000	Assumes same alignment as noted for Phase 2 in 2023 PWFS
ACWD Full-time Employee	4.0	EA	$321,400	$1,300,000	
			Total O&M Cost	***$16,700,000***	

Water Supply Option Overview		
Water Supply Option No.	Water Supply Option Title	Water Supply Source
PW.4	Direct Potable Reuse	USD

Water Supply Option Yield					
Supply Frequency	Supply Availability Frequency (0.0 to 1.0) (e.g., 3-in-10 years = 0.3)	Supply Volume	Dry Year Supply Volume	Average Annual Supply Volume	Basis for Yield Assumptions
Annual	1.0	13,104	13,104	13,104	2023 Purified Water Feasibility Study

Water Supply Option Costs					
Capital Cost	Annualized Capital Cost	Water Supply Cost	O&M Cost	Total Annual Cost	Average Unit Cost
$722,100,000	$36,800,000	$0	$14,300,000	$51,100,000	$3,900

Capital Costs					
Item	Quantity	Units	Unit Cost	Total Cost	Notes
Phase 1 - Advanced Water Purification Facility Treatment Train	9.0	MGD	$20,300,000	$182,700,000	As noted in 2023 Purified Water Feasibility Study
Phase 2 - Advanced Water Purification Facility Treatment Train	6.0	MGD	$22,000,000	$132,000,000	As noted in 2023 Purified Water Feasibility Study
Conveyance from Alvarado WWTP to AWPF - Phase 1	9.0	MGD	$14,400,000	$129,600,000	As noted in 2023 Purified Water Feasibility Study
Conveyance for MF waste from AWPF to USD Collection System - Phase 1	9.0	MGD	$1,100,000	$9,900,000	As noted in 2023 Purified Water Feasibility Study
Conveyance for RO waste from AWPF to EBDA Outfall - Phase 1	9.0	MGD	$9,300,000	$83,700,000	As noted in 2023 Purified Water Feasibility Study
Conveyance for Purified Water from AWPF to TP#2 - Phase 2	6.0	MGD	$10,100,000	$60,600,000	As noted in 2023 Purified Water Feasibility Study
Pit 2 Site Work for DPR	15.0	MGD	$5,200,000	$78,000,000	As noted in 2023 Purified Water Feasibility Study
Land Acquisition	8	acres	$5,700,000	$45,600,000	
			Raw Construction Cost	**$722,100,000**	
Contingency			*20%*		*PFWS already accounts for implementation and contingency costs.*
			Total Construction Cost	**$722,100,000**	
Implementation Cost			*30%*		*PFWS already accounts for implementation and contingency costs.*
			Total Capital Cost	***$722,100,000***	
O&M Costs					

Item	Quantity	Units	Unit Cost	Total Cost	Notes
Phase 1 - Advanced Water Purification Facility Treatment Train - O&M	9.0	MGD	$621,000	$5,600,000	As noted in 2023 Purified Water Feasibility Study
Conveyance from Alvarado WWTP to AWPF - Phase 1 - O&M	9.0	MGD	$248,000	$2,200,000	As noted in 2023 Purified Water Feasibility Study
Conveyance for MF waste from AWPF to USD Collection System - Phase 1 - O&M	9.0	MGD	$14,000	$100,000	As noted in 2023 Purified Water Feasibility Study
Conveyance for RO waste from AWPF to EBDA Outfall - Phase 1 - O&M	9.0	MGD	$121,000	$1,100,000	As noted in 2023 Purified Water Feasibility Study
Conveyance for Purified Water from AWPF to TP#2 - Phase 2 - O&M	9.0	MGD	$194,000	$1,700,000	As noted in 2023 Purified Water Feasibility Study
Phase 2 - Advanced Water Purification Facility Treatment Train - O&M	6.0	MGD	$378,000	$2,300,000	As noted in 2023 Purified Water Feasibility Study
ACWD Full-time Employee	4	EA	$321,400	$1,300,000	
				$0	
			Total O&M Cost	***$14,300,000***	

APPENDIX B: INITIAL LIST OF WATER SUPPLY OPTIONS

Approach

The initial identification and development of water supply options was a collaborative effort between Woodard & Curan, ACWD staff, and the ACWD Board of Directors. Woodard & Curran and the ACWD Water Resources Planning group curated an initial list based on prior work by ACWD, regional studies, and novel concepts. For a water supply option to be complete, it must bring supply to ACWD's service area. Five elements are considered for each water supply option:

Supply Source + **Conveyance** + **Storage** + **Treatment** + **Distribution**

Water supply options were grouped into five primary water supply categories. These categories represent the actual water supply sources each option ultimately delivers. These five categories include imported water, local surface water, groundwater, ocean or San Francisco Bay water, and purified water. Water conservation and demand management were not considered in the initial identification and development of water supply options; these activities were considered during the demand forecast for the WRMP. **Figure B-1** highlights this initial grouping of water supply options into the five categories. **Table B-1** lists local and regional studies that were consulted in the development of the initial of water supply options.

FIGURE B-1: WATER SUPPLY CATEGORIES

Imported Water

State Water Project
- Treated
- Local Recharge
- Stored with Semitropic
- Expanded storage

San Francisco
- Blended with local GW

Water Transfers
- Local
- Statewide

Central Valley Project

Local Surface Water

Alameda Creek
- Treated
- Local Recharge
- Expanded local recharge

Local Runoff
- Local Recharge
- Stormwater Capture

Groundwater

Niles Cone
- Blended
- Desalinated at Newark Desal Facility
- Additional Brackish Groundwater
- GW Treatment
- Expanded use of the basin

New Groundwater
- Establish ACWD GW Bank
- Fallow farmland

Ocean / Bay Water

Local Desal
- Ocean / Bay Water Desal

Regional Partnerships
- Bay Area Regional Desal Project

Recycled Water

Union Sanitary District
- Local Recharge
- IPR via NDF or New GW Treatment
- DPR via regional partnership

Dublin San Ramon Services District
- Local Recharge
- IPR via NDF or New GW Treatment

Blue = Existing Water Supply
Red = New Water Supply

TABLE B-1: LOCAL AND REGIONAL STUDIES REFERENCED

Study Name	Description
Bay Area Regional Reliability Study Drought Contingency Plan	The report was commissioned by ACWD, Bay Area Water Supply and Conservation Agency (BAWSCA), Contra Costa Water District (CCWD), Marin Municipal Water District (MMWD), San Francisco Public Utilities Commission (SFPUC), and Zone 7 Water Agency to leverage existing regional infrastructural assets and water resources to strengthen the Bay Area's water supply reliability in

Study Name	Description
	the face of extended drought and climate change. Specifically, the report outlined a series of proposed regional projects to achieve these overarching goals.
ACWD 2020 Urban Water Management Plan	The 2020 Urban Water Management Plan (UWMP) is a guiding document updated every five years to support ACWD's long-term water resources planning by ensuring sufficient water supplies are available to meet existing and future demands. The document contains an overview of ACWD's historic and projected water use and sources of supply, demand management strategies, water shortage contingency plan, and highlights ACWD's actions taken in groundwater management, desalination, water recycling.
ACWD-USD-SFPUC Purified Water Feasibility Study 2023	This study investigated the potential for potable reuse projects using wastewater from USD to provide purified water to either ACWD or SFPUC. The purpose of this study was to identify and analyze potable reuse project concepts and alternatives to inform next steps in the evaluation of pursuing a regional purified water project. The potable reuse options studied included the recharge of purified water to the Niles Cone Basin as well as the delivery of purified water to ACWD's Water Treatment Plant 2 (WTP2) for supplemental raw water augmentation.
ACWD-USD Purified Water Feasibility Study 2016	This study updated an existing feasibility analysis investigating a large-scale purified water program between ACWD and USD. The document addressed planning assumptions, including wastewater and water needs, regulations, non-potable purified water demand, and treatment technologies; the evaluation of an indirect potable reuse (IPR) project to recharge the Niles Cone Basin; the definition and evaluation of new scenarios for joint ACWD-USD purified water projects; the development of the preferred projects at the feasibility level; and a discussion of the projects' feasibility and implementation strategies.
ACWD Alternative Water Supply Study 2014	This study conducted a high-level assessment of conceptual alternative investments that could reduce or eliminate ACWD's dependence on SWP supplies while also ensuring ACWD's current level of water supply reliability is maintained or improved. Studied local and regional alternative supplies included San Francisco Bay water desalination, water exchanges, purified water, additional groundwater and surface water storage, additional stormwater capture, and additional conservation. Five portfolios of alternative water supplies were recommended for further assessment, with three designed to enhance the reliability of existing supplies and two that would replace SWP supplies.
Northern California Salinity Coalition East Bay Saline Groundwater Desalination Facility Project Summary	This report explores the construction of a brackish groundwater desalination facility that uses Bay shore perimeter wells to draw from the Newark Aquifer underlying San Francisco Bay. Desalinated water would then be conveyed to ACWD's distribution system and/or into the Bay Division Pipeline for use by SFPUC.

Study Name	Description
ACWD Desalination Recirculation Concept Memorandum	This study investigated the potential yield of implementing a desalinated water recirculation program at Newark Desalination Facility (NDF) that adds a treatment train on the concentrate line to recover additional supply from discharge.
ACWD Sunol Aqueduct Options Spreadsheet	This workbook conceptualizes various ways to utilize the existing, disused Sunol Aqueduct alignment.
ACWD-Zone 7-SCVWD Del Valle Reservoir Expansion Concept Memorandum	This study investigated the potential reoperation of Lake Del Valle Reservoir to enhance emergency water supply storage south of the Sacramento-San Joaquin Delta. The memorandum analyzes four potential projects: the implementation of Forecast-Informed Reservoir Operations (FIRO), the raising of the maximum operating lake level coupled with the implementation of FIRO, the lowering of the minimum operating lake level, and raising the existing dam.

Woodard & Curran held a workshop with ACWD's WRMP Extended Team on January 16, 2025, to introduce and discuss an initial list of 42 water supply options. The Extended Team included representation from the general manager's office, engineering, groundwater management, operations, and the planning group at ACWD. ACWD staff provided feedback on the viability of supply options and signaled their interest in certain projects and types of projects. With this feedback, the Woodard & Curran team further refined the list of 42 supply options in preparation for the February 6, 2025, meeting of the ACWD Board of Directors.

At the February 6, 2025, ACWD Board of Directors meeting, District staff presented the list of 42 initial supply options. The Board provided feedback on the presented options and suggested the addition of two more supply options, bringing the total list of initial supply options to 44. These 44 supply options are presented below in **Table B-2** through **Table B-6**.

Imported Surface Water

During the initial water supply options development process, 17 imported surface water options were identified. Each option and a brief description are included below in **Table B-2**.

TABLE B-2: INITIAL IMPORTED SURFACE WATER SUPPLY OPTIONS

Supply Option Title	Description
Create an ACWD Groundwater Bank and Join Central Valley Project	ACWD could purchase agricultural land in Central Valley with appurtenant water rights, fallow the land, and then create a groundwater bank. Operationally, banked water may be used when needed or marketed when not needed. Additionally, this project would have ACWD join the Central Valley Project (CVP) to establish a water market with local agencies.
Create an ACWD Groundwater Bank	ACWD could purchase agricultural land in Central Valley with appurtenant water rights, fallow the land, and then create a groundwater bank. Operationally, banked water may be used when needed or marketed when not needed.

Supply Option Title	Description
Expand Participation in the Semitropic Groundwater Banking Program	ACWD could expand its existing partnership with the Semitropic Groundwater Bank to store surplus SWP supplies during wet years and "withdraw" water supplies during the dry years via a paper exchange with a partnering agency. This supply option would enhance resiliency by increasing the volume of surface water conveyed to Semitropic via the SWP in order to secure greater withdrawal volumes during dry years.
Join the Antelope Valley-East Kern Groundwater Banking Program	ACWD could partner with Antelope Valley-East Kern Water Agency to convey surplus surface water deliveries from the SWP to the High Desert Water Bank for aquifer storage. In dry seasons, ACWD would coordinate with downstream users to engage in a paper trade in which ACWD receives the partner's SWP allocation while the downstream user receives ACWD's banked groundwater.
Join Irvine Ranch, Sacramento Regional, or Other Water Banking Programs	ACWD could pursue other significant groundwater banking opportunities to identify an alternative groundwater bank that addresses the shortcomings of Semitropic. Desirable qualities would include low levels of uncertainty due to Sustainable Groundwater Management Act (SGMA) and water quality, a greater return confidence in critically dry years and reduced dependence on SWP/Delta operations, greater put and conveyance capacity in wet years, lower cost than Semitropic, and an additional return capacity to supplement Semitropic during dry years.
Construct a Pretreatment Facility at East Bay Municipal Utility District's (EBMUD) Walnut Creek Water Treatment Plant	ACWD could partner with East Bay Municipal Utility District (EBMUD) to construct a Pretreatment Facility at the existing Walnut Creek Water Treatment Plant (WCWTP) to treat and deliver surface water from the Sacramento River and Los Vaqueros Reservoir to neighboring water agencies, including ACWD. This is a companion project to Los Vaqueros Expansion and would require use of a future Transfer Bethany Pipeline.
Establish Regional Water Market	ACWD could partner with local Bay Area water agencies to establish a regional water market aiming to provide both short-term interagency exchanges or transfers as well as long-term resiliency and flexibility to respond to emergency conditions or events. A support tool would be developed to guide future water exchanges and transfers between partnering agencies.
Establish a Water Market or Partnerships with Other SWP Agencies	ACWD can use its recent Water Management Tools amendment to establish partnerships with other SWP agencies to further optimize wet year storage and trading for dry year water.
Increase Blending Peak Capacity at SFPUC-Fremont Takeoff	Increasing blending capacity at the SFPUC-ACWD Fremont Takeoff would allow ACWD to take more SFPUC supplies and produce more groundwater supplies to accommodate water treatment plant outages or interruptions to SWP supply without compromising water quality
Los Vaqueros Reservoir Expansion	Raising the existing dam at Los Vaqueros Reservoir might enlarge its capacity by 115,000 AF and increase the volume of surface water deliveries available to ACWD. This option is currently tabled due to lack of sufficient support from other agencies.
Join the Central Valley Project	ACWD can evaluate the feasibility and benefits of joining the CVP. In addition to being a new supply source, involvement in both the CVP and SWP would enhance ACWD's water transfer capability.

Supply Option Title	Description
Lease Storage in San Luis Reservoir from Existing Partner	ACWD could partner with an existing user to sublease a portion of dedicated storage in San Luis Reservoir after its 60,000 AF expansion.
Construct Sites Reservoir	ACWD could consider opportunities to invest in construction of Sites Reservoir. Sites is a 1.5 million AF off-stream, surface storage reservoir connected to the SWP. As a partner, ACWD would be eligible to receive an allocation from Sites Reservoir via the SWP.
Sunol Aqueduct	The disused Sunol Aqueduct can be used to convey imported water supplies to ACWD's service area. The Sunol Aqueduct might require rehabilitation or replacement, pending results of a thorough condition assessment. The Sunol Aqueduct is owned by SFPUC; use of the aqueduct would require acquisition of the asset or a leasing arrangement with SFPUC. As a closed channel, use of the Sunol Aqueduct might prevent future regulatory erosion of water supplies currently conveyed via Alameda Creek
Secure Water from Yuba Water Agency	ACWD could partner with Yuba Water Agency in one of two ways. First, as a non-signatory to the Yuba Accord, ACWD could partner with Yuba Water Agency to receive supplies that are reserved outside the Accord and only available in certain drought years. Alternatively, ACWD could join the existing Yuba Accord which is currently being renewed and receive expanded access to supplies in most other years.
Groundwater Banking within Alameda Creek Watershed	ACWD can pursue local groundwater banking inside the Alameda Creek Watershed to store excess water supplies during wet and normal years for use in dry years. ACWD might partner with Zone 7 to operate the proposed Chain of Lakes groundwater bank in the Livermore Valley Groundwater Basin. ACWD might also bank water in the Niles Cone Basin, pending the results of hydrogeologic study.
Secure Dedicated Storage in Los Vaqueros Reservoir	This supply option would have ACWD secure either purchased or leased dedicated storage from CCWD in the existing Los Vaqueros Reservoir.

Local Surface Water

During the initial water supply options development process, six local surface water options were identified. Each option and a brief description are included below in **Table B-3**.

TABLE B-3: INITIAL LOCAL SURFACE WATER SUPPLY OPTIONS

Supply Option Title	Description
Construct ACWD-SFPUC Intertie and Augment Local Supply	ACWD could construct an intertie between ACWD's NDF and SFPUC's Bay Division Pipeline and would create opportunities for water transfers and emergency supplies.
Del Valle Reservoir Expansion	ACWD and other partners could modify FIRO rules at Lake Del Valle, enlarging its capacity by 35,000 AF. This would increase the volume of surface water deliveries available to ACWD and is distinguished from a Water Control Manual revision in that it would reallocate existing flood storage to water supply storage.

Supply Option Title	Description
Del Valle Reservoir Lowering	ACWD and other partners could lower the surface water treatment plant intakes and boat ramps to accommodate lowering nominal winter water levels to capture more runoff in wet and above average years.
Construct Centralized and Decentralized Regional Stormwater Capture Infrastructure	ACWD could partner with municipalities inside its service area to develop centralized and decentralized stormwater infrastructure to enhance the region's capacity to capture and store stormwater flows for recharge or potable use offsets.
Enhance Yields from Del Valle Reservoir	ACWD could investigate opportunities to enhance yields from Del Valle Reservoir within existing water right permit volume.
Expand Distribution System and Augment Local Supply	ACWD could expand operations of NDF and improve ACWD's existing distribution system to promote an increased ability to both extract from and recharge the Niles Cone Basin.

Groundwater

During the initial water supply options development process, 11 groundwater options were identified. Each option and a brief description are included below in **Table B-4**.

TABLE B-4: INITIAL GROUNDWATER SUPPLY OPTIONS

Supply Option Title	Description
Source Desalination Supply from Bay Influence Zone	ACWD could site new desalination supply wells such that they are drawing more Bay water in a zone of mixing with freshwater, effectively adding a new supply resulting from a fractional but intentional draw from the Bay. Moreover, this is premised on the facts that (1) the Niles Cone Basin is connected to the Bay (and has been a source of much saltwater intrusion in the past) and (2) Aquifer Reclamation Program (ARP) wells have been significantly "cleaned up", leaving excess desalination capacity.
East Bay Saline Groundwater Desalination Facility	ACWD could install Salinity Barrier Wells (SBWs) that would produce brackish water to be treated at the NDF and would have minimal impact on ACWD's freshwater reserves in the Niles Cone Basin. Additionally, the SBWs would allow for a potentially sizable expansion of Niles Cone extraction operations as saltwater intrusion would be mitigated under heavy draw down conditions. This concept is similar to the Bay Desalination concept that would employ shallow slant wells as intakes.

Supply Option Title	Description
Revise Groundwater Rule Curves for Expanded Groundwater Operation in the Niles Cone Basin	ACWD can expand groundwater pumping in the Niles Cone Basin and lower annual nominal groundwater levels to bolster the Alameda Creek watershed supply via increased annual capture in above average years and reductions in saline outflow.
Expand Niles Cone Storage in the Below Hayward Fault Sub-basin	ACWD can expand the extraction of groundwater from the Niles Cone Below Hayward Fault Sub-basin to levels below the current minimum operating level of -5 feet above mean sea level (ft msl) for short durations during critical droughts.
Expand Niles Cone Storage in the Above Hayward Fault Sub-basin	Likewise, ACWD can extract groundwater from the Niles Cone Above Hayward Fault Sub-basin to levels below the current minimum operating level of 15-20 ft msl.
Enhanced Groundwater Treatment for PFAS and Hardness	Enhanced groundwater treatment for PFAS and hardness can allow ACWD to use more local groundwater during normal and wet years as ACWD would no longer require SFPUC supply for blending to meet water quality objectives. This option could leverage a proposed amendment to the water supply contract with SFPUC to reduce ACWD’s minimum purchase requirement.
Implement Desalination Recirculation	A brine recirculation program at NDF that adds a treatment train on the concentrate line to recover additional supply can allow for groundwater currently treated at NDF to be produced elsewhere. This option is feasible given that aquifer remediation has advanced so far that brine discharged from NDF is less salty than the original supply of water when NDF was built.
Install Groundwater Wells and Construct Southern Blending Facility	This supply option would have ACWD install groundwater wells near SFPUC takeoffs (i.e., near Warm Springs), which would allow for the construction of a smaller facility to blend groundwater and SFPUC supplies to the 150-ppm hardness goal.
Newark Desalination Facility Expanded Use	This supply option would have ACWD expand its operations at NDF. If water conditions in the Niles Cone Basin were to continue improving, ACWD could be able to treat a higher volume of water at NDF and discharge more brine. It is likely this project would require an accompanying recharge project.
New Desalination Facility in Southern Service Area	ACWD construct a desalination facility in the southern portion of ACWD’s service area and would enable ACWD to provide water to this area without competing with NDF. This option could be coupled with a purified water recharge project to alleviate groundwater overdraft conditions.

Supply Option Title	Description
Construct the Newark Desalination Facility-Blending Facility Intertie Pipeline	ACWD could construct an intertie pipeline connecting NDF to ACWD's blending facility, enabling ACWD to leverage existing production capacity at NDF and take advantage of surplus local groundwater during above average water years. This project leverages proposed SFPUC minimum purchase amendments.

Ocean or San Francisco Bay Water Desalination

During the initial water supply options development process, three ocean or San Francisco Bay desalinated water options were identified. Each option and a brief description are included below in **Table B-5**.

TABLE B-5: INITIAL OCEAN OR SAN FRANCISCO BAY WATER SUPPLY OPTIONS

Supply Option Title	Description
Partner with Local Agencies to Construct a Regional Desalination Facility	ACWD could partner with other regional water agencies construct a 25 mgd brackish water desalination facility that would draw source water from CCWD's Mallard Slough Pump Station. Currently, new partners for this facility are not being considered.
Bay Water Desalination	ACWD could construct a San Francisco Bay water desalination facility and construct a transmission pipeline to convey brine to USD's existing wastewater discharge line located at the Alvarado Wastewater Treatment Plant (WWTP).
Partner with Valley Water in Bay Desalination	ACWD could partner with Santa Clara Valley Water District to construct a San Francisco Bay water desalination facility that would either convey desalinated water via a pipeline located near ACWD's service area boundary (i.e., Scott Creek/Fremont Blvd. at Milpitas border) or to engage in a paper exchange for Santa Clara Valley Water District's South Bay Aqueduct (SBA) supply.

Purified Water

During the initial water supply options development process, six purified water options were identified. Each option and a brief description are included below in **Table B-6**.

TABLE B-6: INITIAL PURIFIED WATER SUPPLY OPTIONS

Supply Option Title	Description
Partner with Local Agencies to Engage in a Regional Reuse Project	ACWD could partner with local water agencies to implement a regional reuse project. Options range from pursuing small scale non-potable reuse programs (i.e., SFPUC Non-Potable Onsite Program) to the construction of an AWPF and conveyance of purified water from Union Sanitary District (USD) to the Quarry Lakes Groundwater Recharge Area (i.e., ACWD-USD Purified Water Project).
Construct ACWD-SFPUC Intertie and Indirect Potable	ACWD could construct an intertie between NDF and SFPUC's Bay Division Pipeline and an AWPF to purify local wastewater effluent for recharge in the Niles Cone Basin. Added recharge would allow ACWD to extract more groundwater

Supply Option Title	Description
Reuse Advanced Water Purification Facility	from the Basin for treatment at NDF, creating opportunities for water transfers and emergency supplies.
Purified Water for GW Recharge (Phase 1)	ACWD could construct an AWPF to treat wastewater flows from USD, recharge purified water from the AWPF at Quarry Lakes, construct a new groundwater facility in the Peralta-Tyson wellfield, and utilize groundwater instead of SFPUC supply.
Purified Water for Raw Water Augmentation (Phase 2)	ACWD could expand the capacity of the AWPF constructed during Phase 1 (see above) to treat local wastewater flows from USD to a higher quality and use the purified water as source water for WTP2 rather than SWP supplies.
Recharge Purified Water from Dublin-San Ramon Services District (DSRSD) and Expand Distribution System	ACWD could partner with Dublin San Ramon Services District (DSRSD) to use DSRSD's treated effluent from an AWPF for recharge at Quarry Lakes. Discharge would be conveyed via Alameda Creek. ACWD could produce this water via groundwater production wells or ARP wells supplying NDF.
Expand Distribution System and IPR AWPF	ACWD could partner with USD to construct an AWPF to purify local wastewater effluent for recharging the Niles Cone Basin. Added recharge would enable ACWD to extract more groundwater from the Basin for treatment at NDF. To accommodate expanded operations of NDF, ACWD would need to improve its distribution system.

APPENDIX E
PORTFOLIO DEVELOPMENT, EVALUATION, AND IMPLEMENTATION

TECHNICAL MEMORANDUM

TO: Thomas Niesar, Alameda County Water District (ACWD)

PREPARED BY: Dawn Flores, Max Storms, Max McNally, Chris Hewes (Woodard & Curran)

REVIEWED BY: Katie Cole and Persephene St. Charles (Woodard & Curran); Phillippe Daniel (Liquisti)

DATE: February 23, 2026

RE: Portfolio Development, Evaluation, and Implementation for ACWD's Water Resources Master Plan 2050 (Phase 2, Task 6 – Portfolios)

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ACRONYMS AND ABBREVIATIONS

ACWD	Alameda County Water District
AFY	Acre-Feet per Year
ASR	Aquifer Storage & Recovery
BARR	Bay Area Regional Reliability
BAWSCA	Bay Area Water Supply & Conservation Agency
CEQA	California Environmental Quality Act
CIP	Capital Improvement Plan
DDW	State Water Resources Control Board Division of Drinking Water
DPR	direct potable reuse
DWR	Department of Water Resources
EBRPD	East Bay Regional Parks District
EPA	Environmental Protection Agency
FIRO	Forecast-Informed Reservoir Operations
GSP	groundwater sustainability plan
IP	Integrated planning
IPR	indirect potable reuse
IRP	Integrated Resources Plan
JPA	joint powers authority
MCL	maximum contaminant level
mgd	million gallons per day
MPQ	Minimum Purchase Quantity
MSJWTP	Mission San Jose Water Treatment Plant
msl	mean sea level
NDF	Newark Desalination Facility
NEBIM	Niles East Bay Integrated Model
NPDES	National Pollutant Discharge Elimination System
PFAS	per- and polyfluoroalkyl substances
RWQCB	Regional Water Quality Control Board
SBA	South Bay Aqueduct
Semitropic	Semitropic Groundwater Bank
SFPUC	San Francisco Public Utilities Commission
SGMA	Sustainable Groundwater Management Act
SWC	State Water Contractors
SWP	State Water Project
SWRCB	State Water Resources Control Board
TM	Technical Memorandum

USACE	United States Army Corps of Engineers
USD	Union Sanitary District
UWMP	Urban Water Management Plan
UWUO	Urban Water Use Objective
WEMP	Water Efficiency Master Plan
WRMP	Water Resources Master Plan
WTP	Water Treatment Plant

GLOSSARY

Term	**Definition**
Aquifer	Natural underground layer of porous, water-bearing materials usually capable of yielding water supply
Availability	Supply volumes available for use by ACWD based on hydrology, facilities, and operations
Baseline Supply	Scenario used to represent supply availability, facility capacity, and operations in the future without implementation of any options or strategies
Direct Potable Reuse	Purified water that either undergoes conventional surface water treatment or is provided directly to the potable water distribution system. In either case, purified water is integrated into the potable water system without going through an adequately sized environmental buffer.
Imported Water	Water supply that is delivered from watersheds outside of local watersheds
Indirect Potable Reuse	Purified water enters an adequately sized environmental buffer, either a groundwater basin or surface water reservoir. The water can later be pumped out of the groundwater basin or taken out of the surface water reservoir and used similarly to existing water supplies.
Local Surface Water	Water use for supply that is diverted from local watersheds
Supply Option	Water supply project that generates a volume of water
Portfolio	Combination of supply options and resource strategies
Purified Water	Also known as advanced treated recycled water or potable reuse; municipal wastewater that has been treated to meet standards for human consumption.

Term	**Definition**
Recharge	Replenishment of an aquifer with a surface water supply, such as stormwater, local surface water, purified water, or imported water
Water Supply Reliability	The consistent ability of water supplies to meet demand while considering factors such as hydrology, facilities, and operations
Scenario	Future conditions that impact future demands and supply availability
Resource Strategy	Water management action that may have a cost, but does not generate a volume of water.
Water Banking	Water management technique where water is stored in groundwater basins or aquifers during periods of supply surplus for use during periods of drought or emergency

1. INTRODUCTION

Alameda County Water District (ACWD or District) is undertaking an update to its 1995 Integrated Resources Plan (IRP). Since the IRP was adopted nearly 30 years ago, the District has experienced many changes that warrant an updated look at the future of its water supply. The updated Water Resources Master Plan (WRMP) 2050 will serve as a long-range planning document that outlines the District's water supply strategy and informs other aspects of District planning. The goal of the WRMP is to inform critical decision making on future infrastructure and water supply investments by providing valuable information about the District's future resilience in the face of known uncertainties, such as climate change and changing regulations. This plan will create a roadmap for water supply reliability by analyzing changing conditions and the communities served by the District – now and in the future.

This technical memorandum (TM) details the portfolio development, evaluation, and implementation planning processes conducted as part of the WRMP 2050. This TM is the culmination of the technical work performed in prior TMs to project future demands, forecast supply reliability under several future scenarios, and characterize the water supply options and water resource strategies that form the building blocks of the portfolios.

This TM is organized into the following sections:

- **Section 1 - Introduction**: An overview of the WRMP 2050 and this TM's purpose and structure.
- **Section 2 - Portfolio Development Process and Descriptions**: A description of each portfolio and the supply options contained within it.
- **Section 3 - Portfolio Evaluation**: An accounting of the criteria used to evaluate each portfolio, as well as the evaluation results.
- **Section 4 - Preferred Portfolio**: A description of the preferred portfolio developed out of the portfolio creation and evaluation processes described in the prior sections.
- **Section 5 - Implementation Plan**: A roadmap for implementation of the preferred portfolio, including ongoing monitoring and triggers for implementing multiple phases.

2. PORTFOLIO DEVELOPMENT PROCESS AND DESCRIPTIONS

2.1 Introduction

Portfolio development was guided by a thematic approach designed to address the WRMP's overarching goals and objectives. Each portfolio represents a distinct strategy, incorporating a combination of water supply options tailored to meet specific performance criteria and operational needs. All portfolios were constructed to satisfy two critical conditions:

- Meet projected 2050 (assumed full buildout) demand under Scenario B conditions, which reflects a "moderate" level of future climate change and regulatory impacts (see more detail in TM4 – Baseline Supply Availability Forecast)
- Achieve water quality goals[1], ensuring water quality remains within acceptable limits

Initially, 11 portfolios were developed and modeled quantitatively using ACWD's RiverWare model. This modeling process enabled detailed simulation of operations related to:

- Water staging and recovery
- Groundwater recharge
- Pumping strategies
- Water treatment
- Blending operations

Each portfolio was evaluated across a range of evaluation criteria that are described further in **Section 3**.

Following initial modeling, the portfolios were presented during an Extended Team workshop (7/23/2025), where feedback from ACWD staff was gathered. Based on this input, the portfolios were refined to better align with operational realities and stakeholder priorities. The resulting portfolios are described in more detail in **Sections 2.3** through **2.14**, following a description of the baseline portfolio in **Section 2.2**.

As a result of this iterative process, a 12th portfolio was ultimately created to address specific insights and needs that emerged during the evaluation. This additional portfolio is described separately in **Section 4**. For presentation purposes, Portfolio 12 is shown as Phases 12A, 12B, and 12C throughout this TM; however, these phases together comprise a single, integrated portfolio.

Hereafter, each subsection provides capital costs and average annual costs, which include both operations and maintenance (O&M) and water supply purchase costs, for the supply options contained within each portfolio. Costs were developed according to the methodology found in TM5 (Water Supply Options and Water Resources Strategies). Details of the cost estimates are part of that TM's appendix.

[1] Compliance with PFAS regulation, plus meeting hardness target adopted by the ACWD Board of Directors.

Table 1 below lists all 12 portfolios and the specific water supply options included in each. Individual water supply options are characterized in detail in TM5 (Water Supply Options and Water Resources Strategies). Note that some water supply options, particularly for Portfolio 12, were modified for purposes of modeling as part of the overall portfolio they were placed into, as compared to the assumptions presented as a standalone supply option in TM5. Some variations in average annual supply volume should be expected across most supply options when they are combined into a portfolio. Significant changes in supply option assumptions between TM5 and TM6 are highlighted in **Table 2**.

The WRMP portfolio development and evaluation process was facilitated using the Integrated Planning (IP) Tool. The IP Tool is an evaluation platform with an Excel interface to access supply options, portfolios, evaluation criteria, and methods. IP Tool provides an interactive platform that allows ACWD staff to explore the sensitivities and basis for evaluating results to support ongoing portfolio analysis. This dynamic planning tool will allow ACWD to make as-needed adjustments to project options, portfolio composition, and evaluation criteria as conditions change in the future.

TABLE 1: WATER SUPPLY OPTIONS THAT MAKE UP EACH PORTFOLIO

Options	Portfolios													
	#1 - Increase Local Reliance - Small Changes (GW Treatment)	#2 - Increase Local Reliance + External Banking	#3 - Increase Local Reliance + Internal Banking	#4 - Increase Local Reliance - Medium Changes (GW Treatment & Optimization)	#5 - Increase Local Reliance - Enhanced Southern Service Area	#6 - Increase Local Reliance - Large Changes (GW Treatment, Optimization, & Desal)	#7 - Improve Imported Water Supply Reliability	#8 - Increased Environmental Stewardship (Multiple Benefits)	#9 - Develop Local Drought-Resilient Supply (Bay Desal)	#10 - Develop Local Drought-Resilient Supply (IPR)	#11 - Develop Local Drought-Resilient Supply (DPR)	#12A - Low Cost, Low Regret	#12B - Enhance12A with local option to address declining availability of imported supplies	#12C - Enhance12B to address Scenario C climate change
GW.1 Southern Groundwater Facility	☐	☐	☐	☐	☐	☑	☐	☐	☐	☐	☐	☐	☑	☑
GW.2 + GW.3 Revise Groundwater Rule Curves & Lower Minimum Operating Levels for the Niles Cone Groundwater Basin	☑	☑	☑	☐	☑	☑	☐	☑	☐	☐	☐	☑	☑	☑
GW.4 Enhanced Groundwater Treatment for PFAS and Hardness	☑	☐	☐	☑	☐	☑	☐	☑	☐	☐	☐	☑	☑	☑
GW.5 Optimize Newark Desalination Facility Operations	☐	☐	☐	☑	☐	☑	☐	☑	☐	☐	☐	☑	☑	☑
GW.6 Construct Southern Blending Facility	☐	☐	☐	☐	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐
IW.1 Groundwater Banking Outside Alameda Creek Watershed	☐	☑	☑	☐	☐	☐	☐	☐	☐	☐	☐	☑	☑	☑
IW.2 Regional Surface Water Storage	☐	☐	☐	☐	☐	☐	☑	☐	☐	☐	☐	☐	☐	☐
IW.3 New imported water supply from Yuba Water	☐	☑	☐	☐	☐	☐	☑	☐	☐	☐	☐	☑	☑	☑
IW.4 Sunol Aqueduct	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
IW.5 Groundwater Banking Inside Alameda Creek Watershed	☐	☐	☑	☐	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐
IW.6 Increase Peak Blending Capacity at Fremont Turnout	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
IW.7 Pretreatment Facility at EBMUD's Walnut Creek Water Treatment Plant	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
LW.1 Augment Wet Year Recharge and Expand ACWD Distribution	☑	☑	☑	☐	☑	☑	☐	☑	☐	☐	☐	☑	☑	☑
LW.2 Augment Wet Year Recharge and Construct SFPUC Intertie	☐	☐	☐	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
LW.3 Optimize and Enhance Del Valle Yields	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
LW.4 Regional Stormwater Capture	☐	☐	☐	☐	☐	☐	☐	☑	☐	☐	☐	☐	☐	☐
OW.1 Bay Water Desalination	☐	☐	☐	☐	☐	☐	☐	☐	☑	☐	☐	☐	☐	☐
PW.1 Indirect Potable Reuse with SFPUC Intertie	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
PW.2 Indirect Potable Reuse with Expanded ACWD Distribution	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
PW.3a Indirect Potable Reuse for Groundwater Recharge (Phase 1)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑
PW.3b Indirect Potable Reuse for Raw Water Augmentation (Phase 2)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
PW.3c Indirect Potable Reuse for Groundwater Recharge & Raw Water Augmentation (Phase 1 + Phase 2)	☐	☐	☐	☐	☐	☐	☐	☑	☐	☑	☐	☐	☐	☐
PW.4 Direct Potable Reuse	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑	☐	☐	☐
DM.1 Additional Water Use Efficiency	☐	☐	☐	☐	☐	☐	☐	☑	☐	☐	☐	☐	☑	☑
OI.1 Distribution System Improvements	☑	☑	☑	☑	☑	☑	☐	☑	☐	☐	☐	☐	☐	☐
OI.2 Mission San Jose Treatment Plant (TP1) Rehab	☐	☑	☐	☐	☐	☐	☑	☐	☐	☐	☐	☐	☐	☐

TABLE 2: SUPPLY OPTION DIFFERENCES BETWEEN TM5 AND TM6

Supply Option ID	TM5 Supply Option Name	Description of Changes in TM6
LW.1	Augment Wet Year Recharge and Expand ACWD Distribution	This option was renamed "Augment Wet Year Recharge" for TM6 because the "Expand ACWD Distribution" component was decoupled and reflected separately as water resource strategy OI.1 (Distribution System Improvements) with its own separate capital costs. In selected portfolio 12, LW.1 is implemented alone without OI.1 because other tandem supply projects are assumed to remove the hydraulic limitation addressed by OI.1.
GW.1	Groundwater Desalination	For consistency, in this TM this option has been renamed "Southern Groundwater Facility".
PW.3a	Indirect Potable Reuse for Groundwater Recharge (Phase 1)	Specifically when used in Portfolio 12C, this option is assumed to rely on RO treatment constructed previously in Phase 12A (as part of GW.4) and thus has a slightly reduced capital cost for Portfolio 12C.
DM.1	Additional Water Use Efficiency	In TM5, DM.1 is reported to have an average yield of just under 1,000 AFY. This value is based on an average yield across multiple years of ramped-up implementation. Once fully implemented in a 2050 supply portfolio, the full potential yield of this option is 1,500 AFY which is reflected in this TM.

2.2 Baseline Portfolio

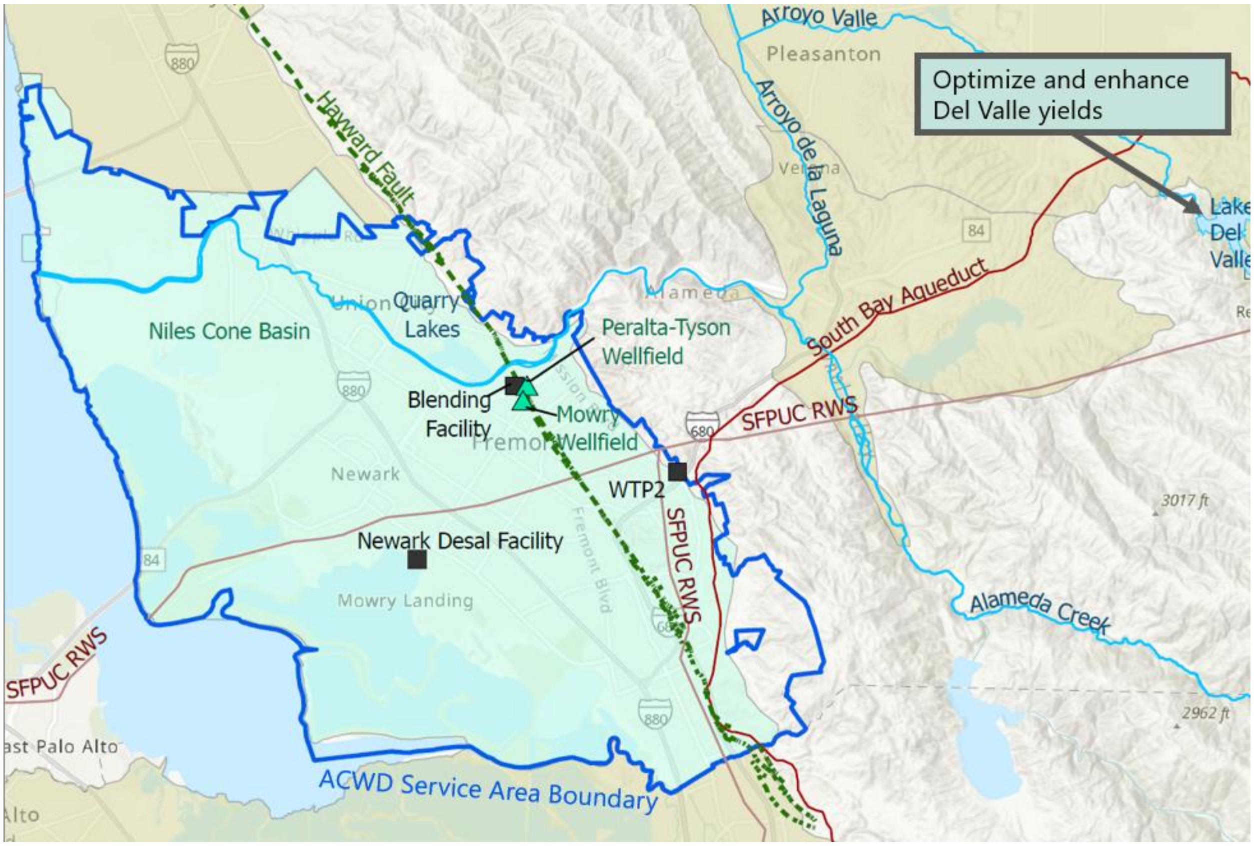
The Baseline Portfolio represents "business as usual" with no new supplies and no major changes to operations. The exception is the inclusion of "optimize and enhance Del Valle Yields" (LW.3) which ACWD is already beginning to implement, thus it was included in the baseline portfolio and in all other portfolios. **Figure 1** shows the basemap of ACWD's service area and surrounding region which will be used throughout **Section 2** to highlight the general location of the supply options contained within each portfolio. Key features of the basemap include:

- ACWD's service area – highlighted in the dark blue line
- The boundary of the Niles Cone Groundwater Basin (Niles Cone) – shown in the light green polygon
- Point locations of various ACWD facilities, including Newark Desal Facility, Water Treatment Plant 2 (WTP2), Quarry Lakes, Blending Facility, and wellfields.

Supply options are shown in labeled, colored rectangles, color-coded by supply type as follows:

- Groundwater
- Surface water
- Imported water
- Purified water
- Water use efficiency
- Desalinated water

FIGURE 1: BASELINE PORTFOLIO BASEMAP



The same future scenario conditions were evaluated for both the Baseline Portfolio and all other portfolios to better compare and contrast the impacts of each portfolio. Average annual supplies used in this portfolio are shown in **Table 3**.

TABLE 3: BASELINE PORTFOLIO AVERAGE ANNUAL SUPPLY UTILIZATION

Supply Source	Average Annual Volume
SFPUC (direct use)	12,700 AF
SWP (direct use)	9,700 AF
SWP (recharge)	3,700 AF
Lake Del Valle	5,300 AF
Groundwater[1]	12,700 AF

1. Groundwater includes naturally recharged stormwater and managed aquifer recharge (local watershed runoff that is diverted into the Quarry Lakes Recharge Ponds and in-channel impoundment area of Alameda Creek Flood Control Channel)

This portfolio has a total capital cost of $0 million (assumes no capital projects) and has an annual cost (including O&M and imported water purchase) of $52 million per year (in 2025 dollars), as shown in **Table 4**.

TABLE 4: BASELINE PORTFOLIO ANNUAL COST

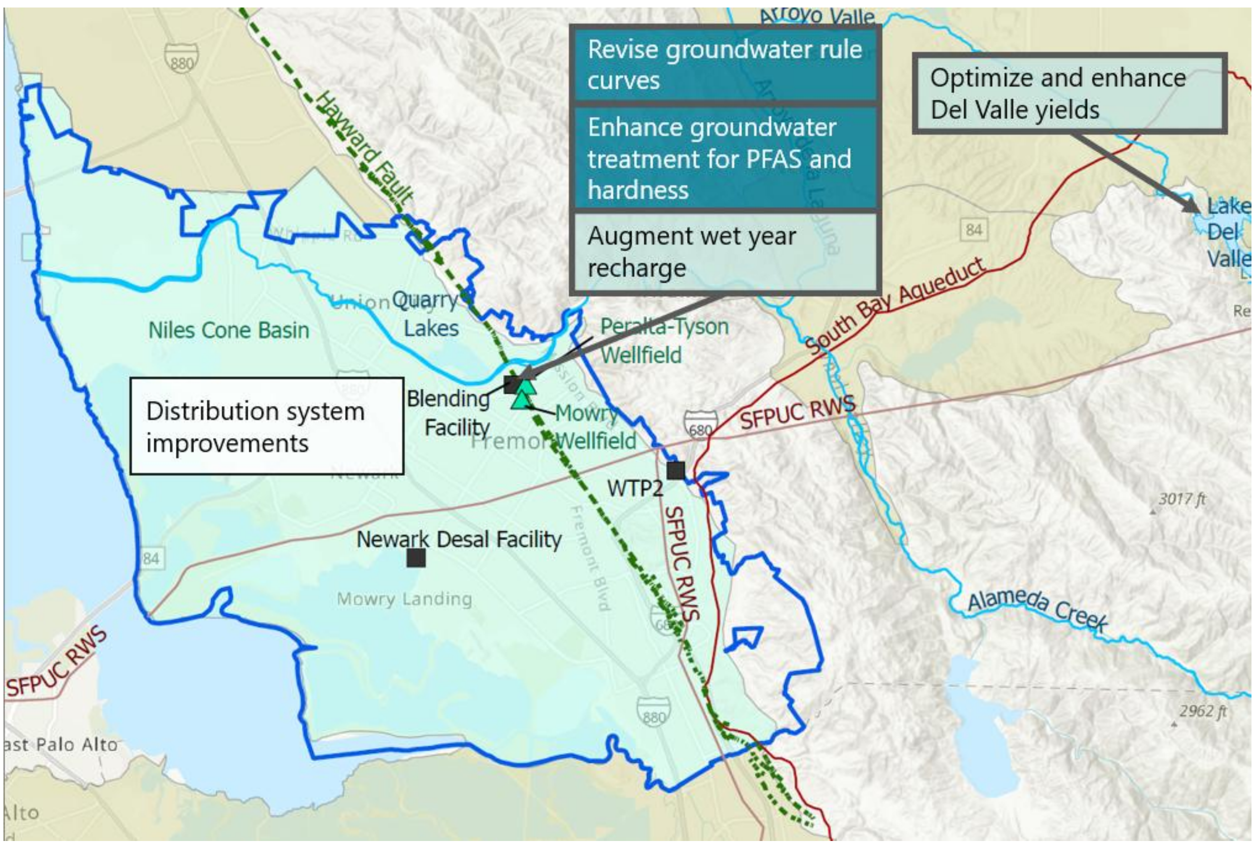
Annual Cost Component	Annual Cost (2025 $)
Groundwater pumping	$1.0M
Conveyance and distribution for new facilities	$-
Treatment Plant 2	$1.4M
Brackish Groundwater Desalination Treatment	$1.4M
PFAS Treatment	$1.4M
Blender	<$0.1M
New Full Time Equivalents	$-
Semitropic	$1.2M
SFPUC Water Purchase	$33.5M
SWP Water	$11.9M
Annual Cost	**$51.9M**

2.3 Portfolio 1: Increase Local Reliance – Small Changes

Portfolio 1 includes options that focus on increasing groundwater recharge and production by implementing options that are relatively easy to implement. Portfolio 1 includes the following supply options, as shown in **Figure 2:**

- Augment wet year recharge (LW.1)
- Optimize and enhance Del Valle Yields (LW.3)
- Revise groundwater rule curves (GW.2) & lower minimum operating levels (GW.3) in the Niles Cone Groundwater Basin
- Enhance groundwater treatment for per- and polyfluoroalkyl substances (PFAS) and hardness (GW.4)
- Distribution system improvements (OI.1)

FIGURE 2: PORTFOLIO 1 SUPPLY OPTIONS



Average annual supplies used in this portfolio are shown in **Table 5**. Modeling estimates that in an average year, imported water purchases will decrease from 26,100 acre-feet per year (AFY) under baseline conditions to 25,400 AFY with the implementation of options included in Portfolio 1. SFPUC purchases will decrease by approximately 600 AFY while SWP use will decrease by approximately 100 AFY. The increase in groundwater production will allow for increased recharge of SWP and local surface water supplies.

TABLE 5: PORTFOLIO 1 AVERAGE ANNUAL SUPPLY UTILIZATION

Supply Source	Average Annual Volume	Baseline Portfolio Average Annual Volume
SFPUC (direct use)	12,100 AF	12,700 AF
SWP (direct use)	7,900 AF	9,700 AF
SWP (recharge)	5,400 AF	3,700 AF
Lake Del Valle	5,200 AF	5,300 AF
Groundwater[1]	14,300 AF	12,700 AF

1. Groundwater includes naturally recharged stormwater and managed aquifer recharge (local watershed runoff that is diverted into the Quarry Lakes Recharge Ponds and in-channel impoundment area of Alameda Creek Flood Control Channel)

This portfolio has a total capital cost of $191 million (in 2025 dollars), as shown in **Table 6**, and has an annual cost (including O&M and imported water purchase) of $55 million per year (in 2025 dollars), as shown in **Table 7**.

TABLE 6: PORTFOLIO 1 CAPITAL COST

Supply Option	Capital Cost (2025 $)
Augment wet year recharge (LW.1)	$0
Optimize and enhance Del Valle Yields (LW.3)	$0
Revise groundwater rule curves (GW.2) & lower minimum operating levels in the Niles Cone Groundwater Basin (GW.3)	$0
Enhance groundwater treatment for PFAS and hardness (GW.4)	$151.2M
Distribution system improvements (OI.1)	$40.0M
Total Capital Cost	**$191.2M**

TABLE 7: PORTFOLIO 1 ANNUAL COST

Annual Cost Component	Annual Cost (2025 $)
Groundwater pumping	$1.2M
Conveyance and distribution for new facilities	$0.3M
Treatment Plant 2	$1.3M
Brackish Groundwater Desalination Treatment	$1.4M
PFAS Treatment	$3.6M
RO Treatment	$1.1M
Blender	<$0.1M
New Full Time Equivalents	$0.6M
Semitropic	$1.2M
SFPUC Water Purchase	$32.0M
SWP Water	$11.9M
Annual Cost	**$54.6M**

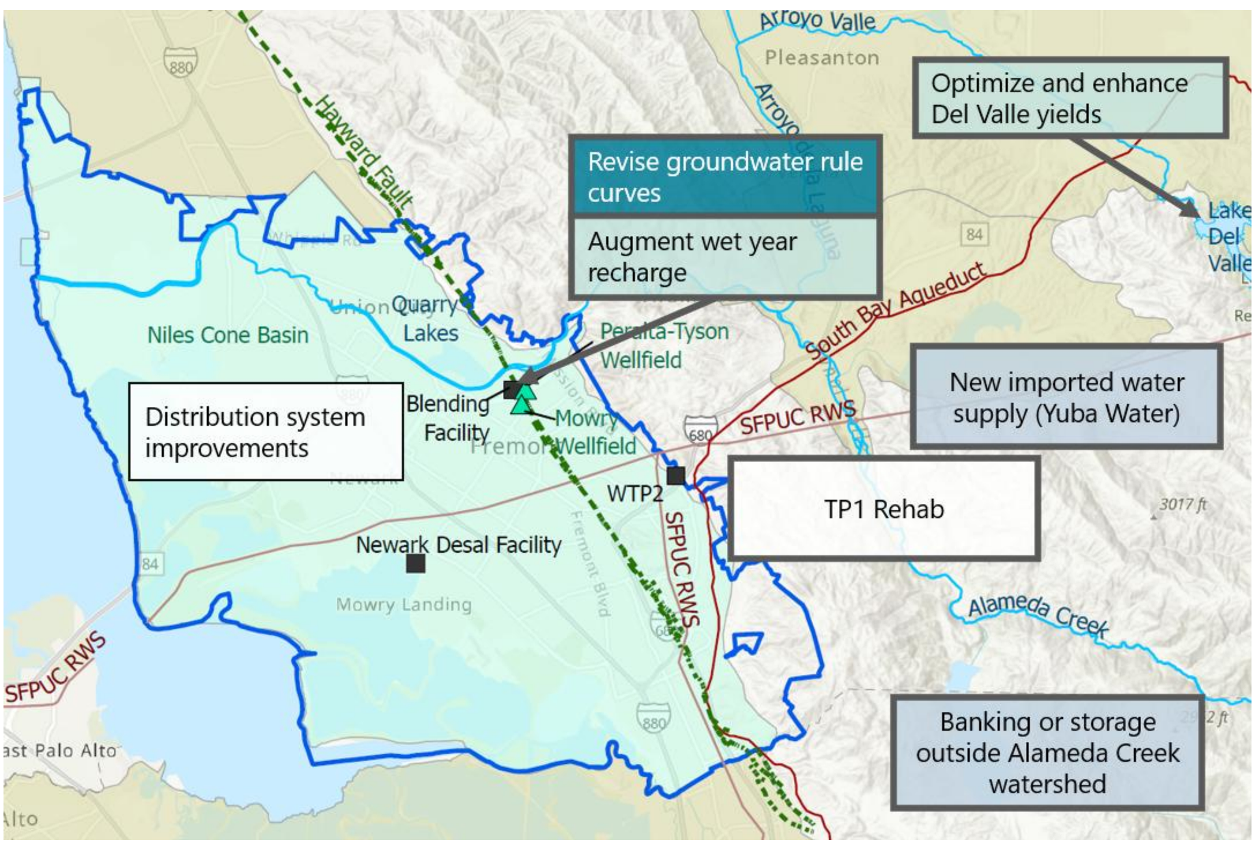
2.4 Portfolio 2: Increase Local Reliance + External Banking

Portfolio 2 includes options that focus on increasing groundwater recharge and production, but adds a new groundwater bank outside of the watershed which could be supplemented by a new imported water supply (Yuba Water). Portfolio 2 includes the following supply options:

- Revise groundwater rule curves (GW.2) & lower minimum operating levels (GW.3) in the Niles Cone Groundwater Basin Groundwater banking outside of Alameda Creek Watershed (IW.1)
- New imported water supply from Yuba Water (IW.3)
- Augment wet year recharge (LW.1)
- Optimize and enhance Del Valle Yields (LW.3)
- Distribution system improvements (OI.1)
- Mission San Jose Treatment Plant rehab (OI.2)

Portfolio 2 supply options are shown in **Figure 3.** Note that while this portfolio includes "Increase Local Reliance" in its themed title, it ultimately shows a net increase in imported water due to the addition of an external groundwater bank. The portfolio title is meant to indicate the similarity of Portfolio 2 to Portfolios 1-6 which all share a core component of increasing groundwater recharge and production.

FIGURE 3: PORTFOLIO 2 SUPPLY OPTIONS



Average annual supplies used in this portfolio are shown in **Table 8**. Modeling estimates that in an average year, imported water purchases will increase from 26,100 AFY under baseline conditions to 26,500 AFY with the implementation of options included in Portfolio 2. SFPUC purchases will decrease by approximately 600 AFY while SWP use will increase by approximately 1,000 AFY. Note that this portfolio puts more weight on imported and surface water supply and treatment, while groundwater production remains approximately the same.

TABLE 8: PORTFOLIO 2 AVERAGE ANNUAL SUPPLY UTILIZATION

Supply Source	Average Annual Volume	Baseline Portfolio Average Annual Volume
SFPUC (direct use)	12,100 AF	12,700 AF
SWP (direct use)	10,100 AF	9,700 AF
SWP (recharge)	4,300 AF	3,700 AF
Lake Del Valle	5,300 AF	5,300 AF
Groundwater[1]	12,600 AF	12,700 AF

1. Groundwater includes naturally recharged stormwater and managed aquifer recharge (local watershed runoff that is diverted into the Quarry Lakes Recharge Ponds and in-channel impoundment area of Alameda Creek Flood Control Channel)

This portfolio has a total capital cost of $92 million (in 2025 dollars), as shown in **Table 9**, and has an annual cost (including O&M and imported water purchase) of $50 million per year (in 2025 dollars), as shown in **Table 10**.

TABLE 9: PORTFOLIO 2 CAPITAL COST

Supply Option	Capital Cost (2025 $)
Augment wet year recharge (LW.1)	$0
Optimize and enhance Del Valle Yields (LW.3)	$0
Revise groundwater rule curves (GW.2) & lower minimum operating levels in the Niles Cone Groundwater Basin (GW.3)	$0
Groundwater Banking Outside Alameda Creek Watershed (IW.1)	$25.3M
New Imported Water Supply (from Yuba) (IW.3)	$0
Distribution system Improvements (OI.1)	$40.0M
Mission San Jose Treatment Plant rehab (OI.2)	$26.4M
Total Capital Cost	**$91.7M**

TABLE 10: PORTFOLIO 2 ANNUAL COST

Annual Cost Component	Annual Cost (2025 $)
Groundwater pumping	$1.0M
Conveyance and distribution for new facilities	$0.3M
Treatment Plant 2	$0.5M
Treatment Plant 1	$0.5M
Brackish Groundwater Desalination Treatment	$1.5M
PFAS Treatment	$1.4M
Blender	<$0.1M
New Full Time Equivalents	$0
Semitropic	$1.2M
New Groundwater Bank	$1.0M
SFPUC Water Purchase	$31.9M
SWP Water	$11.9M
Annual Cost	**$51.8M**

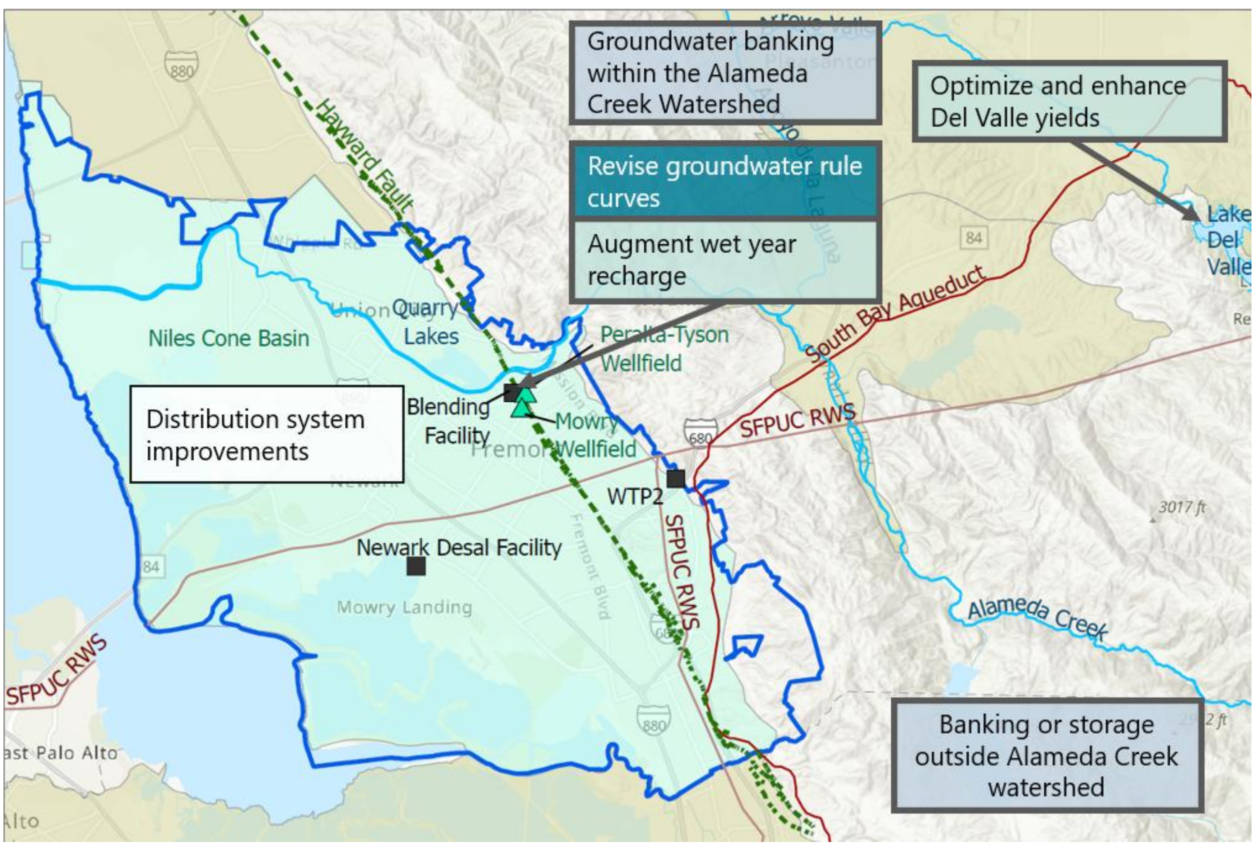
2.5 Portfolio 3: Increase Local Reliance + Internal Banking

Portfolio 3 is similar to Portfolio 2, but adds an additional groundwater bank inside the watershed in addition to the bank added outside the watershed. Together, these groundwater banks function to show the impact that a diverse set of groundwater banks have on long-term reliability. Portfolio 3 includes the following supply options, as shown in **Figure 4**:

- Revise groundwater rule curves (GW.2) & lower minimum operating levels (GW.3) in the Niles Cone Groundwater Basin Groundwater banking outside of Alameda Creek Watershed (IW.1)
- Groundwater banking inside of Alameda Creek Watershed (IW.5)
- Augment wet year recharge (LW.1)
- Optimize and enhance Del Valle Yields (LW.3)
- Distribution system improvements (OI.1)

Note that while this portfolio includes "Increase Local Reliance" in its themed title, it ultimately shows a net increase in imported water due to the addition of both internal and external groundwater banks. The portfolio title is meant to indicate the similarity of Portfolio 3 to Portfolios 1-6 which all share a core component of increasing groundwater recharge and production.

FIGURE 4: PORTFOLIO 3 SUPPLY OPTIONS



Average annual supplies used in this portfolio are shown in **Table 11.** Modeling estimates that in an average year, imported water purchases will increase from 26,100 AFY under baseline conditions to 26,700 AFY with the implementation of options included in Portfolio 3. SFPUC purchases will decrease by approximately 900 AFY while SWP use will increase by approximately 1,500 AFY. Note that this portfolio puts more weight on imported and surface water supply and treatment. While the groundwater row in table below decreases somewhat, more water is used for recharge (banking).

TABLE 11: PORTFOLIO 3 AVERAGE ANNUAL SUPPLY UTILIZATION

Supply Source	Average Annual Volume	Baseline Portfolio Average Annual Volume
SFPUC (direct use)	11,800 AF	12,700 AF
SWP (direct use)	10,200 AF	9,700 AF
SWP (recharge)	4,700 AF	3,700 AF
Lake Del Valle	5,300 AF	5,300 AF
Groundwater[1]	12,300 AF	12,700 AF

1. Groundwater includes naturally recharged stormwater and managed aquifer recharge (local watershed runoff that is diverted into the Quarry Lakes Recharge Ponds and in-channel impoundment area of Alameda Creek Flood Control Channel)

This portfolio has a total capital cost of $316 million (in 2025 dollars), as shown in **Table 12**, and has an annual cost (including O&M and imported water purchase) of $58 million per year (in 2025 dollars), as shown in **Table 13**.

TABLE 12: PORTFOLIO 3 CAPITAL COST

Supply Option	Capital Cost (2025 $)
Augment wet year recharge (LW.1)	$0
Optimize and enhance Del Valle Yields (LW.3)	$0
Revise groundwater rule curves (GW.2) & lower minimum operating levels in the Niles Cone Groundwater Basin (GW.3)	$0
Groundwater Banking Outside Alameda Creek Watershed (IW.1)	$25.3M
Groundwater Banking Inside Alameda Creek Watershed (IW.5)	$251.1M
Distribution system improvements (OI.1)	$40.0M
Total Capital Cost	**$316.4M**

TABLE 13: PORTFOLIO 3 ANNUAL COST

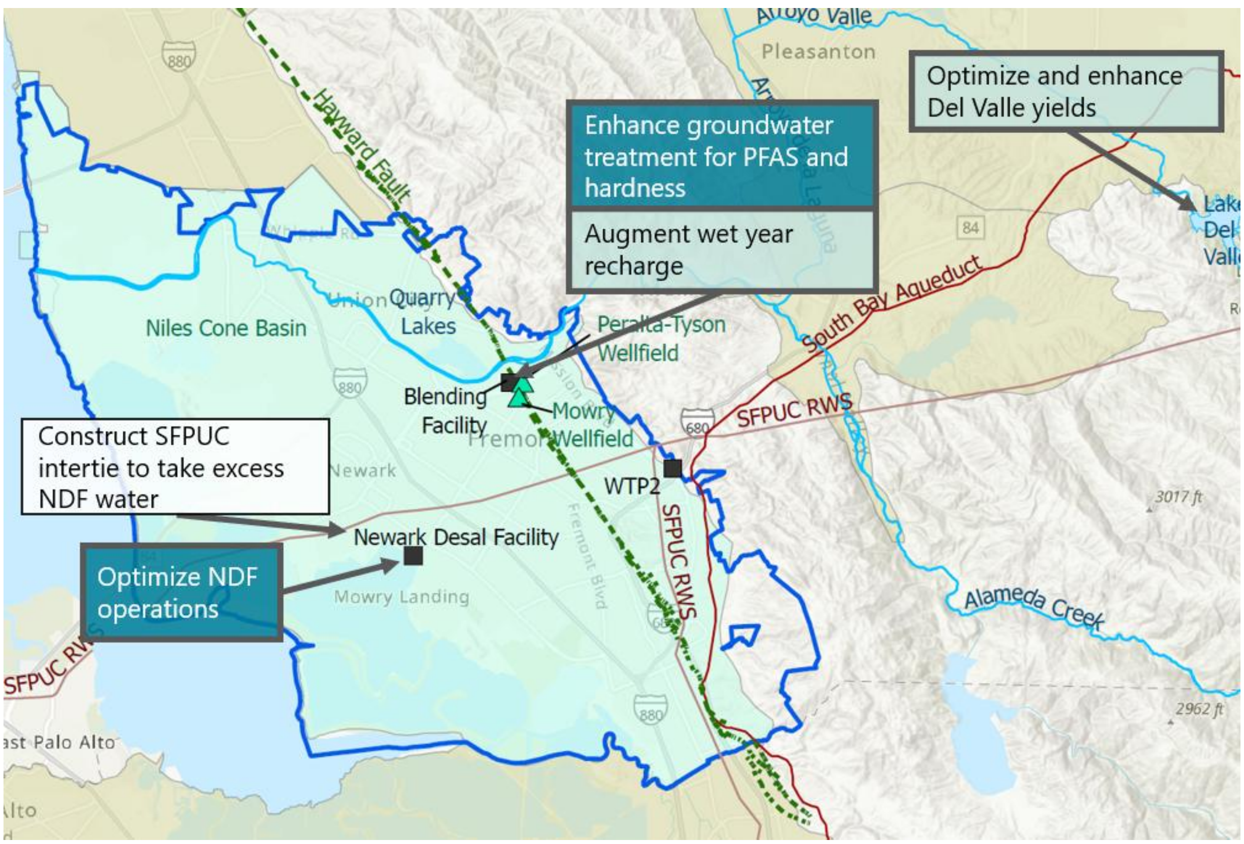
Annual Cost Component	Annual Cost (2025 $)
Groundwater pumping	$1.1M
Conveyance and distribution for new facilities	$1.9M
Treatment Plant 2	$1.5M
Brackish Groundwater Desalination Treatment	$1.6M
PFAS Treatment	$1.4M
Blender	<$0.1M
New Full Time Equivalents	$0.6M
Semitropic	$1.2M
New External Groundwater Bank	$1.0M
New Internal Groundwater Bank	$2.7M
SFPUC Water Purchase	$31.2M
SWP Water	$11.9M
New Imported Water	$1.9M
Annual Cost	**$58.0M**

2.6 Portfolio 4: Increase Local Reliance – Medium Changes (Groundwater Treatment & optimization)

Portfolio 4 includes options that focus on increasing local groundwater recharge and production by implementing two options that involve facility changes that increase groundwater production. This portfolio demonstrates the impact of making facility changes without making the other basin management/operational changes found in similar Portfolios 1, 2, 3, 5, and 6. Portfolio 4 includes the following supply options, as shown in **Figure 5**:

- Enhanced groundwater treatment for PFAS and hardness (GW.4)
- Optimize Newark Desalination Facility operations (GW.5)
- Augment wet year recharge and construct SFPUC intertie (LW.2)
- Optimize and enhance Del Valle Yields (LW.3)
- Distribution system improvements (OI.1)

FIGURE 5: PORTFOLIO 4 SUPPLY OPTIONS



Average annual supplies used in this portfolio are shown in **Table 14.** Modeling estimates that in an average year, imported water purchases will decrease from 26,100 AFY under baseline conditions to 22,200 AFY with the implementation of options included in Portfolio 4. SFPUC purchases will decrease by approximately

3,300 AFY while SWP use will decrease by approximately 600 AFY. The increase in groundwater production will allow for increased recharge of SWP and local surface water supplies.

TABLE 14: PORTFOLIO 4 AVERAGE ANNUAL SUPPLY UTILIZATION

Supply Source	Average Annual Volume	Baseline Portfolio Average Annual Volume
SFPUC (direct use)	9,400 AF	12,700 AF
SWP (direct use)	5,500 AF	9,700 AF
SWP (recharge)	7,300 AF	3,700 AF
Lake Del Valle	4,800 AF	5,300 AF
Groundwater[1]	17,600 AF	12,700 AF

1. Groundwater includes naturally recharged stormwater and managed aquifer recharge (local watershed runoff that is diverted into the Quarry Lakes Recharge Ponds and in-channel impoundment area of Alameda Creek Flood Control Channel)

This portfolio has a total capital cost of $225 million (in 2025 dollars), as shown in **Table 15**, and has an annual cost (including O&M and imported water purchase) of $48 million per year (in 2025 dollars), as shown in **Table 16**.

TABLE 15: PORTFOLIO 4 CAPITAL COST

Supply Option	Capital Cost (2025 $)
Enhanced groundwater treatment for PFAS and hardness (GW.4)	$151.2M
Optimize Newark Desalination Facility operations (GW.5)	$0.4M
Augment wet year recharge and construct SFPUC intertie (LW.2)	$32.9M
Optimize and enhance Del Valle Yields (LW.3)	$0
Distribution system improvements (OI.1)	$40.0M
Total Capital Cost	**$224.5M**

TABLE 16: PORTFOLIO 4 ANNUAL COST

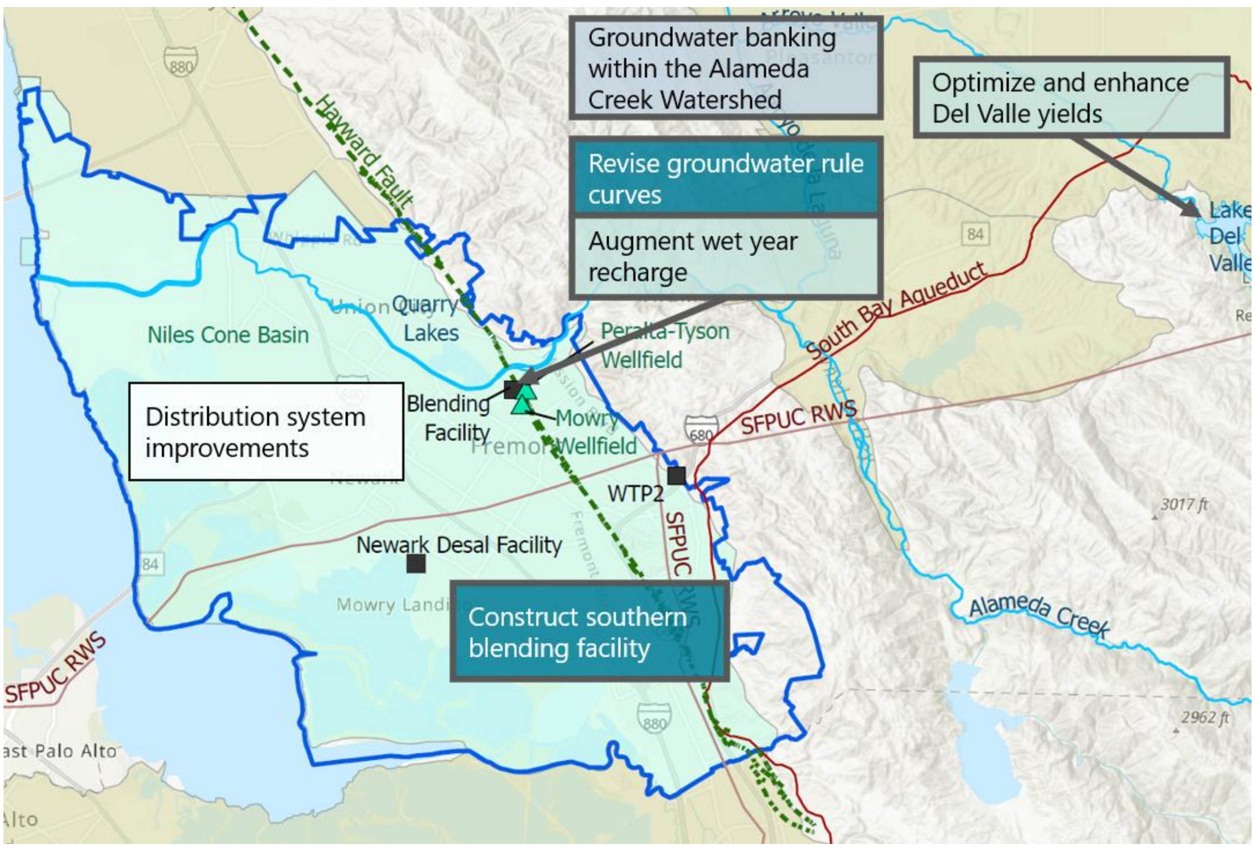
Annual Cost Component	Annual Cost (2025 $)
Groundwater pumping	$1.4M
Conveyance and distribution for new facilities	$0.9M
Treatment Plant 2	$1.0M
Brackish Groundwater Desalination Treatment	$1.7M
PFAS Treatment	$3.6M
RO Treatment	$1.1M
Blender	<$0.1M
New Full Time Equivalents	$0.6M
Semitropic	$1.2M
SFPUC Water Purchase	$24.8M
SWP Water	$11.9M
Annual Cost	**$48.3M**

2.7 Portfolio 5: Increase Local Reliance – Enhanced Southern Service Area

Portfolio 5 includes options that focus on increasing local groundwater recharge and production in the southern service area. Primarily, this involves the development of a new water supply in this region; ACWD is currently conducting a study to determine more information about this opportunity. This portfolio assumes the southern groundwater facility will involve blending with SFPUC supply to achieve water quality goals. Portfolio 5 includes the following supply options, as shown in **Figure 6**:

- Revise groundwater rule curves (GW.2) & lower minimum operating levels (GW.3) in the Niles Cone Groundwater Basin Construct Southern Blending Facility (GW.6)
- Groundwater banking inside Alameda Creek Watershed (IW.5)
- Augment wet year recharge (LW.1)
- Optimize and enhance Del Valle Yields (LW.3)
- Distribution system improvements (OI.1)

FIGURE 6: PORTFOLIO 5 SUPPLY OPTIONS



Average annual supplies used in this portfolio are shown in **Table 17.** Modeling estimates that in an average year, imported water purchases will increase from 26,100 AFY under baseline conditions to 27,200 AFY with the implementation of options included in Portfolio 5. SFPUC purchases will remain approximately the same while SWP use will increase by approximately 1,200 AFY. The increase in groundwater production will allow for increased recharge of SWP and local surface water supplies.

TABLE 17: PORTFOLIO 5 AVERAGE ANNUAL SUPPLY UTILIZATION

Supply Source	Average Annual Volume	Baseline Portfolio Average Annual Volume
SFPUC (direct use)	12,600 AF	12,700 AF
SWP (direct use)	9,300 AF	9,700 AF
SWP (recharge)	5,300 AF	3,700 AF
Lake Del Valle	5,400 AF	5,300 AF
Groundwater[1]	13,500 AF	12,700 AF

1. Groundwater includes naturally recharged stormwater and managed aquifer recharge (local watershed runoff that is diverted into the Quarry Lakes Recharge Ponds and in-channel impoundment area of Alameda Creek Flood Control Channel)

This portfolio has a total capital cost of $335 million (in 2025 dollars), as shown in **Table 18**, and has an annual cost (including O&M and imported water purchase) of $56 million per year (in 2025 dollars), as shown in **Table 19**.

TABLE 18: PORTFOLIO 5 CAPITAL COST

Supply Option	Capital Cost (2025 $)
Revise groundwater rule curves (GW.2) & lower minimum operating levels in the Niles Cone Groundwater Basin (GW.3)	$0
Construct Southern Blending Facility (GW.6)	$43.9M
Groundwater banking Inside Alameda Creek Watershed (IW.5)	$251.1M
Augment wet year recharge (LW.1)	$0
Optimize and enhance Del Valle Yields (LW.3)	$0
Distribution system improvements (OI.1)	$40.0M
Total Capital Cost	**$335.0M**

TABLE 19: PORTFOLIO 5 ANNUAL COST

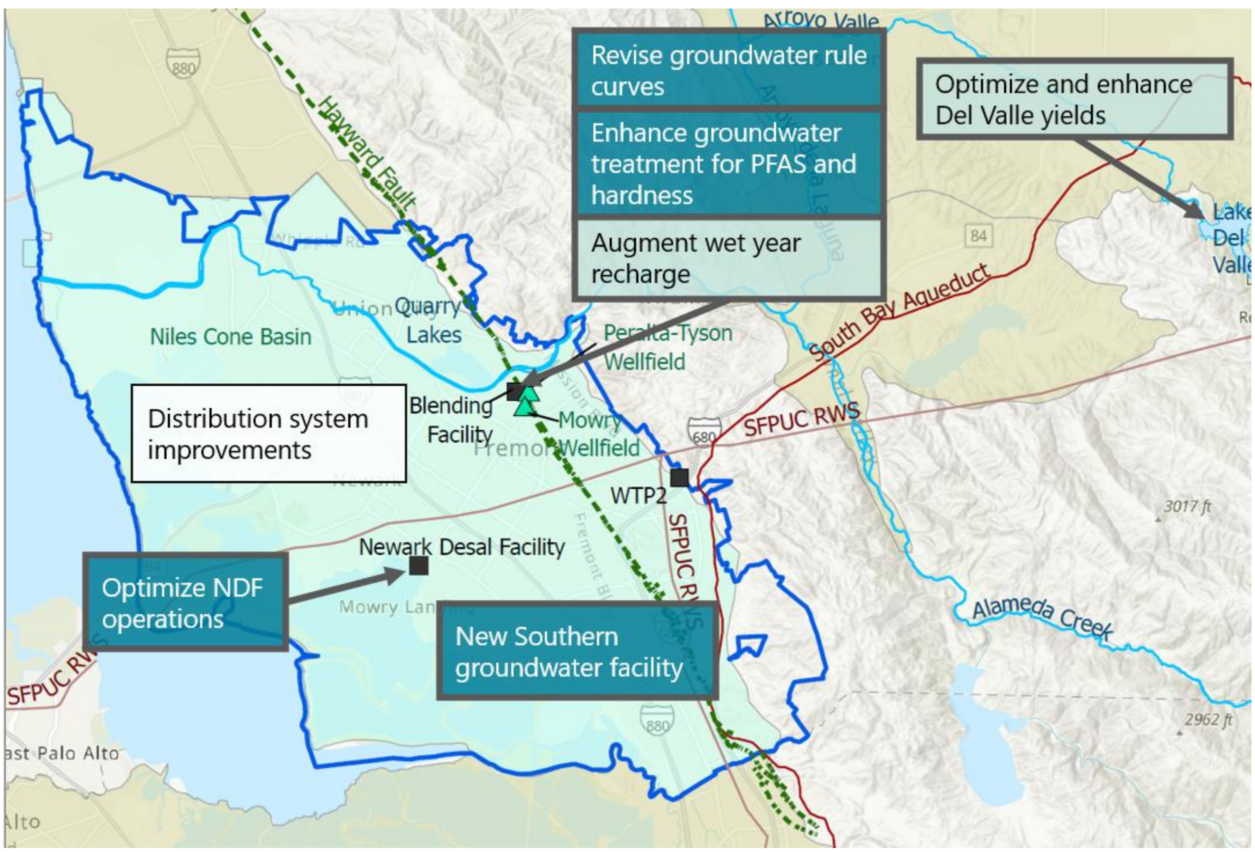
Annual Cost Component	Annual Cost (2025 $)
Groundwater pumping	$1.2M
Conveyance and distribution for new facilities	$2.1M
Treatment Plant 2	$1.4M
Brackish Groundwater Desalination Treatment	$1.6M
PFAS Treatment	$1.4M
Blender	<$0.1M
New Full Time Equivalents	$1.3M
Semitropic	$1.2M
SFPUC Water Purchase	$33.4M
SWP Water	$11.9M
Annual Cost	**$55.5M**

2.8 Portfolio 6: Increase Local Reliance – Large Changes (Groundwater Treatment, Optimization, & Desalination)

Portfolio 6 represents the most involved portfolio amongst the series of portfolios named "Increase Local Reliance" because it involves the core operational changes common to Portfolios 1-3 and 5, plus the two facility improvements in Portfolio 4, and adds a new groundwater desalination facility in the southern service area that further expands the ability to use local groundwater supplies. Portfolio 6 includes the following supply options, as shown in **Figure 7**:

- Southern Groundwater Facility with an assumed 2,800 AFY new groundwater yield (GW.1)
- Revise groundwater rule curves (GW.2) & lower minimum operating levels (GW.3) in the Niles Cone Groundwater Basin Enhanced groundwater treatment for PFAS and hardness (GW.4)
- Optimize Newark Desalination Facility operations (GW.5)
- Augment wet year recharge (LW.1)
- Optimize and enhance Del Valle Yields (LW.3)
- Distribution System Improvements (OI.1)

FIGURE 7: PORTFOLIO 6 SUPPLY OPTIONS



Average annual supplies used in this portfolio are shown in **Table 20.** Modeling estimates that in an average year, imported water purchases will decrease from 26,100 AFY under baseline conditions to 22,200 AFY with the implementation of options included in Portfolio 6. SFPUC purchases will decrease by approximately 3,300 AFY while SWP use will decrease by approximately 600 AFY. The increase in groundwater production will allow for increased recharge of SWP and local surface water supplies.

TABLE 20: PORTFOLIO 6 AVERAGE ANNUAL SUPPLY UTILIZATION

Supply Source	Average Annual Volume	Baseline Portfolio Average Annual Volume
SFPUC (direct use)	9,400 AF	12,700 AF
SWP (direct use)	5,500 AF	9,700 AF
SWP (recharge)	7,300 AF	3,700 AF
Lake Del Valle	4,800 AF	5,300 AF
Groundwater[1]	17,600 AF	12,700 AF

1. Groundwater includes naturally recharged stormwater and managed aquifer recharge (local watershed runoff that is diverted into the Quarry Lakes Recharge Ponds and in-channel impoundment area of Alameda Creek Flood Control Channel)

This portfolio has a total capital cost of $370 million (in 2025 dollars), as shown in **Table 21**, and has an annual cost (including O&M and imported water purchase) of $50 million per year (in 2025 dollars), as shown in **Table 22**.

TABLE 21: PORTFOLIO 6 CAPITAL COST

Supply Option	Capital Cost (2025 $)
Southern Groundwater Facility (GW.1)	$178.7M
Revise groundwater rule curves (GW.2) & lower minimum operating levels in the Niles Cone Groundwater Basin (GW.3)	$0
Enhanced groundwater treatment for PFAS and hardness (GW.4)	$151.2M
Optimize Newark Desalination Facility operations (GW.5)	$0.4M
Augment wet year recharge (LW.1)	$0
Optimize and enhance Del Valle Yields (LW.3)	$0
Distribution System Improvements (OI.1)	$40.0M
Total Capital Cost	**$370.3M**

TABLE 22: PORTFOLIO 6 ANNUAL COST

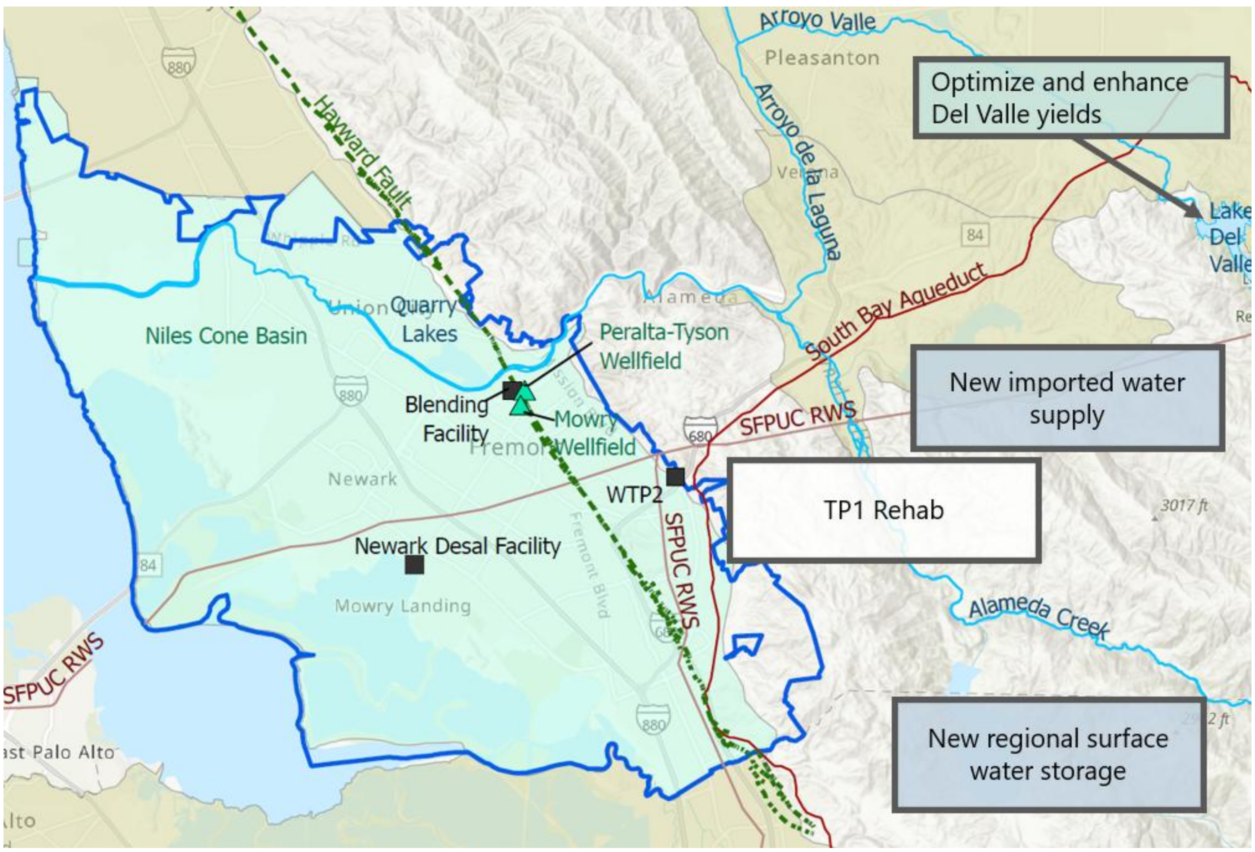
Annual Cost Component	Annual Cost (2025 $)
Groundwater pumping	$1.4M
Conveyance and distribution for new facilities	$0.8M
Treatment Plant 2	$1.0M
Brackish Groundwater Desalination Treatment	$1.7M
PFAS Treatment	$3.6M
RO Treatment	$2.2M
Blender	<$0.1M
New Full Time Equivalents	$1.3M
Semitropic	$1.2M
SFPUC Water Purchase	$24.8M
SWP Water	$11.9M
Annual Cost	**$49.9M**

2.9 Portfolio 7: Improve Imported Water Supply Reliability

Rather than enhancing local supplies, Portfolio 7 represents a theme of “shoring up” the reliability of the existing imported water system by investing in a new imported water supply, regional surface water storage to capture excess wet year water, and rehabilitating ACWD’s Water Treatment Plant 1. Portfolio 7 includes the following supply options, as shown in **Figure 8**:

- Regional surface water storage (IW.2)
- New imported supply (IW.3)
- Optimize and enhance Del Valle Yields (LW.3)
- Mission San Jose Treatment Plant rehab (OI.2)

FIGURE 8: PORTFOLIO 7 SUPPLY OPTIONS



Average annual supplies used in this portfolio are shown in **Table 23.** Modeling estimates that in an average year, imported water purchases will increase from 26,100 AFY under baseline conditions to 26,800 AFY with the implementation of options included in Portfolio 7. SFPUC purchases will decrease by approximately 1,500 AFY while SWP use will increase by approximately 2,200 AFY.

TABLE 23: PORTFOLIO 7 AVERAGE ANNUAL SUPPLY UTILIZATION

Supply Source	Average Annual Volume	Baseline Portfolio Average Annual Volume
SFPUC (direct use)	11,200 AF	12,700 AF
SWP (direct use)	10,600 AF	9,700 AF
SWP (recharge)	5,000 AF	3,700 AF
Lake Del Valle	5,400 AF	5,300 AF
Groundwater[1]	12,000 AF	12,700 AF

1. Groundwater includes naturally recharged stormwater and managed aquifer recharge (local watershed runoff that is diverted into the Quarry Lakes Recharge Ponds and in-channel impoundment area of Alameda Creek Flood Control Channel)

This portfolio has a total capital cost of $26 million (in 2025 dollars), as shown in **Table 24**, and has an annual cost (including O&M and imported water purchase) of $49 million per year (in 2025 dollars), as shown in **Table 25**.

TABLE 24: PORTFOLIO 7 CAPITAL COST

Supply Option	Capital Cost (2025 $)
Regional surface water storage (IW.2)	$0
New imported supply (IW.3)	$0
Optimize and enhance Del Valle Yields (LW.3)	$0
Mission San Jose Treatment Plant rehab (OI.2)	$26.4M
Total Capital Cost	**$26.4M**

TABLE 25: PORTFOLIO 7 ANNUAL COST

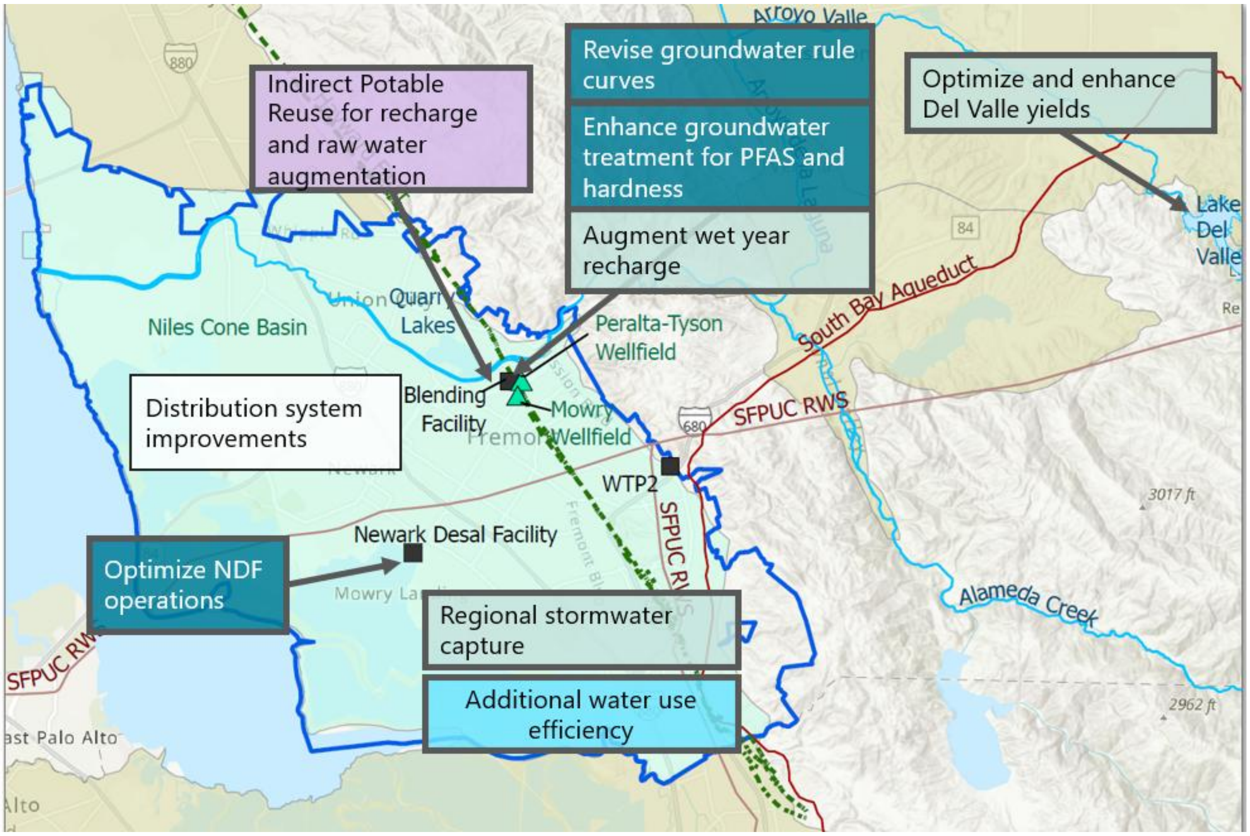
Annual Cost Component	Annual Cost (2025 $)
Groundwater pumping	$1.1M
Conveyance and distribution for new facilities	$0
Treatment Plant 2	$0.5M
Treatment Plant 1	$1.0M
Brackish Groundwater Desalination Treatment	$1.6M
PFAS Treatment	$1.4M
Blender	<$0.1M
New Full Time Equivalents	$0
Semitropic	$1.2M
SFPUC Water Purchase	$29.5M
SWP Water	$11.9M
New Imported Water	$0.5M
Annual Cost	**$48.8M**

2.10 Portfolio 8: Increased Environmental Stewardship (Multiple Benefits)

Portfolio 8 contains the largest number of water supply options, focusing on implementing a suite of options that all function to provide multiple benefits to ACWD, its customers, regional partners, and the environment. For example, in addition to expanded sustainable operations of the groundwater basin, the Portfolio adds purified water which reuses an otherwise discarded resource and reduces discharges of treated wastewater to the environment. Purified water is recharged into the groundwater system so it can later be pumped and treated before entering the distribution system (also known as indirect potable reuse or IPR). This portfolio also includes increased water use efficiency (decrease demands on natural resources) and regional stormwater capture (reduce the environmental impact of quantity and quality of runoff during storm events). Portfolio 8 includes the following supply options, as shown in **Figure 9**:

- Revise groundwater rule curves (GW.2) & lower minimum operating levels (GW.3) in the Niles Cone Groundwater Basin Enhanced groundwater treatment for PFAS and hardness (GW.4)
- Optimize Newark Desalination Facility operations (GW.5)
- Augment wet year recharge (LW.1)
- Optimize and enhance Del Valle Yields (LW.3)
- Regional Storm Water Capture (LW.4)
- Indirect Potable Reuse for Groundwater Recharge & Raw Water Augmentation (PW.3c)
- Additional Water Use Efficiency (DM.1)
- Distribution System Improvements (OI.1)

FIGURE 9: PORTFOLIO 8 SUPPLY OPTIONS



Average annual supplies used in this portfolio are shown in **Table 26.** Modeling estimates that in an average year, imported water purchases will decrease from 26,100 AFY under baseline conditions to 15,600 AFY with the implementation of options included in Portfolio 8. SFPUC purchases will decrease by approximately 5,900 AFY while SWP use will decrease by approximately 4,600 AFY. The increase in groundwater production will allow for increased recharge of SWP and local surface water supplies.

TABLE 26: PORTFOLIO 8 AVERAGE ANNUAL SUPPLY UTILIZATION

Supply Source	Average Annual Volume	Baseline Portfolio Average Annual Volume
SFPUC (direct use)	6,800 AF	12,700 AF
SWP (direct use)	2,700 AF	9,700 AF
SWP (recharge)	6,100 AF	3,700 AF
Lake Del Valle	4,200 AF	5,300 AF
Groundwater[1]	12,900 AF	12,700 AF
Purified Water (raw water augmentation)	5,000 AF	N/A
Purified Water (recharge)	6,100 AF	N/A
Additional Water Use Efficiency	1,500 AF	N/A

1. Groundwater includes naturally recharged stormwater and managed aquifer recharge (local watershed runoff that is diverted into the Quarry Lakes Recharge Ponds and in-channel impoundment area of Alameda Creek Flood Control Channel)

This portfolio has a total capital cost of $928 million (in 2025 dollars), as shown in **Table 27**, and has an annual cost (including O&M and imported water purchase) of $56 million per year (in 2025 dollars), as shown in **Table 28**.

TABLE 27: PORTFOLIO 8 CAPITAL COST

Supply Option	Capital Cost (2025 $)
Revise groundwater rule curves (GW.2) & lower minimum operating levels in the Niles Cone Groundwater Basin (GW.3)	$0
Enhanced groundwater treatment for PFAS and hardness (GW.4)	$151.2M
Optimize Newark Desalination Facility operations (GW.5)	$0.4M
Augment wet year recharge (LW.1)	$0
Optimize and enhance Del Valle Yields (LW.3)	$0
Regional Storm Water Capture (LW.4)	$0
Indirect Potable Reuse for Groundwater Recharge & Raw Water Augmentation (PW.3c)	$735.9M
Additional Water Use Efficiency (DM.1)	$0
Distribution System Improvements (OI.1)	$40.0M
Total Capital Cost	**$927.5M**

TABLE 28: PORTFOLIO 8 ANNUAL COST

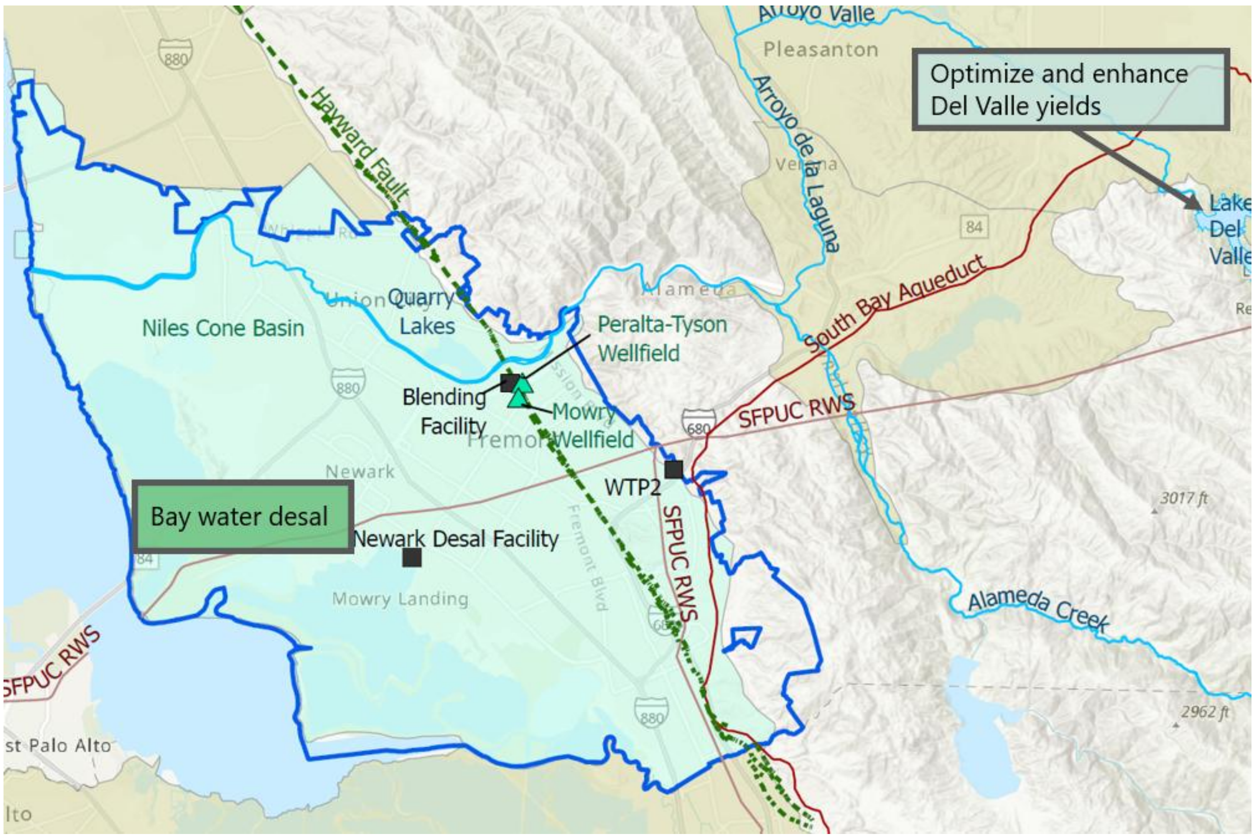
Annual Cost Component	Annual Cost (2025 $)
Groundwater pumping	$1.4M
Conveyance and distribution for new facilities	$5.6M
Treatment Plant 2	$0.7M
Brackish Groundwater Desalination Treatment	$1.5M
PFAS Treatment	$3.6M
RO Treatment	$1.1M
Purified Water Treatment	$7.9M
Blender	<$0.1M
New Full Time Equivalents	$1.9M
Semitropic	$1.2M
Additional Water Use Efficiency	$1.3M
SFPUC Water Purchase	$17.9M
SWP Water	$11.9M
Annual Cost	**$56.0M**

2.11 Portfolio 9: Develop Local Drought-Resilient Supply (Bay Desal)

Portfolios 9, 10, and 11 each involve the addition of one large new water supply that provides a consistent source of supply, even during droughts. Each portfolio allows for independent evaluation of the impact of this new supply for comparison to other new supply types. Portfolio 9 adds a San Francisco Bay water desalination supply. Portfolio 9 includes the following supply options, as shown in **Figure 10**:

- Optimize and enhance Del Valle Yields (LW.3)
- Bay Water Desalination (OW.1)

FIGURE 10: PORTFOLIO 9 SUPPLY OPTIONS



Average annual supplies used in this portfolio are shown in **Table 29.** Modeling estimates that in an average year, imported water purchases will decrease from 26,100 AFY under baseline conditions to 21,900 AFY with the implementation of options included in Portfolio 9. SFPUC purchases will decrease by approximately 3,800 AFY while SWP use will decrease by approximately 400 AFY.

TABLE 29: PORTFOLIO 9 AVERAGE ANNUAL SUPPLY UTILIZATION

Supply Source	Average Annual Volume	Baseline Portfolio Average Annual Volume
SFPUC (direct use)	8,900 AF	12,700 AF
SWP (direct use)	9,900 AF	9,700 AF
SWP (recharge)	3,100 AF	3,700 AF
Lake Del Valle	5,300 AF	5,300 AF
Groundwater[1]	10,300 AF	12,700 AF
Desalinated Bay Water	7,400 AF	N/A

1. Groundwater includes naturally recharged stormwater and managed aquifer recharge (local watershed runoff that is diverted into the Quarry Lakes Recharge Ponds and in-channel impoundment area of Alameda Creek Flood Control Channel)

This portfolio has a total capital cost of $660 million (in 2025 dollars), as shown in **Table 30**, and has an annual cost (including O&M and imported water purchase) of $58 million per year (in 2025 dollars), as shown in **Table 31**.

TABLE 30: PORTFOLIO 9 CAPITAL COST

Supply Option	Capital Cost (2025 $)
Optimize and enhance Del Valle Yields (LW.3)	$0
Bay Water Desal (OW.1)	$660.0M
Total Capital Cost	**$660.0M**

TABLE 31: PORTFOLIO 9 ANNUAL COST

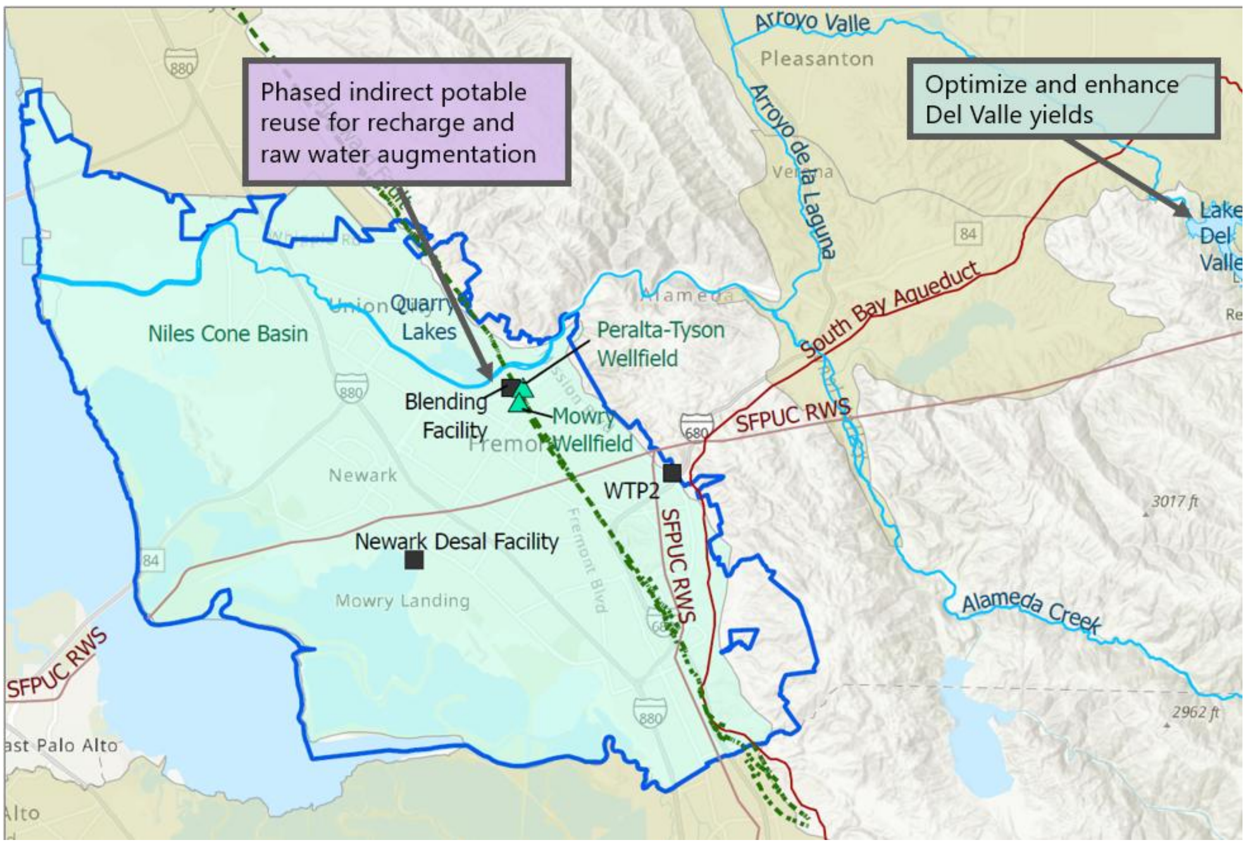
Annual Cost Component	Annual Cost (2025 $)
Groundwater pumping	$0.8M
Conveyance and distribution for new facilities	$0
Treatment Plant 2	$1.5M
Brackish Groundwater Desalination Treatment	$1.3M
PFAS Treatment	$1.4M
Desalination	$15.4M
Blender	<$0.1M
New Full Time Equivalents	$0.6M
Semitropic	$1.2M
SFPUC Water Purchase	$23.6M
SWP Water	$11.9M
Annual Cost	**$57.8M**

2.12 Portfolio 10: Develop Local Drought-Resilient Supply (IPR)

Portfolios 9, 10, and 11 each involve the addition of one large new water supply that provides a consistent source of supply, even during droughts. Each portfolio allows for independent evaluation of the impact of this new supply for comparison to other new supply types. Portfolio 10 adds a project that recharges purified water into the groundwater system so it can later be pumped and treated before entering the distribution system (also known as indirect potable reuse or IPR). Portfolio 10 includes the following supply options, as shown in **Figure 11**:

- Optimize and enhance Del Valle Yields (LW.3)
- Indirect Potable Reuse for groundwater recharge and raw water augmentation (PW.3c)

FIGURE 11: PORTFOLIO 10 SUPPLY OPTIONS



Average annual supplies used in this portfolio are shown in **Table 32.** Modeling estimates that in an average year, imported water purchases will decrease from 26,100 AFY under baseline conditions to 17,700 AFY with the implementation of options included in Portfolio 10. SFPUC purchases will decrease by approximately 4,100 AFY while SWP use will decrease by approximately 4,300 AFY. The increase in groundwater production will allow for increased recharge of SWP and local surface water and purified water supplies.

TABLE 32: PORTFOLIO 10 AVERAGE ANNUAL SUPPLY UTILIZATION

Supply Source	Average Annual Volume	Baseline Portfolio Average Annual Volume
SFPUC (direct use)	8,600 AF	12,700 AF
SWP (direct use)	3,200 AF	9,700 AF
SWP (recharge)	5,900 AF	3,700 AF
Lake Del Valle	4,300 AF	5,300 AF
Groundwater[1]	11,800 AF	12,700 AF
Purified Water (raw water augmentation)	5,000 AF	N/A
Purified Water (recharge)	6,100 AF	N/A

1. Groundwater includes naturally recharged stormwater and managed aquifer recharge (local watershed runoff that is diverted into the Quarry Lakes Recharge Ponds and in-channel impoundment area of Alameda Creek Flood Control Channel)

This portfolio has a total capital cost of $795 million (in 2025 dollars), as shown in **Table 33**, and has an annual cost (including O&M and imported water purchase) of $58 million per year (in 2025 dollars), as shown in **Table 34**.

TABLE 33: PORTFOLIO 10 CAPITAL COST

Supply Option	Capital Cost (2025 $)
Optimize and enhance Del Valle Yields (LW.3)	$0
Indirect Potable Reuse for groundwater recharge and raw water augmentation (PW.3c)	$794.7M
Total Capital Cost	**$794.7M**

TABLE 34: PORTFOLIO 10 ANNUAL COST

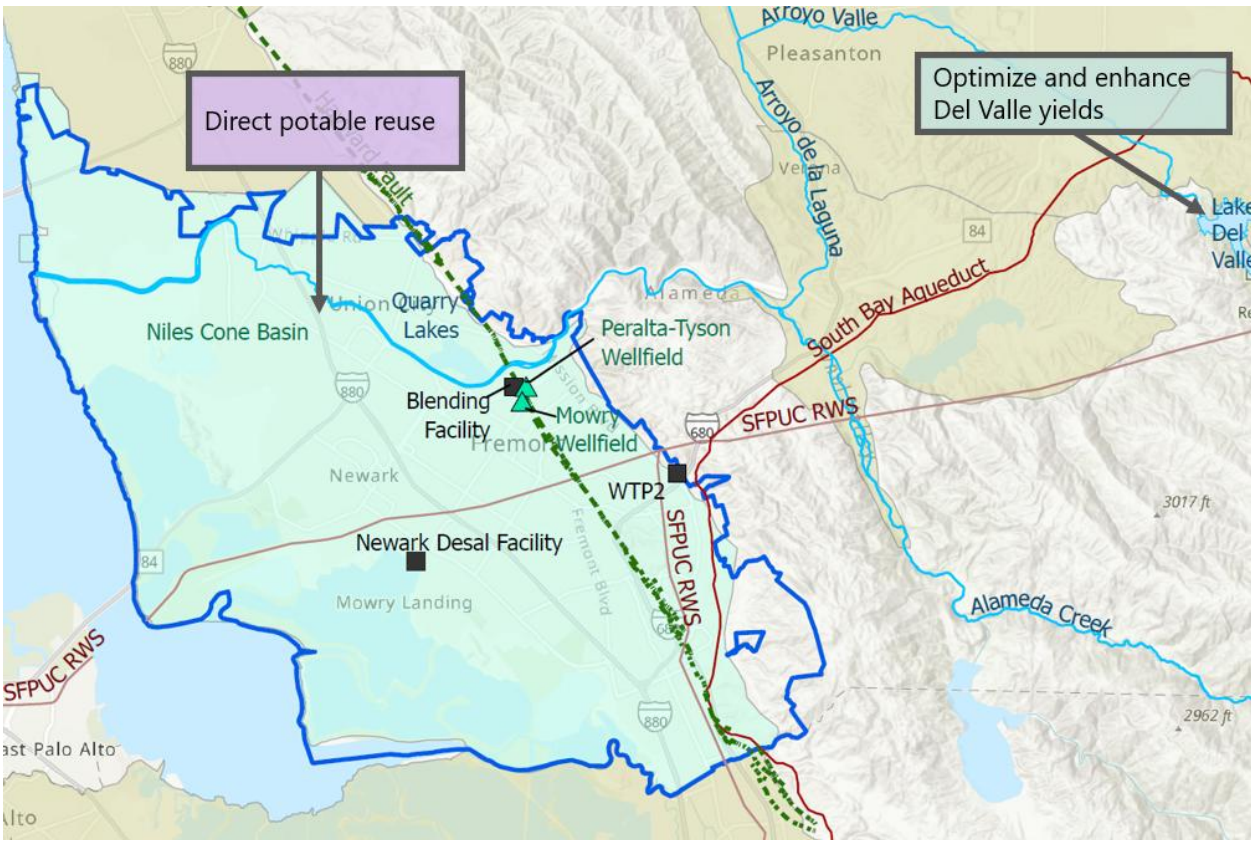
Annual Cost Component	Annual Cost (2025 $)
Groundwater pumping	$1.4M
Conveyance and distribution for new facilities	$5.3M
Treatment Plant 2	$0.7M
Brackish Groundwater Desalination Treatment	$1.6M
PFAS Treatment	$1.4M
RO Treatment	$2.6M
Purified Water Treatment	$7.9M
Blender	<$0.1M
New Full Time Equivalents	$1.3M
Semitropic	$1.2M
SFPUC Water Purchase	$22.9M
SWP Water	$11.9M
Annual Cost	**$58.2M**

2.13 Portfolio 11: Develop Local Drought-Resilient Supply (DPR)

Portfolios 9, 10, and 11 each involve the addition of one large new water supply that provides a consistent source of supply, even during droughts. Each portfolio allows for independent evaluation of the impact of this new supply for comparison to other new supply types. Portfolio 11 adds a project that would directly convey purified water into WTP2 for additional treatment and distribution to customers (also known as direct potable reuse or DPR because of the bypass of an environmental buffer, as with IPR). Portfolio 11 includes the following supply options, as shown in **Figure 12**:

- Optimize and enhance Del Valle Yields (LW.3)
- Direct potable reuse (PW.4)

FIGURE 12: PORTFOLIO 11 SUPPLY OPTIONS



Average annual supplies used in this portfolio are shown in **Table 35.** Modeling estimates that in an average year, imported water purchases will decrease from 26,100 AFY under baseline conditions to 17,000 AFY with the implementation of options included in Portfolio 11. SFPUC purchases will decrease by approximately 3,700 AFY while SWP use will decrease by approximately 5,400 AFY. The increase in groundwater production will allow for increased recharge of SWP and local surface water and purified water supplies.

TABLE 35: PORTFOLIO 11 AVERAGE ANNUAL SUPPLY UTILIZATION

Supply Source	Average Annual Volume	Baseline Portfolio Average Annual Volume
SFPUC (direct use)	9,000 AF	12,700 AF
SWP (direct use)	2,200 AF	9,700 AF
SWP (recharge)	5,800 AF	3,700 AF
Lake Del Valle	4,100 AF	5,300 AF
Groundwater[1]	10,600 AF	12,700 AF
Purified Water (raw water augmentation)	13,100 AF	N/A

1. Groundwater includes naturally recharged stormwater and managed aquifer recharge (local watershed runoff that is diverted into the Quarry Lakes Recharge Ponds and in-channel impoundment area of Alameda Creek Flood Control Channel)

This portfolio has a total capital cost of $722 million (in 2025 dollars), as shown in **Table 36**, and has an annual cost (including O&M and imported water purchase) of $56 million per year (in 2025 dollars), as shown in **Table 37**.

TABLE 36: PORTFOLIO 11 CAPITAL COST

Supply Option	Capital Cost (2025 $)
Optimize and enhance Del Valle Yields (LW.3)	$0
Direct potable reuse (PW.4)	$722.1M
Total Capital Cost	**$722.1M**

TABLE 37: PORTFOLIO 11 ANNUAL COST

Annual Cost Component	Annual Cost (2025 $)
Groundwater pumping	$1.0M
Conveyance and distribution for new facilities	$5.1M
Treatment Plant 2	$0.6M
Brackish Groundwater Desalination Treatment	$1.8M
PFAS Treatment	$1.4M
Purified Water Treatment	$7.9M
Blender	<$0.1M
New Full Time Equivalents	$1.3M
Semitropic	$1.2M
SFPUC Water Purchase	$23.7M
SWP Water	$11.9M
Annual Cost	**$56.1M**

2.14 Portfolio 12: Preferred Portfolio

Portfolio 12 was developed after the initial 11 portfolios were evaluated and is described as the preferred portfolio in **Section 4**.

2.15 Options Not Selected for Portfolios

There are some supply options shown in the earlier **Table 1** that are not contained within any of the portfolios. These are described below.

Sunol Aqueduct (IW.4) – The Sunol Aqueduct is an abandoned SFPUC-owned conveyance originally constructed by the Spring Valley Water Company in the early 1900s. Historically, it conveyed water sourced from multiple groundwater facilities in the Alameda Creek watershed, as well as Calaveras Reservoir. These supplies co-mingled at the Sunol Water Temple, where they entered the aqueduct for delivery to regional customers in Alameda County and on the San Francisco Peninsula. The Sunol Aqueduct has been viewed for many years as a potential asset to add to ACWD's local supply infrastructure. ACWD has taken steps to protect the aqueduct and advocate for its preservation through multiple regional projects and initiatives, including the Highway 84 realignment and bridge retrofit projects in Niles Canyon, as well as planning and preliminary design related to the Niles Canyon Trail proposal by Alameda County.

ACWD previously evaluated converting the aqueduct into a local raw water transmission facility. This preliminary review concluded that, given the aqueduct's geometry, condition, routing, and other constraints, its maximum conveyance capacity is on the order of 60 cubic feet per second, less than 10% of ACWD's existing diversion right. As a result, the aqueduct could not be relied upon as a stand-alone substitute for ACWD's existing diversions in the flood control channel. Even if it were somehow capable of conveying substantially higher flow rates, this approach would still require obtaining new water rights in Sunol Valley (or modifying the point of diversion of ACWD's existing right) and constructing a new diversion structure in Sunol Valley. Given the aqueduct's limited capacity, the challenges of building a new in-stream diversion with a newly reestablished salmonid fishery, and the added obligation to manage streamflow and habitat conditions through sensitive Niles Canyon, this option was not pursued.

Use of the Sunol Aqueduct was considered as a potential portfolio component during WRMP development. However, since the aqueduct does not create new supply, improve access to existing sources, or add storage, it was found to provide no incremental system yield or drought benefit.

The only potential value identified for this concept is as an alternate route for importing recharge supply via the South Bay Aqueduct (SBA) should future regulations or other factors materially constrain use of natural waterways for SWP conveyance. Developing this concept for ACWD benefit would require acquisition of the asset from SFPUC; new connections to the SBA at its headworks and to ACWD's recharge facilities at the outlet; and significant repairs and upgrades (e.g., structural rehabilitation, lining, and potential seismic improvements).

While the Sunol Aqueduct could convey limited SWP or Del Valle supplies to ACWD's recharge facilities in lieu of Alameda Creek, the creek currently provides a much wider range of conveyance at low cost through established operations that are included in ACWD's Biological Opinion. Because ACWD does not experience net conveyance losses from Alameda Creek, there is no meaningful efficiency gain to be achieved. This contingency benefit was considered, but it is speculative and limited, and does not alone justify the high rehabilitation cost, complexity, and low operational value under the conditions evaluated.

It is therefore recommended that the Sunol Aqueduct remain as a potential contingency to be considered only if conditions change substantially in the future.

Increase Peak Blending Capacity at Fremont Turnout (IW.6) – This option does not create new supply in most year types. It provides a modest increase in operational flexibility by allowing more low-hardness, PFAS-free SFPUC water to reach the Blending Facility, which could extend groundwater blending during emergencies such as an extended SWP disruption or an outage at ACWD's water treatment plants (see TM5 for more details). However, the additional Fremont Turnout capacity—especially when combined with increased groundwater production—would exceed the distribution system's ability to move water away from the Blending Facility, and it would increase reliance on ACWD's most expensive supply source. For these reasons, this option was not advanced; however, a smaller-capacity version of this concept is recommended for evaluation as part of the future Production and PFAS/Hardness Study (see **Section 5**).

Pretreatment Facility at EBMUD's Walnut Creek Water Treatment Plant (IW.7) – This supply option is dependent on the Transfer-Bethany Pipeline and Los Vaqueros Expansion, which were cancelled in late 2024 during the development of the WRMP. The WRMP lists this supply option to acknowledge that it was considered and characterized, but due to the cancellation of Los Vaqueros Expansion, the option was not deemed feasible for purposes of inclusion in supply portfolio development.

Indirect Potable Reuse with SFPUC Intertie (PW.1) & Indirect Potable Reuse with Expanded ACWD Distribution (PW.2) – Both PW.1 and PW.2 rely on building advanced water purification facilities and using purified water effluent for groundwater recharge. These options would also remove operational bottlenecks to improve ACWD's ability to convey treated groundwater. These options largely function as higher cost versions of LW.1 and LW.2, aimed at enabling more consistent use of NDF rather than expanding overall purified water production capacity. In contrast, the separately characterized purified water options PW.3 and PW.4 provide substantially greater yields, expand purified water treatment capacity, and give ACWD multiple pathways to offset both SFPUC and SWP supplies. Because PW.1 and PW.2 provide lower yields (at similar or potentially higher costs) and lack the broader system benefits and flexibility of PW.3 and PW.4, they were not strong candidates for inclusion in any portfolios.

3. PORTFOLIO EVALUATION

3.1 Evaluation Criteria Development

The purpose of portfolio evaluation is to review each portfolio against a set of criteria that represent District priorities and needs. The evaluation criteria were developed and approved by ACWD's Board of Directors during the WRMP Phase 1 scoping effort at the April 25, 2024, Board workshop. Metrics for evaluation criteria were reviewed with ACWD's Extended Team of staff members during a March 12, 2025, workshop. Together, the evaluation criteria and metrics address the various goals and objectives of the WRMP. Some criteria involve a portfolio characteristic that is more directly quantifiable (e.g., cost) while others are more qualitative in nature (e.g., regional leadership). Each criterion is described individually in **Section 3.2**, along with the results of the evaluation across portfolios.

Portfolios 1-11 were initially evaluated across all criteria. An additional Portfolio 12 was developed after the initial development and evaluation of Portfolios 1-11 (as described in **Section 4**). Although Portfolio 12 was evaluated later, it is included in this section so that it can be compared relative to the results for 1-11.

3.2 Evaluation Criteria Descriptions and Results

Each subsection below defines the respective evaluation criterion, the metric used to measure it, how it's aligned with the goals and objectives of the WRMP, and how each of the portfolios scored against each criteron.

- **Section 3.2.1 - Long-Term Reliability**
- **Section 3.2.2 - Local Control**
- **Section 3.2.3 - Cost Efficiency**
- **Section 3.2.4 - Regulatory Risk**
- **Section 3.2.5 - Drinking Water Equity**
- **Section 3.2.6 - Environmental Stewardship**
- **Section 3.2.7 - Regional Leadership**
- **Section 3.2.8 - Leveraging Resources**
- **Section 3.2.9 - Community Benefits**
- **Section 3.2.10 - System Adaptability/Emergency Resilience**

Section 3.2.11 summarizes the portfolio scoring results across all evaluation criteria.

3.2.1 Long-Term Reliability

Long-term reliability measures a water system's ability to consistently meet demand over extended periods, especially under stress conditions like drought or climate change. The portfolios developed for the WRMP were modeled in ACWD's RiverWare systems model to assess performance of the portfolios under Scenario B (moderate climate change and reduced Semitropic accessibility) and Scenario C (extreme climate change and further reduced Semitropic accessibility). These scenarios are discussed in further detail in the Baseline Supply Availability TM. The frequency and severity of shortages were used as metrics for measuring each portfolio's long-term reliability. Given an ACWD Board-directed level of service threshold set at 90%, a shortage year is defined as a year where there is at least a 10% lower supply than demand.

The frequency and volume of shortages under both Scenarios B and C for each portfolio are shown in **Table 38**.

TABLE 38: LONG TERM RELIABILITY

Portfolio	Scenario B		Scenario C	
	Frequency of shortage through modeling period	Maximum annual shortage volume	Frequency of shortage through modeling period	Maximum annual shortage volume
Baseline	6 of 100 years	10,700 AF	11 of 100 years	16,900 AF
#1 - Increase Local Reliance - Small Changes (GW Treatment)	4 of 100 years	9,300 AF	8 of 100 years	18,100 AF
#2 - Increase Local Reliance + External Banking	1 of 100 years	6,900 AF	10 of 100 years	12,400 AF
#3 - Increase Local Reliance + Internal Banking	1 of 100 years	7,000 AF	5 of 100 years	9,200 AF
#4 - Increase Local Reliance - Medium Changes (GW Treatment & Optimization)	3 of 100 years	7,100 AF	5 of 100 years	16,200 AF
#5 - Increase Local Reliance - Enhanced Southern Service Area	4 of 100 years	7,100 AF	8 of 100 years	8,900 AF
#6 - Increase Local Reliance - Large Changes (GW Treatment, Optimization, & Desal)	3 of 100 years	7,100 AF	5 of 100 years	16,200 AF
#7 - Improve Imported Water Supply Reliability	2 of 100 years	9,400 AF	8 of 100 years	16,500 AF
#8 - Increased Environmental Stewardship (Multiple Benefits)	0 of 100 years	0 AF	0 of 100 years	0 AF
#9 - Develop Local Drought-Resilient Supply (Bay Desal)	0 of 100 years	0 AF	0 of 100 years	0 AF
#10 - Develop Local Drought-Resilient Supply (IPR)	0 of 100 years	0 AF	1 of 100 years	4,500 AF
#11 - Develop Local Drought-Resilient Supply (DPR)	0 of 100 years	0 AF	0 of 100 years	0 AF
#12A - Low Cost, Low Regret	0 of 100 years	0 AF	4 of 100 years	5,600 AF
#12B - Enhance 12A with local option to address declining availability of imported supplies	0 of 100 years	0 AF	1 of 100 years	4,700 AF
#12C - Enhance 12B to address Scenario C climate change	0 of 100 years	0 AF	0 of 100 years	0 AF

Green = 0 out of 100 years shortage; 0 AF of maximum shortage volume
Yellow = 1-2 out of 100 years shortage; 1-8,000 AF of maximum shortage volume
Orange = >2 out of 100 years shortage; >8,000 AF of maximum shortage volume

3.2.2 Local Control

Local control refers to the degree to which facilities and/or supplies are owned and operated by ACWD, allowing for greater autonomy in decision-making and responsiveness to community needs. While reliability is an important criterion in deciding ACWD's future water supply mix, the ability to have future control over those supplies will enhance ACWD's ability to better adapt and respond to changing conditions while limiting the potential impacts from decisions made outside of ACWD's control. The local control criterion is simply the volumetric-weighted percentage of the portfolio's supply that is under ACWD's local control:

- Local supplies (including groundwater and Del Valle water) are considered to be 100 percent under ACWD control,
- Regional supplies (including purified water and bay desalination) are considered to be 50 percent under ACWD control because they would be joint projects with other local agencies or have some operational component that would rely on other agencies, and
- Imported supplies are considered to be 0 percent under ACWD control because they are purchased water produced and allocated by SFPUC or the SWP.

The resulting percentage of supplies under ACWD control are shown in **Table 39.**

TABLE 39: LOCAL CONTROL

Portfolio	Percent of Supplies Under ACWD Control
Baseline	41%
#1 - Increase Local Reliance - Small Changes (GW Treatment)	43%
#2 - Increase Local Reliance + External Banking	40%
#3 - Increase Local Reliance + Internal Banking	40%
#4 - Increase Local Reliance - Medium Changes (GW Treatment & Optimization)	50%
#5 - Increase Local Reliance - Enhanced Southern Service Area	41%
#6 - Increase Local Reliance - Large Changes (GW Treatment, Optimization, & Desal)	50%
#7 - Improve Imported Water Supply Reliability	39%
#8 - Increased Environmental Stewardship (Multiple Benefits)	54%
#9 - Develop Local Drought-Resilient Supply (Bay Desal)	43%
#10 - Develop Local Drought-Resilient Supply (IPR)	48%
#11 - Develop Local Drought-Resilient Supply (DPR)	48%
#12A - Low Cost, Low Regret	46%
#12B - Enhance 12A with local option to address declining availability of imported supplies	51%
#12C - Enhance 12B to address Scenario C climate change	53%

Green = >=49%
Yellow = 43%-48% (range based on average +/- ½ of a standard deviation)
Orange = <=42%

3.2.3 Cost Efficiency

Cost efficiency reflects both the initial capital costs as well as annual per-AF unit costs to provide the supplies (O&M and imported water purchases) for each portfolio. Capital costs are provided separately from annual costs because they can be funded through loans and grants, while annual costs are covered by the District. Color-coding was evaluated by annual costs. The capital costs and O&M cost of water per AF for each portfolio are compared in **Table 40.** Both annual and capital costs are shown in 2025 dollars. Note that while the results in **Section 2** demonstrate slightly different annual supply volumes based on model results, for purposes of this evaluation, annual cost for each portfolio was divided by 44,500 AF (baseline, 2050 buildout demands) to come up with a standardized per AF cost.

TABLE 40: COST EFFICIENCY

Portfolio	Capital Cost	Annual Cost of Water (per AF)
Baseline[1]	$0M	$1,170[1]
#1 - Increase Local Reliance - Small Changes (GW Treatment)	$190M	$1,230
#2 - Increase Local Reliance + External Banking	$90M	$1,160
#3 - Increase Local Reliance + Internal Banking	$200M	$1,300
#4 - Increase Local Reliance - Medium Changes (GW Treatment & Optimization)	$220M	$1,080
#5 - Increase Local Reliance - Enhanced Southern Service Area	$220M	$1,310
#6 - Increase Local Reliance - Large Changes (GW Treatment, Optimization, & Desal)	$370M	$1,120
#7 - Improve Imported Water Supply Reliability	$30M	$1,100
#8 - Increased Environmental Stewardship (Multiple Benefits)	$930M	$1,260
#9 - Develop Local Drought-Resilient Supply (Bay Desal)	$660M	$1,300
#10 - Develop Local Drought-Resilient Supply (IPR)	$790M	$1,310
#11 - Develop Local Drought-Resilient Supply (DPR)	$720M	$1,260
#12A - Low Cost, Low Regret	$180M	$1,200
#12B - Enhance 12A with local option to address declining availability of imported supplies	$360M	$1,210
#12C - Enhance 12B to address Scenario C climate change	$880M	$1,350

Green = <$1,180/AF
Yellow = $1,180/AF - $1,260/AF (range based on average +/- ½ of a standard deviation)
Orange = >$1,260/AF

1. Note that the Baseline portfolio's annual cost is based on buildout demands in 2050 and reflects a significant increase in SFPUC purchases as a percent of total in order to meet those demands, absent any other new supply options/projects. This value does not represent a "current" cost for operations in 2025.

3.2.4 Regulatory Risk

Regulatory risk evaluates the potential for regulatory uncertainty during construction and operations phases of options in each portfolio. Projects with high regulatory uncertainty may face delays, increased costs, or operational restrictions. Understanding these risks is vital for project feasibility and long-term compliance. Qualitative consideration of potential portfolio permitting complexity, the need for regulatory coordination with multiple agencies, and overall regulatory compliance complexity were used to articulate the risks shown in **Table 41.**

TABLE 41: REGULATORY RISK

Portfolio	Operational Regulatory Risk	Construction Regulatory Risk
Baseline	No change in operations	No regulatory risk
#1 - Increase Local Reliance - Small Changes (GW Treatment)	Typical operations permits similar to current ACWD permits	Low complication (common permitting, regulatory coordination)
#2 - Increase Local Reliance + External Banking	Typical operations permits similar to current ACWD permits (shared permitting responsibility with already established agreements)	Low complication (common permitting, regulatory coordination)
#3 - Increase Local Reliance + Internal Banking	Typical operations permits similar to current ACWD permits with additional coordination of internal groundwater bank monitoring and operations management	Low complication (common permitting, regulatory coordination)
#4 - Increase Local Reliance - Medium Changes (GW Treatment & Optimization)	Typical operations permits similar to current ACWD permits with additional permitting for a SFPUC intertie for NDF water	Low complication (common permitting, regulatory coordination)
#5 - Increase Local Reliance - Enhanced Southern Service Area	Typical operations permits similar to current ACWD permits with additional coordination of internal groundwater bank monitoring	Low complication (common permitting, regulatory coordination)
#6 - Increase Local Reliance - Large Changes (GW Treatment, Optimization, & Desal)	More complicated permitting due to increased treatment	Medium complication (common permitting, but higher number of construction projects will require more permitting)
#7 - Improve Imported Water Supply Reliability	Typical operations permits similar to ACWD permits	High complication due to inclusion of new surface reservoir (significant permitting and regulatory coordination needed)
#8 - Increased Environmental Stewardship (Multiple Benefits)	More complicated permitting with addition of a purified water system	Medium complication (common permitting, but higher number of construction projects will require more permitting)
#9 - Develop Local Drought-Resilient Supply (Bay Desal)	Complicated regulatory coordination and permitting with Bay Desal Plant	High complication (less common permitting for new Bay desal plant plus significant regulatory coordination)

Portfolio	Operational Regulatory Risk	Construction Regulatory Risk
#10 - Develop Local Drought-Resilient Supply (IPR)	More complicated permitting with addition of a purified water system	Medium complication (common permitting, but higher number of construction projects will require more permitting)
#11 - Develop Local Drought-Resilient Supply (DPR)	More complicated permitting with addition of a purified water system	High complication (both common and less common permitting, plus higher number of construction projects will require more permitting)
#12A - Low Cost, Low Regret	Typical operations permits similar to ACWD permits with additional coordination of internal groundwater bank monitoring	Low complication (common permitting, regulatory coordination)
#12B - Enhance 12A with local option to address declining availability of imported supplies	More complicated permitting due to increased treatment	Low complication (common permitting, regulatory coordination)
#12C - Enhance 12B to address Scenario C climate change	More complicated permitting with addition of a purified water system	Medium complication (common permitting, but higher number of construction projects will require more permitting)

	Operation Risk	*Construction Risk*
Green	*Typical operations permits and/or regulatory coordination/reporting*	*Relatively low count of regulatory agencies and/or coordination complexity involved with construction (fewer projects or less complicated projects)*
Yellow	*Relative increase in permitting and/or coordination*	*Medium relative count of regulatory agencies and/or coordination complexity involved with construction (increased number of projects or somewhat more complex projects)*
Orange	*Highest relative complexity of permitting (specifically Bay Desal).*	*Highest relative count of regulatory agencies and/or coordination complexity involved with construction (large number or projects or more complex projects)*

3.2.5 Drinking Water Equity

Drinking water equity refers to the potential for distribution of varying qualities of water across the service area. ACWD has always met all primary and secondary quality standards throughout the service area. However, ACWD has, in the past, supplied water with a range of hardness levels relative to the blending ratio of groundwater to SFPUC water served to a customer. Each portfolio was expressed as either having more, less, or the same blending mix of SFPUC water relative to baseline conditions. More use of SFPUC water equates to lower equity (indicates a greater difference in supplies used by customers across the service area). The results of the equity assessment are shown below in **Table 42.**

TABLE 42: DRINKING WATER EQUITY

Portfolio	Equity Assessment
Baseline	Baseline use of SFPUC supplies for blending
#1 - Increase Local Reliance - Small Changes (GW Treatment)	Less use of SFPUC supplies for blending than baseline
#2 - Increase Local Reliance + External Banking	Less use of SFPUC supplies for blending than baseline
#3 - Increase Local Reliance + Internal Banking	Less use of SFPUC supplies for blending than baseline
#4 - Increase Local Reliance - Medium Changes (GW Treatment & Optimization)	Similar to baseline
#5 - Increase Local Reliance - Enhanced Southern Service Area	Less use of SFPUC supplies for blending than baseline
#6 - Increase Local Reliance - Large Changes (GW Treatment, Optimization, & Desal)	Similar to baseline
#7 - Improve Imported Water Supply Reliability	Less use of SFPUC supplies for blending than baseline
#8 - Increased Environmental Stewardship (Multiple Benefits)	Uses more water from SFPUC supplies for blending than baseline
#9 - Develop Local Drought-Resilient Supply (Bay Desal)	Less use of SFPUC supplies for blending than baseline
#10 - Develop Local Drought-Resilient Supply (IPR)	Uses more water from SFPUC supplies for blending than baseline
#11 - Develop Local Drought-Resilient Supply (DPR)	Less use of SFPUC supplies for blending than baseline
#12A - Low Cost, Low Regret	Less use of SFPUC supplies for blending than baseline
#12B - Enhance 12A with local option to address declining availability of imported supplies	Less use of SFPUC supplies for blending than baseline
#12C - Enhance 12B to address Scenario C climate change	Less use of SFPUC supplies for blending than baseline

Green = Less use of SFPUC supplies for blending than baseline
Yellow = Similar to baseline use of SFPUC supplies for blending
Orange = More use of SFPUC supplies for blending than baseline

3.2.6 Environmental Stewardship

Environmental stewardship assesses the portfolios' ability to minimize ecological impacts and improve watershed sustainability. Most of ACWD's local water supply originates in the Alameda Creek Watershed, which is a mixture of largely undeveloped open range and parks, as well as developed, populated areas.

Protection of the watershed to maintain water quality is thus of critical importance, in terms of both protecting open space and ensuring water quality and erosion protection in developed areas. This criterion also aligns closely with one of the WRMP goals of "Healthy watersheds and aquifers that are managed to provide multiple benefits." This criterion measures environmental stewardship as an aggregate of several metrics as proxies for overall environmental stewardship which is difficult to quantify directly:

- Quantified energy use associated with water conveyance, production, and delivery as kilowatt-hour (kWh) per AF
- Qualitative reduction to wastewater treatment plant discharges to the Bay (e.g., through the use of recycled water)
- Qualitative impact to groundwater quality based on the quality of waters used for groundwater recharge or the pumping of water out of the basin with treatment for PFAS and hardness (slight long-term improvement in quality).

Environmental stewardship assessment results are shown in **Table 43**.

TABLE 43: ENVIRONMENTAL STEWARDSHIP

Portfolio	Energy Intensity (kWh/AF)	Groundwater quality improvements and/or reduction in wastewater effluent
Baseline	1,000	None (while current practices inherently involve watershed and basin protection, baseline reflects no changes from current practices)
#1 - Increase Local Reliance - Small Changes (GW Treatment)	1,300	Provides slight improvements in groundwater quality over time
#2 - Increase Local Reliance + External Banking	1,200	Provides slight improvements in groundwater quality over time
#3 - Increase Local Reliance + Internal Banking	1,300	None
#4 - Increase Local Reliance - Medium Changes (GW Treatment & Optimization)	1,300	Provides slight improvements in groundwater quality over time
#5 - Increase Local Reliance - Enhanced Southern Service Area	1,300	None
#6 - Increase Local Reliance - Large Changes (GW Treatment, Optimization, & Desal)	1,500	Provides slight improvements in groundwater quality over time
#7 - Improve Imported Water Supply Reliability	1,200	None
#8 - Increased Environmental Stewardship (Multiple Benefits)	1,600	Provides direct groundwater quality improvements (recharge) and reduces effluent to Bay
#9 - Develop Local Drought-Resilient Supply (Bay Desal)	1,800	None
#10 - Develop Local Drought-Resilient Supply (IPR)	1,300	Reduces effluent to Bay
#11 - Develop Local Drought-Resilient Supply (DPR)	1,200	Reduces effluent to Bay
#12A - Low Cost, Low Regret	1,400	Provides slight improvements in groundwater quality over time.
#12B - Enhance 12A with local option to address declining availability of imported supplies	1,400	Provides slight improvements in groundwater quality over time.
#12C - Enhance 12B to address Scenario C climate change	1,400[1]	Provides direct groundwater quality improvements (recharge) and reduces effluent to Bay

Green = <1,400 kWh/AF; provides 2 or more environmental improvements
Yellow = 1,400 – 1799 kWh/AF; provides only one (slight) environmental improvement
Orange = >=1,800 kWh/AF; no environmental improvements

1. Portfolio 12C includes IPR which involves significant power to produce. However, because this portfolio offsets a significant volume of SFPUC and SWP imported supplies compared to Portfolios 12A and 12B, total energy costs remain somewhat similar. Portfolio 12C has a slightly higher overall average energy use rate, but rounding of the values for high-level planning purposes makes them appear the same.

3.2.7 Regional Leadership

The regional leadership criterion assesses a portfolio's (and in essence, ACWD's) contribution to broader regional water goals, such as improving overall water supply reliability, quality, or cost-efficiency within the Bay Area. Opportunities for regional collaboration, shared infrastructure, and coordinated planning that benefit multiple communities are used to qualitatively assess portfolios given the types of options included. Regional leadership results are shown in **Table 44.**

TABLE 44: REGIONAL LEADERSHIP

Portfolio	Regional Leadership Assessment
Baseline	Low
#1 - Increase Local Reliance - Small Changes (GW Treatment)	Low
#2 - Increase Local Reliance + External Banking	Low
#3 - Increase Local Reliance + Internal Banking	Low
#4 - Increase Local Reliance - Medium Changes (GW Treatment & Optimization)	Provides some regional benefit (SFPUC intertie)
#5 - Increase Local Reliance - Enhanced Southern Service Area	Low
#6 - Increase Local Reliance - Large Changes (GW Treatment, Optimization, & Desal)	Low
#7 - Improve Imported Water Supply Reliability	Low
#8 - Increased Environmental Stewardship (Multiple Benefits)	Provides regional benefit (purified water + stormwater)
#9 - Develop Local Drought-Resilient Supply (Bay Desal)	Provides regional benefit (bay desal)
#10 - Develop Local Drought-Resilient Supply (IPR)	Provides regional benefit (purified water)
#11 - Develop Local Drought-Resilient Supply (DPR)	Provides regional benefit (purified water)
#12A - Low Cost, Low Regret	Low
#12B - Enhance 12A with local option to address declining availability of imported supplies	Low
#12C - Enhance 12B to address Scenario C climate change	Provides regional benefit (purified water)

Green = Provides a direct regional benefit
Yellow = Provides some level of regional benefit (SFPUC intertie)
Orange = Low or no regional leadership benefit

3.2.8 Leveraging Resources

Leveraging resources evaluates how well a portfolio utilizes existing infrastructure, labor, and institutional capacity. Efficient use of resources reduces costs, accelerates implementation, and enhances operational sustainability. This criterion was measured qualitatively based on the extent to which a portfolio builds on current facilities, minimizes redundancy, and optimizes workforce deployment. The results for leveraging resources are shown in **Table 45.**

TABLE 45: LEVERAGING RESOURCES

Portfolio	Leveraging Resources Assessment
Baseline	Baseline uses existing labor and facilities
#1 - Increase Local Reliance - Small Changes (GW Treatment)	Moderate increase in labor to manage supplies and leverages existing facility capacity
#2 - Increase Local Reliance + External Banking	Low increase in labor to manage supplies and leverages existing facility capacity
#3 - Increase Local Reliance + Internal Banking	Moderate increase in labor to manage supplies and leverages existing facility capacity
#4 - Increase Local Reliance - Medium Changes (GW Treatment & Optimization)	Moderate increase in labor to manage supplies and leverages existing facility capacity
#5 - Increase Local Reliance - Enhanced Southern Service Area	Moderate increase in labor to manage supplies and leverages existing facility capacity
#6 - Increase Local Reliance - Large Changes (GW Treatment, Optimization, & Desal)	High increase in labor to manage supplies and constructs significant new facilities
#7 - Improve Imported Water Supply Reliability	Low increase in labor to manage supplies and leverages existing facility capacity
#8 - Increased Environmental Stewardship (Multiple Benefits)	High increase in labor to manage supplies and constructs significant new facilities
#9 - Develop Local Drought-Resilient Supply (Bay Desal)	Moderate increase in labor to manage supplies and constructs significant new facilities
#10 - Develop Local Drought-Resilient Supply (IPR)	High increase in labor to manage supplies and constructs significant new facilities
#11 - Develop Local Drought-Resilient Supply (DPR)	High increase in labor to manage supplies and constructs significant new facilities
#12A - Low Cost, Low Regret	High increase in labor to manage supplies and constructs significant new facilities
#12B - Enhance 12A with local option to address declining availability of imported supplies	High increase in labor to manage supplies and constructs significant new facilities
#12C - Enhance 12B to address Scenario C climate change	High increase in labor to manage supplies and constructs significant new facilities

Green = Low increase in labor to manage supplies (0-1 new staff) and leverages existing facility capacity (e.g. minimal new facility construction required)
Yellow = Moderate increase in labor to manage supplies (1-3 new staff) OR constructs significant new facilities
Orange = Moderate (1-3 new staff) to High (>3 new staff) increase in labor to manage supplies AND constructs significant new facilities

3.2.9 Community Benefits

Community benefits encompass the social and economic advantages that a portfolio provides, such as job creation, support for local partnerships, recreational opportunities, and flood mitigation. The community benefits are shown in **Table 46.**

TABLE 46: COMMUNITY BENEFITS

Portfolio	Community Benefits Assessment
Baseline	None
#1 - Increase Local Reliance - Small Changes (GW Treatment)	Expected to provide construction and operator jobs
#2 - Increase Local Reliance + External Banking	Expected to provide construction and operator jobs
#3 - Increase Local Reliance + Internal Banking	Expected to provide construction and operator jobs
#4 - Increase Local Reliance - Medium Changes (GW Treatment & Optimization)	Expected to provide construction and operator jobs
#5 - Increase Local Reliance - Enhanced Southern Service Area	Expected to provide construction and operator jobs
#6 - Increase Local Reliance - Large Changes (GW Treatment, Optimization, & Desal)	Expected to provide construction and operator jobs
#7 - Improve Imported Water Supply Reliability	Expected to provide construction and operator jobs
#8 - Increased Environmental Stewardship (Multiple Benefits)	Expected to provide construction and operator jobs, and support community partnerships (stormwater, water use efficiency programs)
#9 - Develop Local Drought-Resilient Supply (Bay Desal)	Expected to provide construction and operator jobs
#10 - Develop Local Drought-Resilient Supply (IPR)	Expected to provide construction and operator jobs
#11 - Develop Local Drought-Resilient Supply (DPR)	Expected to provide construction and operator jobs
#12A - Low Cost, Low Regret	Expected to provide construction and operator jobs
#12B - Enhance 12A with local option to address declining availability of imported supplies	Expected to provide construction and operator jobs, and support community partnerships (water use efficiency programs)
#12C - Enhance 12B to address Scenario C climate change	Expected to provide construction and operator jobs, and support community partnerships (water use efficiency programs)

Green = Provides construction and operator jobs (has at least one construction project); also supports community partnerships through various programs
Yellow = Provides construction and operator jobs (has at least one construction project)
Orange = No community benefits

3.2.10 System Adaptability/Emergency Resilience

Although the WRMP is focused on longer-term supply reliability, the interest in assessing a portfolio's ability to improve resilience relative to baseline is valuable. Adaptability and resilience measure a system's capacity to respond to emergencies (e.g., seismic events, Delta outages) and adjust to future uncertainties like climate change or population growth. This criterion was measured qualitatively based on each portfolio's system adaptability, specifically the extent to which new infrastructure creates redundancy and interconnection across the service area, and each portfolio's ability to respond to supply outages, specifically a Delta outage. The system adaptability and emergency resilience is shown in **Table 47**.

TABLE 47: SYSTEM ADAPTABILITY/EMERGENCY RESILIENCE

Portfolio	System Adaptability	Emergency Resilience
Baseline	No improvement in facility resilience	No improvement in ability to respond to emergencies
#1 - Increase Local Reliance - Small Changes (GW Treatment)	Little change to existing infrastructure except for distribution system improvements, some additional groundwater treatment	Distribution system improvements but little local supply development
#2 - Increase Local Reliance + External Banking	Distribution system improvements and increased ability to treat surface water (can access more stored water if something happens to local supplies)	Distribution system improvements but little local supply development and externally banked water may be difficult to access in a Delta outage
#3 - Increase Local Reliance + Internal Banking	Little change to existing infrastructure except for distribution system improvements, some additional banking	Distribution system improvements and local water bank would provide more resilience to Delta outage
#4 - Increase Local Reliance - Medium Changes (GW Treatment & Optimization)	Little change to existing infrastructure, some additional groundwater treatment (NDF, desal)	Distribution system improvements plus NDF optimization would improve resilience in a Delta outage
#5 - Increase Local Reliance - Enhanced Southern Service Area	Some additional facilities via distribution system improvements and access to southern portion basins	Distribution system improvements plus southern basin groundwater development and local water bank would improve resilience in a Delta outage
#6 - Increase Local Reliance - Large Changes (GW Treatment, Optimization, & Desal)	Increased groundwater treatment and pumping plus distribution system improvements	Distribution system improvements plus increased groundwater production from new groundwater desal plant would improve resilience in a Delta outage

Portfolio	System Adaptability	Emergency Resilience
#7 - Improve Imported Water Supply Reliability	Little to no changes to infrastructure	No additional local supply development would make supplies vulnerable to a Delta outage
#8 - Increased Environmental Stewardship (Multiple Benefits)	Several new infrastructure projects create redundancy	Significant local supply development but purified water is not considered seismically resilient
#9 - Develop Local Drought-Resilient Supply (Bay Desal)	New treatment adjacent to coast may be vulnerable to sea level rise	Significant local supply development would provide reliable supplies during a Delta outage
#10 - Develop Local Drought-Resilient Supply (IPR)	Several new infrastructure projects create redundancy	Significant local supply development but purified water is not considered seismically resilient
#11 - Develop Local Drought-Resilient Supply (DPR)	Several new infrastructure projects create redundancy	Significant local supply development but purified water is not considered seismically resilient
#12A - Low Cost, Low Regret	Distribution system improvements and increased ability to treat surface water and groundwater (can access more stored water if something happens to local supplies)	Distribution system improvements and local water bank would provide more resilience to Delta outage
#12B - Enhance 12A with local option to address declining availability of imported supplies	Distribution system improvements and increased ability to treat surface water and groundwater (can access more stored water if something happens to local supplies)	Distribution system improvements and local water bank would provide more resilience to Delta outage
#12C - Enhance 12B to address Scenario C climate change	Several new infrastructure projects create redundancy	Significant local supply development would provide reliable supplies during a Delta outage, but purified water is not considered seismically resilient

	System Adaptability	*Emergency Resilience*
Green	*Several new infrastructure projects create redundancy*	*Significant improvement in ability to respond to an imported supply outage*
Yellow	*Moderate changes to infrastructure or operations*	*Some improved ability to respond to an imported supply outage*
Orange	*Little to no changes to infrastructure*	*Little to no local supply development*

3.2.11 Summary Evaluation Results

The summary of all evaluation criteria results is shown in **Table 48**. Given that several of the criteria are qualitative, a color coding system was used to group portfolio performance under each criterion, where green indicates relative good performance, yellow indicates relative medium performance, and orange indicates relative low performance. These performance groupings are intended to show how portfolios compare to each other under a particular criterion and are intended as visual indicators of relative standing. Details on the color-coding for each criterion can be found at the end of each subsection above.

TABLE 48: SUMMARY EVALUATION RESULTS

Portfolios	Long Term Reliability (Scenario B)		Long Term Reliability (Scenario C)		Local Control	Cost Efficiency (Unit Cost)	Regulatory Risk (Operation)	Regulatory Risk (Construction)	Drinking Water Equity	Environmental Stewardship (energy use)	Environmental Stewardship (other criteria)	Regional Leadership	Leveraging Existing Resources (labor, capacity)	Community Benefits	System Adaptability	Emergency Resilience
	Frequency of shortage through modeling period	Maximum Shortage Volume	Frequency of shortage through modeling period.	Maximum Shortage Volume	Summary Percent Local Control (weighted 100% local, 50% Regional)	Quantitative assessment based on unit cost.	Based on operating permits required and additional regulatory coordination/reporting	Qualitative assessment of the number and type of permits to construct/implement	Qualitative assessment of water quality (secondary)	Energy intensity	Qualitative based on other benefits: GW quality improvements and/or reduction in WW effluent	Qualitative assessment of level of regional benefits provided.	Based on leveraging of existing labor and facility capacity	Qualitative assessment based on expectation that jobs will be provided and/or community partnerships supported (stormwater, conservation projects)	Resilience of facilities/infrastructure	Ability to respond to supply outages (Delta outages)
Baseline	6 of 100 years	10700 AF	11 of 100 years	16900 AF	41%	$1170/AF ($0M Capital Cost)	0.0	No regulatory risk	Baseline use of SFPUC supplies for blending	1000 kWh/AF	None (while current practices inherently involve watershed and basin protection, baseline reflects no changes from current practices)	Low	Baseline uses existing labor and facilities.	None	No improvement in facility resilience	No improvement in ability to respond to emergencies
#1 - Increase Local Reliance - Small Changes (GW Treatment)	4 of 100 years	9300 AF	8 of 100 years	18100 AF	43%	$1230/AF ($190M Capital Cost)	Typical operations permits similar to current ACWD permits	Low complication (common permitting, regulatory coordination)	Less use of SFPUC supplies for blending than baseline	1300 kWh/AF	Provides slight improvements in groundwater quality over time.	Low	Moderate increase in labor to manage supplies and leverages existing facility capacity	Expected to provide construction and operator jobs	Little change to existing infrastructure except for distribution system improvements, some additional GW treatment.	Distribution system improvements but little local supply development
#2 - Increase Local Reliance + External Banking	1 of 100 years	6900 AF	10 of 100 years	12400 AF	40%	$1160/AF ($90M Capital Cost)	Typical operations permits similar to current ACWD permits (shared permitting responsibility with already established agreements)	Low complication (common permitting, regulatory coordination)	Less use of SFPUC supplies for blending than baseline	1200 kWh/AF	Provides slight improvements in groundwater quality over time.	Low	Low increase in labor to manage supplies and leverages existing facility capacity	Expected to provide construction and operator jobs	Distribution system improvements and increased ability to treat surface water (so can access more stored water if something happens to local supplies)	Distribution system improvements but little local supply development. Externally banked water may be difficult to access in a Delta outage.
#3 - Increase Local Reliance + Internal Banking	1 of 100 years	7000 AF	5 of 100 years	9200 AF	40%	$1300/AF ($320M Capital Cost)	Typical operations permits similar to current ACWD permits with additional coordination of internal groundwater bank monitoring and operations management	Low complication (common permitting, regulatory coordination)	Less use of SFPUC supplies for blending than baseline	1200 kWh/AF	None	Low	Moderate increase in labor to manage supplies and leverages existing facility capacity	Expected to provide construction jobs	Little change to existing infrastructure except for distribution system improvements, some additional banking.	Distribution system improvements and local water bank would provide more resilience to Delta outage
#4 - Increase Local Reliance - Medium Changes (GW Treatment & Optimization)	3 of 100 years	7100 AF	5 of 100 years	16200 AF	50%	$1080/AF ($220M Capital Cost)	Typical operations permits similar to current ACWD permits with additional permitting for an SFPUC intertie for NDF water	Low complication (common permitting, regulatory coordination)	Similar to baseline	1300 kWh/AF	Provides slight improvements in groundwater quality over time.	Provides some regional benefit (SFPUC intertie)	Moderate increase in labor to manage supplies and leverages existing facility capacity	Expected to provide construction and operator jobs	Little change to existing infrastructure, some additional groundwater treatment (NDF, desal)	Distribution system improvements plus NDF optimization would improve resilience in a Delta outage.
#5 - Increase Local Reliance - Enhanced Southern Service Area	4 of 100 years	7100 AF	8 of 100 years	8900 AF	41%	$1310/AF ($340M Capital Cost)	Typical operations permits similar to current ACWD permits with additional coordination of internal groundwater bank monitoring	Low complication (common permitting, regulatory coordination)	Less use of SFPUC supplies for blending than baseline	1200 kWh/AF	None	Low	Moderate increase in labor to manage supplies and leverages existing facility capacity	Expected to provide construction and operator jobs	Some additonal facilities via distribution system improvements and access to southern portion basin	Distribution system improvements plus southern basin groundwater development and local water bank would improve resilience in a Delta outage.
#6 - Increase Local Reliance - Large Changes (GW Treatment, Optimization, & Desal)	3 of 100 years	7100 AF	5 of 100 years	16200 AF	50%	$1120/AF ($370M Capital Cost)	More complicated permitting due to increased treatment	Med complication (common permitting, but higher number of construction projects will require more permitting)	Similar to baseline	1500 kWh/AF	Provides slight improvements in groundwater quality over time.	Low	High increase in labor to manage supplies and constructs significant new facilities	Expected to provide construction and operator jobs	Increased groundwater treatment and pumping plus distribution system improvements.	Distribution system improvements plus increased groundwater production from new groundwater desal plant would improve resilience in a Delta outage.
#7 - Improve Imported Water Supply Reliability	2 of 100 years	9400 AF	8 of 100 years	16500 AF	39%	$1100/AF ($30M Capital Cost)	Typical operations permits similar to current ACWD permits	High complication due to inclusion of new surface reservoir (significant permitting and reg coordination needed)	Less use of SFPUC supplies for blending than baseline	1200 kWh/AF	None	Low	Low increase in labor to manage supplies and leverages existing facility capacity	Expected to provide construction and operator jobs	Little to no changes to infrastructure	No additional local supply development would make supplies vulnerable to a Delta outage.
#8 - Increased Environmental Stewardship (Multiple Benefits)	0 of 100 years	0 AF	0 of 100 years	0 AF	54%	$1260/AF ($930M Capital Cost)	More complicated permitting with addition of a recycled water system.	Med complication (common permitting, but higher number of construction projects will require more permitting)	Uses more water from SFPUC supplies for blending than baseline	1600 kWh/AF	Provides direct groundwater quality improvements (recharge) and reduces effluent to Bay.	Provides regional benefit (purified water + stormwater)	High increase in labor to manage supplies and constructs significant new facilities	Expected to provide construction and operator jobs, and support community partnerships (stormwater, water use efficiency programs)	Several new infrastructure projects create redundancy	Significant local supply development but recycled water is not considered seismically resilient
#9 - Develop Local Drought-Resilient Supply (Bay Desal)	0 of 100 years	0 AF	0 of 100 years	0 AF	43%	$1300/AF ($660M Capital Cost)	Complicated regulatory coordination and permitting with Bay Desal plant.	High complication (less common permitting for new Bay desal plant plus significant regulatory coordination)	Less use of SFPUC supplies for blending than baseline	1800 kWh/AF	None	Provides regional benefit (bay desal)	Moderate increase in labor to manage supplies and constructs significant new facilities	Expected to provide construction jobs	New treatment adjacent to coast may be vulnerable to SLR	Significant local supply development would provide reliable supplies during a Delta outage.
#10 - Develop Local Drought-Resilient Supply (IPR)	0 of 100 years	0 AF	1 of 100 years	4500 AF	48%	$1310/AF ($790M Capital Cost)	More complicated permitting with addition of a recycled water system.	Med complication (common permitting, but higher number of construction projects will require more permitting)	Uses more water from SFPUC supplies for blending than baseline	1300 kWh/AF	Reduces effluent to Bay.	Provides regional benefit (purified water)	High increase in labor to manage supplies and constructs significant new facilities	Expected to provide construction and operator jobs	Several new infrastructure projects create redundancy	Significant local supply development but recycled water is not considered seismically resilient
#11 - Develop Local Drought-Resilient Supply (DPR)	0 of 100 years	0 AF	0 of 100 years	0 AF	48%	$1260/AF ($720M Capital Cost)	More complicated permitting with addition of a recycled water system.	High complication (both common and less common permitting, plus higher number of construction projects will require more permitting)	Less use of SFPUC supplies for blending than baseline	1200 kWh/AF	Reduces effluent to Bay.	Provides regional benefit (purified water)	High increase in labor to manage supplies and constructs significant new facilities	Expected to provide construction and operator jobs	Several new infrastructure projects create redundancy	Significant local supply development but recycled water is not considered seismically resilient
#12A - Low Cost, Low Regret	0 of 100 years	0 AF	4 of 100 years	5600 AF	46%	$1200/AF ($180M Capital Cost)	Typical operations permits similar to current ACWD permits with additional coordination of internal groundwater bank monitoring	Low complication (common permitting, regulatory coordination)	Less use of SFPUC supplies for blending than baseline	1400 kWh/AF	Provides slight improvements in groundwater quality over time.	Low	High increase in labor to manage supplies and leverages existing facility capacity	Expected to provide construction and operator jobs	Distribution system improvements and increased ability to treat surface water and groundwater (so can access more stored water if something happens to local supplies)	Distribution system improvements and local water bank would provide more resilience to Delta outage
#12B - Enhance12A with local option to address declining availability of imported supplies	0 of 100 years	0 AF	1 of 100 years	4700 AF	51%	$1210/AF ($360M Capital Cost)	More complicated permitting due to increased treatment	Low complication (common permitting, regulatory coordination)	Less use of SFPUC supplies for blending than baseline	1400 kWh/AF	Provides slight improvements in groundwater quality over time.	Low	High increase in labor to manage supplies and leverages existing facility capacity	Expected to provide construction and operator jobs, and support community partnerships (water use efficiency programs)	Distribution system improvements and increased ability to treat surface water and groundwater (so can access more stored water if something happens to local supplies)	Distribution system improvements and local water bank would provide more resilience to Delta outage
#12C - Enhance12B to address Scenario C climate change	0 of 100 years	0 AF	0 of 100 years	0 AF	53%	$1350/AF ($880M Capital Cost)	More complicated permitting with addition of a recycled water system.	Med complication (common permitting, but higher number of construction projects will require more permitting)	Less use of SFPUC supplies for blending than baseline	1400 kWh/AF	Provides direct groundwater quality improvements (recharge) and reduces effluent to Bay.	Provides regional benefit (purified water)	High increase in labor to manage supplies and constructs significant new facilities	Expected to provide construction and operator jobs, and support community partnerships (water use efficiency programs)	Several new infrastructure projects create redundancy	Significant local supply development would provide reliable supplies during a Delta outage, but purified water is not considered seismically resilient

3.3 Comparative Analysis

Within the ten evaluation criteria, reliability and local control were considered by ACWD to be the most important for use in portfolio selection. By examining reliability and local control against capital and unit costs, direct and indirect relationships between portfolio types were revealed - highlighting key tradeoffs for consideration by decision-makers.

Comparing Reliability Against Cost Efficiency

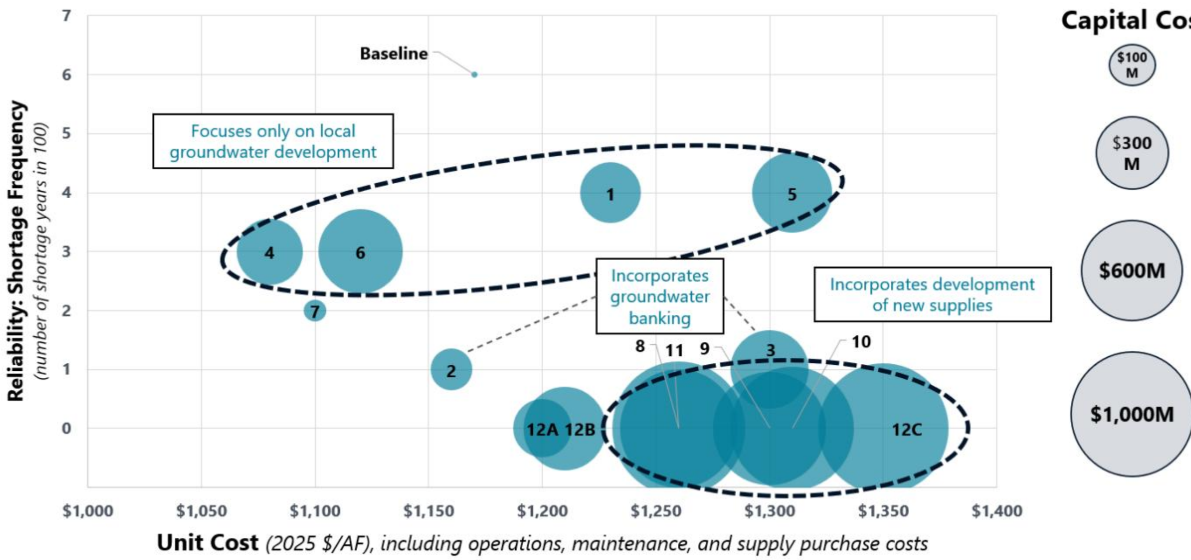
Figure 13 graphs the projected reliability of each portfolio as the projected number of years where shortages will occur under Scenario B relative to estimated unit costs (in 2025 dollars). Scenario B reflects the most likely future conditions in 2050. For additional comparison, each portfolio is represented as a circle sized relative to the aggregate of all project capital costs needed to implement the portfolio.

Figure 13 shows that there are several portfolios that can achieve high reliability with a range of costs. Portfolios 1, 4, 5, and 6 share a similar focus on maximizing existing groundwater production areas without much investment in additional new supplies. Portfolio 7, focusing on imported water supplies, improves reliability one step further, but has limitations in the total volume of additional imported supplies that can be acquired which limit its impact and feasibility. While portfolios 1, 4, 5, 6, and 7 show some improvement from baseline reliability, Portfolios 2, 12A, and 12B are able to further improve reliability at a similar cost. By incorporating new groundwater development and external banking, portfolios 2, 12A, and 12B have the potential to achieve the same one to zero years of shortage (under the most likely conditions in 2050) at a lower capital and unit cost than portfolios 8, 9, 10, 11, and 12C.

Key takeaways from this comparison of reliability (Scenario B) vs cost are:

- Portfolios 2, 12A and 12B are able to further improve reliability without increasing cost relative to portfolios 1, 4, 5, and 6
- Increased banking/storage is a low capital cost way to improve reliability
- Capital investments in new supplies will improve reliability in 2050 but at a higher cost

FIGURE 13: RELIABILITY (SCENARIO B) VS COST



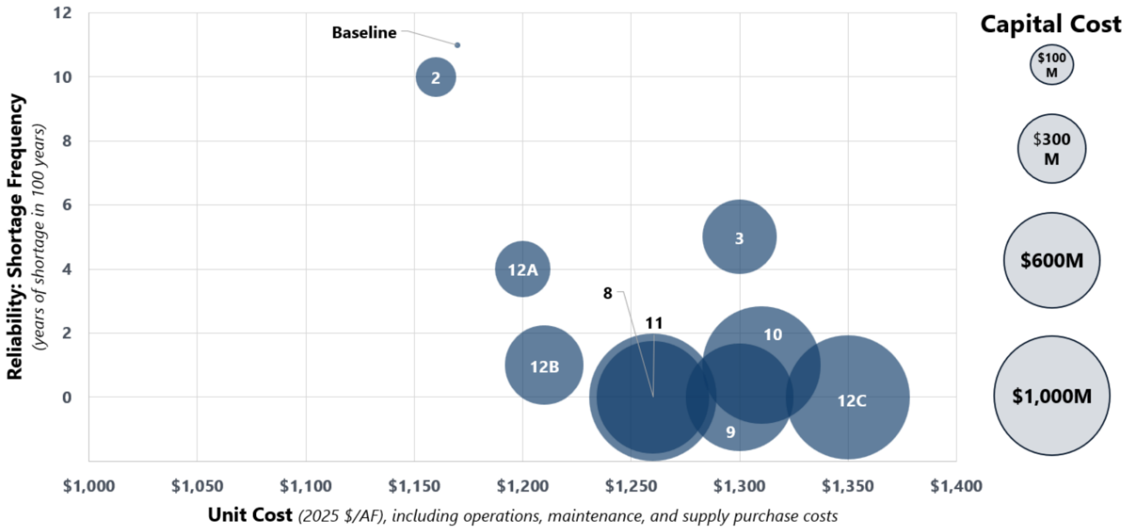
While Scenario B reflects the most likely conditions in 2050, Scenario C was created to reflect potential future climatic conditions by 2075. Given future uncertainty there is a possibility, however, that the conditions projected for 2075 under Scenario C could occur by 2050. Although the planning horizon for this WRMP is 2050, it is worthwhile to consider whether ACWD should invest between now and 2050 in preparing for the potential for increased supply needs by at least 2075. Furthermore, comparing portfolio reliability results under Scenarios B and C can help identify projects that may perform well under Scenario B but not Scenario C, indicating a portfolio with infrastructure investments that will not provide lasting benefits beyond the planning horizon of the WRMP.

Figure 14 shows the reliability results of the portfolios under Scenario C future conditions. Since portfolios 1, 4, 5, and 6 already did not meet reliability thresholds under Scenario B, and Portfolio 7 was not considered feasible, they were removed from the Scenario C analysis. **Figure 14** reflects the decrease in reliability of baseline and portfolios 2, 3, 12A, and 12B under the more extreme climatic conditions. Only those portfolios that invest in new forms of supply, like bay desalination and recycled water, are able to maintain the highest level of future reliability.

Key takeaways from this comparison of reliability (Scenario C) vs cost are:

- Under moderate 2075 (or severe 2050) climate conditions, only those portfolios that generate a significant new supply will meet Board-established reliability threshold goals
- There is a trade-off between cost and preparedness for longer-term future uncertainty for decision makers to consider

FIGURE 14: RELIABILITY (SCENARIO C) VS COST



Comparing Reliability Against Local Control

While reliability is an important criterion in deciding ACWD's future water supply mix, the ability to have future control over those supplies will enhance ACWD's ability to better adapt to and respond to changing conditions while limiting the potential impacts from decisions made outside of ACWD's control. Imported water supplies are managed by entities outside of ACWD and although ACWD secures agreements to purchase those supplies, they are still considered to be outside of ACWD control.

Figure 15 reflects the same Scenario B reliability results shown in **Figure 13**, but charts them relative to the level of local control ACWD has over the aggregate mix of supplies in each portfolio. Whereas **Figure 13** reflects less favorable performance as costs increase from left to right, **Figure 15** shows the opposite pattern: performance improves from left to right as local control increases.

Because Portfolios 1 and 5 maintain relatively higher levels of imported water purchases than other portfolios, they are both less reliable and allow for less local control. Portfolios 2 and 3 improve reliability by giving up some additional local control through participation in shared groundwater banks. Alternatively, Portfolios 4 and 6 show only a slight increase in reliability from Portfolios 1 and 5 but increase local control substantially by investing in development of new local groundwater supplies.

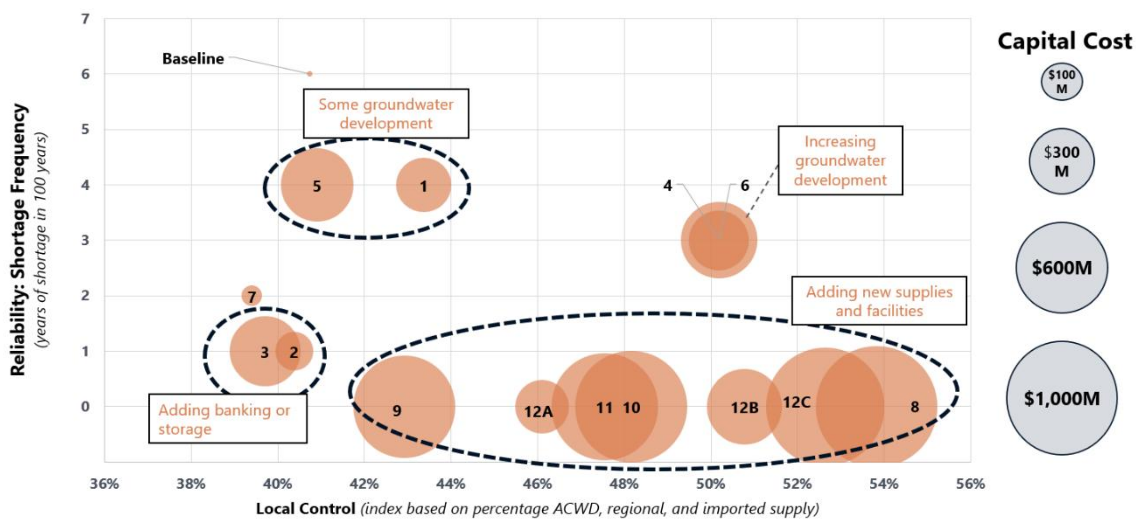
The highest reliability portfolios 8, 9, 10, 11, 12A, 12B, and 12C focus on the development of new supplies with a range of local control depending on the level of external partnership participation needed to produce and convey those supplies to ACWD. Portfolio 9, with a focus only on bay desalination, will require a large scale partnership with many entities in addition to making it a feasible supply, whereas Portfolio 8 relies on the development of recycled water in addition to stormwater capture and use as well as even greater levels of water use efficiency that would be ACWD-only projects.

Key takeaways from this comparison of reliability (Scenario B) vs local control are:

- The cost and reliability benefits of groundwater banking present a tradeoff to having more local control

- Due to limits on local groundwater supplies, portfolios without new regional supplies will be more dependent on imported water outside of ACWD control
- The "new supply" portfolios (8-12) have a similar reliability, but a broad range of local control
- Focusing only on local supplies does not necessarily improve reliability

FIGURE 15: RELIABILITY (SCENARIO B) VS LOCAL CONTROL



4. PREFERRED PORTFOLIO

4.1 Selection of a Preferred Portfolio

After using all ten criteria to evaluate the first 11 portfolios, it became clear that a better portfolio could be built to balance the need for addressing reliability uncertainty and cost, while maximizing local control in a phased, adaptable way that also continues ACWD's legacy of regional leadership and partnerships. The resulting Portfolio 12 was built to be implemented in three phases that can respond to potential future internal and external drivers. The performance of Portfolio 12 in **Section 3** highlights its relative performance against other portfolios and was specifically developed to do the following:

1. **Prioritize low- and no-regret investments that provide multiple benefits under today's conditions**
   Focus initial efforts on measures that perform well across a wide range of future scenarios while addressing multiple current needs.

2. **Layer in future interventions to address uncertainty while avoiding stranded assets**
   Later phases address uncertain future conditions by building on early investments rather than abandoning them.

3. **Establish a monitoring and trigger framework to guide costly future investments**
   A monitoring plan with trigger points guides the timing and scope of investments, ensuring costly steps are taken only when conditions warrant.

4. **Include flexible, adaptive pathways**
   Incorporate elements that can be adapted as circumstances evolve to support long-term resilience while maintaining scalability.

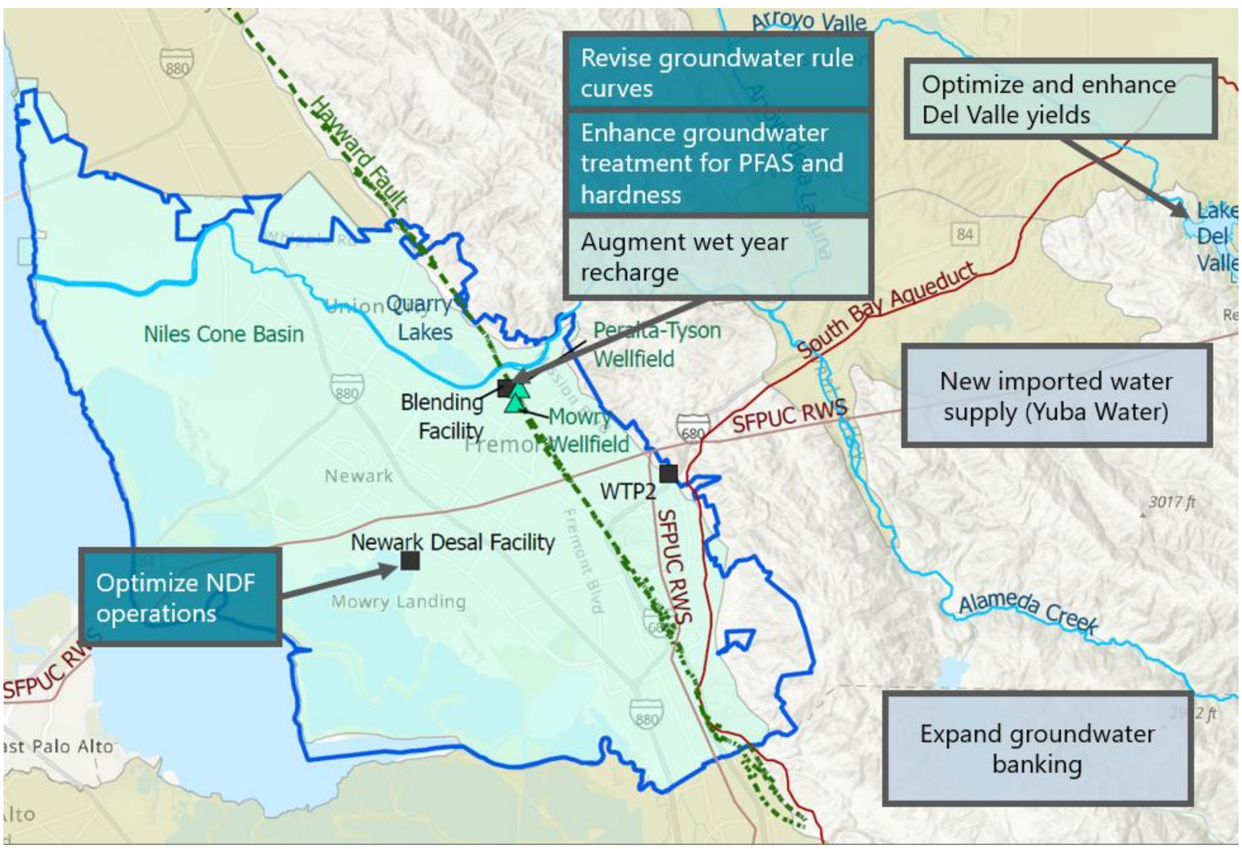
Portfolio 12 is a single portfolio that has three distinct phases, combining supply options that build on existing resources and facilities to enhance the resiliency of ACWD's water system, while adding new supplies to enhance adaptive capacity to respond to more extreme climate change impacts. Phase 1 (**Section 4.2**) begins with no- and low-regret, multi-benefit options that strengthen resilience today, with later phases (**Sections 4.3** and **4.4**) introducing higher-cost supplies as triggered by various factors (see **Section 5**).

4.2 Portfolio 12A (Phase 1)

Portfolio 12A (Phase 1) includes the following supply options, as shown in **Figure 16**:

- Augment wet year recharge (LW.1)
- Optimize and enhance Del Valle Yields (LW.3)
- Revise groundwater rule curves (GW.2) & lower minimum operating levels (GW.3) in the Niles Cone Groundwater Basin
- Enhance groundwater treatment for PFAS and hardness (GW.4)
- Optimize Newark Desalination Facility operations (GW.5)
- Expand groundwater banking (IW.1 and/or IW.5)
- Purchase new imported water supply through the Yuba Accord (IW.3)

FIGURE 16: PORTFOLIO 12A (PHASE 1) SUPPLY OPTIONS



Average annual supplies used in this portfolio are shown in **Table 49**. Modeling estimates that in an average year, imported water purchases will decrease from 26,100 AFY under baseline conditions to 23,550 AFY with the implementation of options included in Portfolio 12A. SFPUC purchases will decrease by 1,500 AFY while SWP use will decrease by 1,050 AFY. The increase in groundwater production will allow for increased recharge of SWP and local surface water supplies.

TABLE 49: PORTFOLIO 12A (PHASE 1) AVERAGE ANNUAL SUPPLY UTILIZATION

Supply Source	Average Annual Volume	Baseline Portfolio Average Annual Volume
SFPUC (direct use)	11,200 AF	12,700 AF
SWP plus Yuba Water (direct use)	10,050 AF	9,700 AF
SWP (recharge)	2,300 AF	3,700 AF
Lake Del Valle	5,400 AF	5,300 AF
Groundwater[1]	15,000 AF	12,700 AF

1. Groundwater includes naturally recharged stormwater and managed aquifer recharge (local watershed runoff that is diverted into the Quarry Lakes Recharge Ponds and in-channel impoundment area of Alameda Creek Flood Control Channel)

This phase has a total capital cost of $177 million (in 2025 dollars), as shown in **Table 50**, and has an annual cost (including O&M and imported water purchase) of $54 million per year (in 2025 dollars), as shown in **Table 51**.

TABLE 50: PORTFOLIO 12A (PHASE 1) CAPITAL COST

Supply Option	Capital Cost (2025 $)
Augment wet year recharge (LW.1)	$0
Optimize and enhance Del Valle Yields (LW.3)	$0
Revise groundwater rule curves (GW.2) & lower minimum operating levels in the Niles Cone Groundwater Basin (GW.3)	$0
Enhance groundwater treatment for PFAS and hardness (GW.4)	$151.2M
Optimize Newark Desalination Facility operations (GW.5)	$0.4M
Groundwater banking outside the Alameda Creek watershed (IW.1) *(could be IW.5, but assumed IW.1 for cost estimating purposes)*	$25.3M
Purchase new imported water supply through the Yuba Accord (IW.3)	$0
Total Capital Cost	**$176.9M**

TABLE 51: PORTFOLIO 12A (PHASE 1) ANNUAL COST

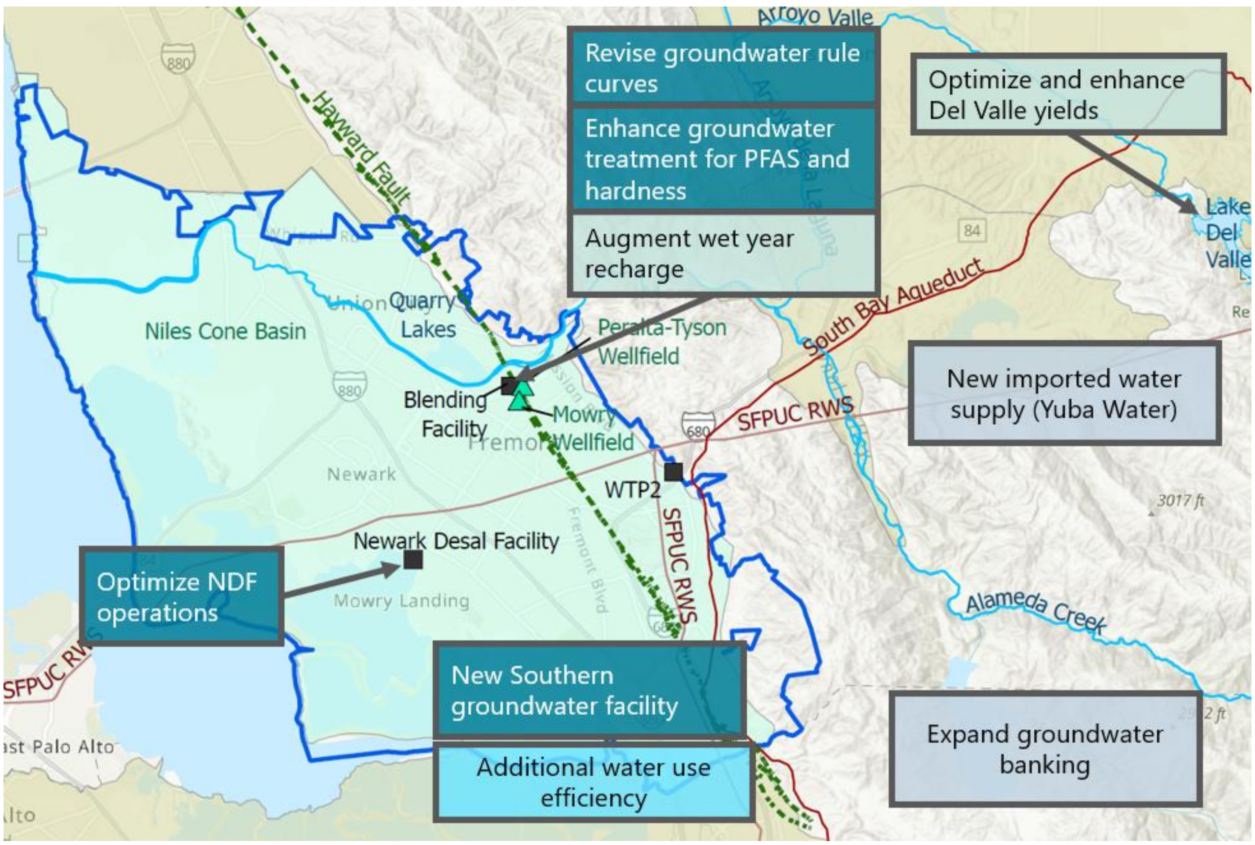
Annual Cost Component	Annual Cost (2025 $)
Groundwater pumping	$0.9M
Conveyance and distribution for new facilities	$0.3M
Treatment Plant 2	$1.5M
Brackish Groundwater Desalination Treatment	$1.6M
PFAS Treatment	$3.6M
RO Treatment	$1.1M
Blender	<$0.1M
New Full Time Equivalents	$0.6M
Semitropic	$1.2M
New Groundwater Bank	$1.0M
SFPUC Water Purchase	$29.5M
SWP Water	$11.9M
New Imported Supply (Yuba Water)	$0.4M
Annual Cost	**$53.6M**

4.3 Portfolio 12B (Phase 2)

Portfolio 12B (Phase 2) enhances the portfolio with an additional local supply option and water use efficiency to address declining availability of imported supplies and enhances resilience to the most vulnerable supply (SWP water). This phase adds one or both of the following options to those options included in Phase 1, as shown in **Figure 17**:

- Southern Groundwater Facility – note that additional study of this area of the Niles Cone Groundwater Basin is needed to determine the groundwater quality and potential production volumes (GW.1 assumed for modeling purposes)
- Additional Water Use Efficiency beyond Urban Water Use Objectives – optional, depending on further study (DM.1)

FIGURE 17: PORTFOLIO 12B (PHASE 2) SUPPLY OPTIONS



Average annual supplies used in this portfolio are shown in **Table 52**. Modeling estimates that in an average year, imported water purchases will decrease from 26,100 AFY under baseline conditions to 21,500 AFY with the implementation of options included in Portfolio 12B. SFPUC purchases will decrease by 2,900 AFY while SWP use will decrease by 1,700 AFY (relative to baseline). The increase in groundwater production will allow for increased recharge of local surface water supplies.

TABLE 52: PORTFOLIO 12B (PHASE 2) AVERAGE ANNUAL SUPPLY UTILIZATION

Supply Source	Average Annual Volume	Baseline Portfolio Average Annual Volume
SFPUC (direct use)	9,800 AF	12,700 AF
SWP plus Yuba Water (direct use)	9,400 AF	9,700 AF
SWP (recharge)	2,300 AF	3,700 AF
Lake Del Valle	5,500 AF	5,300 AF
Groundwater[1]	15,500 AF	12,700 AF
Additional Water Use Efficiency	1,500 AF	N/A

1. Groundwater includes naturally recharged stormwater and managed aquifer recharge (local watershed runoff that is diverted into the Quarry Lakes Recharge Ponds and in-channel impoundment area of Alameda Creek Flood Control Channel)

This phase adds an additional capital cost of $179 million, on top of the Portfolio 12A (Phase 1) capital costs for a total of $356 million (in 2025 dollars) including phase 1, as shown in **Table 53**, and has an annual cost (including O&M and imported water purchase) of $54 million per year (in 2025 dollars), as shown in **Table 54**. Annual costs are inclusive of phases 1 and 2 (Portfolios 12A and 12B).

TABLE 53: PORTFOLIO 12B (PHASE 2) CAPITAL COST

Supply Option	Capital Cost (2025$)
Southern Groundwater Facility (GW.1)	$178.7M
Additional Water Use Efficiency (DM.1)	$0
Total Capital Cost (Portfolio 12B)	**$178.7M**
Total Capital Cost (Portfolios 12A & 12B)	**$355.6M**

TABLE 54: PORTFOLIO 12B (PHASE 2) ANNUAL COST

Annual Cost Component	Annual Cost (2025 $)
Groundwater pumping	$1.0M
Conveyance and distribution for new facilities	$0.8M
Treatment Plant 2	$1.5M
Brackish Groundwater Desalination Treatment	$2.0M
PFAS Treatment	$3.6M
RO Treatment	$2.2M
Blender	<$0.1M
New Full Time Equivalents	$1.3M
Semitropic	$1.2M
New Groundwater Bank	$1.0M
Additional Water Use Efficiency	$1.3M
SFPUC Water Purchase	$25.9M
SWP Water	$11.9M
New Imported Supply (Yuba Water)	$0.4M
Annual Cost	**$54.0M**

4.4 Portfolio 12C (Phase 3)

Portfolio 12C (Phase 3) builds on Phase 2 by adding Indirect Potable Reuse for Groundwater Recharge (PW.3a), as shown in **Figure 18**. Note that supply project PW.3a differs slightly from how it was described in prior TM5 in that it relies on RO treatment that is assumed to be built in Phase 1 as part of GW.4.

After implementing Phases 1 and 2 of the selected portfolio, analysis indicates that the District is not expected to face a significant supply shortage until 2050 or later. Meeting supply needs beyond that timeframe will require development of a large-volume water supply project, which is typically costly and requires many years of planning and coordination. While the purchase of additional imported water may be considered, Scenario C analyses show a long-term decline in the reliability of SWP supplies due primarily to climate change. Given the high capital costs, long lead times, and substantial uncertainty of large-volume supply projects, the District seeks to preserve flexibility and avoid committing to a single solution prematurely. The question is therefore not whether additional supply will be needed, but when (more details on implementation triggers are described in **Section 5**). The two most promising supply options currently available to address this future challenge are Bay desalination and purified water.

Since adoption of the 1995 IRP, recycled water has been identified as the District's next major source of supply. Subsequent planning efforts found that indirect potable reuse offers a more effective long-term solution than traditional non-potable recycled water. The selected portfolio builds on this past work by advancing near-term actions in Phases 1 and 2 that benefit the District today and also better position the District for a future large-scale supply project, **if and when** it is needed. Phase 3 includes a purified water recharge project that leverages existing infrastructure and programs implemented since the 1960's and builds directly on groundwater production, treatment, and operational enhancements implemented in Phases 1 and 2, enabling more effective utilization of the Niles Cone.

During development of Portfolio 12C (phase 3), purified water (IPR) was selected as the significant new supply for potential future development over bay desalination (e.g., Portfolio 9) for the following reasons:

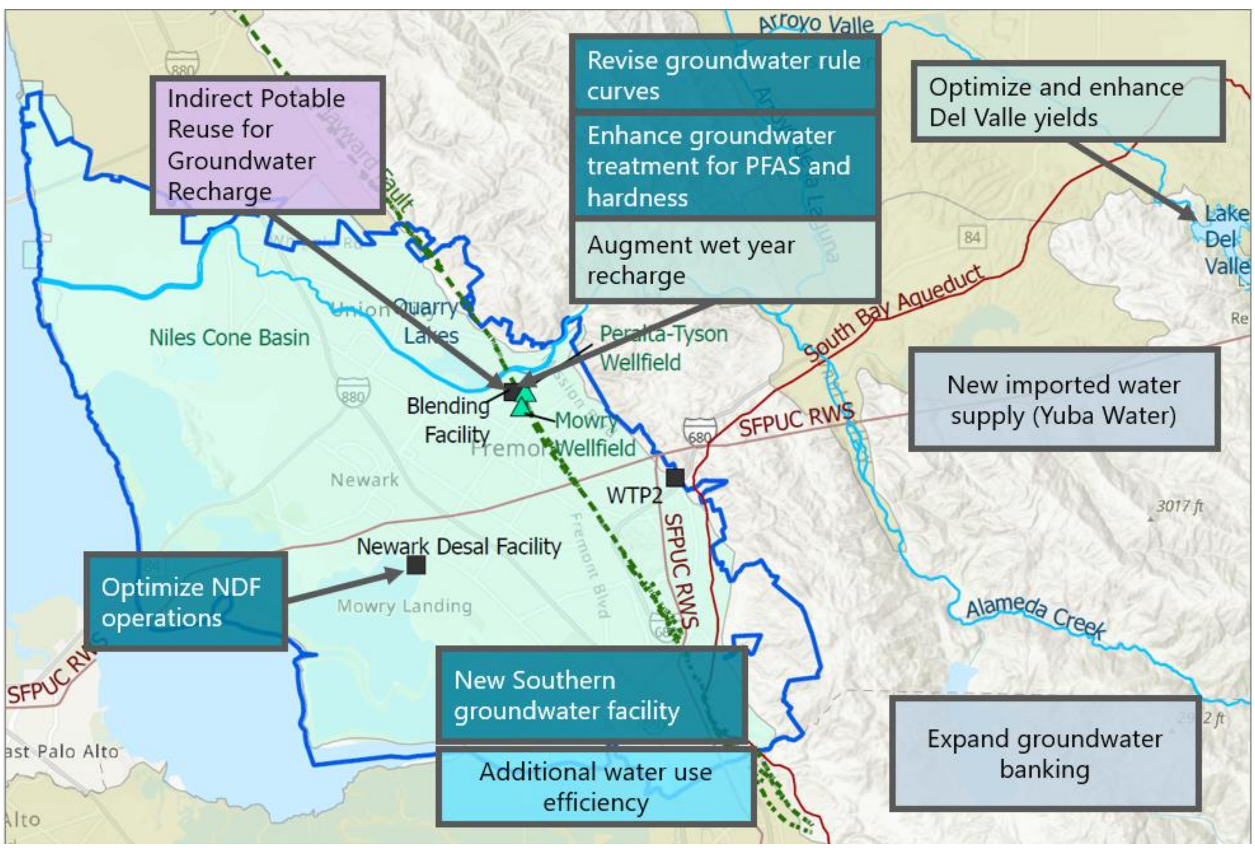
- Local control – While both options require regional partnerships and cannot be produced and managed solely by ACWD, there are differences in the level of control ACWD would have over the produced supply. To be cost-effectively sized, bay desalination would likely need to be developed at a scale larger than the District's projected needs, requiring one or more partners and introducing additional operational and governance complexities (for example, negotiating with agencies that manage the existing brine discharge line and outfall). The IPR option will be closer to ACWD's service area and would be a partnership with USD – allowing for more ACWD control. For example, Portfolio 9's (bay desal) local control index is 43% compared to 53% for Portfolio 12C.

- Regulatory, environment, and permitting risk – Bay desalination is expected to see significantly higher permitting challenges, stronger environmental opposition, and brine management challenges compared to purified water. Similar projects throughout California have faced a history of denials and the time and effort to navigate politics and permitting can be a significant burden to the implementing agency(ies). Purified water benefits from a clear and established regulatory framework in California. Purified water also typically receives stronger support from environmental and community stakeholders and aligns with the State's direction to expand recycling and reduce wastewater discharges through beneficial reuse. The State's commitment to expanding recycled water is reinforced in the funding landscape – there are currently more external funding opportunities for water recycling than for desalination projects.

- Compatibility with existing system and prior projects in portfolio – Purified water for groundwater recharge works in tandem with earlier phases of the preferred portfolio to recharge the Niles Cone at a point in time at which the sustainable yield of the Niles Cone has been exhausted. Bay desalination could provide a large volume of drought-proof supply, but to be cost effective, would end up being over-sized for the District's future water supply needs. The capital cost and early commitment needed to coordinate implementation of bay desalination would shift spending away from the incremental, lower-cost projects in Phases 1 and 2 that optimize existing assets and local supply sources.
- Energy use – While both supply options require a relatively large amount of energy to produce, bay desalination is significantly higher (on the order 4,600 kWh/AF) compared to purified water for groundwater recharge (approximately 2,000 kWh/AF). It can be assumed that future innovations in developing more cost-effective energy sources would benefit both options.
- System Adaptability – new treatment adjacent to the coast for bay desalination may be more vulnerable to sea level rise.

Taken together, purified water was found to provide greater implementability, preserve flexibility, support continued optimization of local supplies, and allow major capital investment to be deferred until a clear need for additional drought-proof supply is demonstrated through a defined monitoring and trigger framework.

FIGURE 18: PORTFOLIO 12C (PHASE 3) SUPPLY OPTIONS



Average annual supplies used in this portfolio are shown in **Table 55**. Modeling estimates that in an average year, imported water purchases will decrease from 26,100 AFY under baseline conditions to 18,200 AFY with the implementation of options included in Portfolio 12C. SFPUC purchases will decrease by 4,800 AFY while SWP use will decrease by 3,100 AFY (relative to baseline). The increase in groundwater production will allow for increased recharge of local surface water supplies.

TABLE 55: PORTFOLIO 12C (PHASE 3) AVERAGE ANNUAL SUPPLY UTILIZATION

Supply Source	Average Annual Volume	Baseline Portfolio Average Annual Volume
SFPUC (direct use)	7,900 AF	12,700 AF
SWP plus Yuba Water (direct use)	9,400 AF	9,700 AF
SWP (recharge)	900 AF	3,700 AF
Lake Del Valle	5,200 AF	5,300 AF
Groundwater[1]	14,400 AF	12,700 AF
Purified water (recharge)	6,100 AF	N/A
Additional Water Use Efficiency	1,500 AF	N/A

1. Groundwater includes naturally recharged stormwater and managed aquifer recharge (local watershed runoff that is diverted into the Quarry Lakes Recharge Ponds and in-channel impoundment area of Alameda Creek Flood Control Channel)

This phase adds an additional capital cost of capital cost of $526 million, for a total of $882 million (in 2025 dollars) including phases 1 and 2, as shown in **Table 56**, and has an annual cost (including O&M and imported water purchase) of $60 million per year (in 2025 dollars), as shown in **Table 57**. Annual costs are inclusive of all phases of Portfolio 12. Modeling of this portfolio estimates that production at NDF is decreased in favor of pumping recharged purified water and RO treatment.

TABLE 56: PORTFOLIO 12C (PHASE 3) CAPITAL COST

Supply Option	Capital Cost (2025$)
Indirect Potable Reuse for Groundwater Recharge (PW.3a)	$526.2M
Total Capital Cost (Portfolio 12C)	**$526.2M**
Total Capital Cost (Portfolios 12A, 12B & 12C)	**$881.8M**

TABLE 57: PORTFOLIO 12 (ALL PHASES) ANNUAL COST

Annual Cost Component	Annual Cost (2025 $)
Groundwater pumping	$1.1M
Conveyance and distribution for new facilities	$4.9M
Treatment Plant 2	$1.5M
Brackish Groundwater Desalination Treatment	$1.2M
PFAS Treatment	$3.6M
RO Treatment	$3.7M
Blender	<$0.1M
Purified Water Treatment	$5.6M
New Full Time Equivalents	$1.9M
Semitropic	$1.2M
New Groundwater Bank	$1.0M
Additional Water Use Efficiency	$1.3M
SFPUC Water Purchase	$21.0M
SWP Water	$11.9M
New Imported Supply (Yuba Water)	$0.4M
Annual Cost	**$60.2M**

5. IMPLEMENTATION PLAN

5.1 Introduction and Schedule

The WRMP is intended to serve as a roadmap for implementing projects to provide reliable, affordable, and high-quality water to ACWD's customers through 2050 and beyond. The preferred Portfolio 12 was built as three phases to allow for a dynamic planning and adaptive decision-making process, enabling ACWD to continually revisit assumptions, incorporate new data, and accommodate changing future conditions. In addition to the implementation of the supply projects within Portfolio 12, there are several key water resources strategies that were identified to support supply project implementation and meet other WRMP goals beyond water supply.

The WRMP implementation plan, depicted in **Figure 19**, **Figure 20**, and **Table 58**, is intended to assist ACWD in dynamic implementation of the future projects and policies identified in **Section 4**. Key elements of the implementation plan include:

- Project implementation phasing and considerations
- Near-term analyses and internal drivers for future decision points
- External triggers for future decision points
- Interconnectivity between projects through triggers and decision points
- Estimated capital and annual (operations & maintenance, plus supply purchase) costs for WRMP implementation
- Policy strategies that could/should be implemented to help support overall implementation of WRMP projects and to support additional WRMP Goals.

FIGURE 19: IMPLEMENTATION SCHEDULE

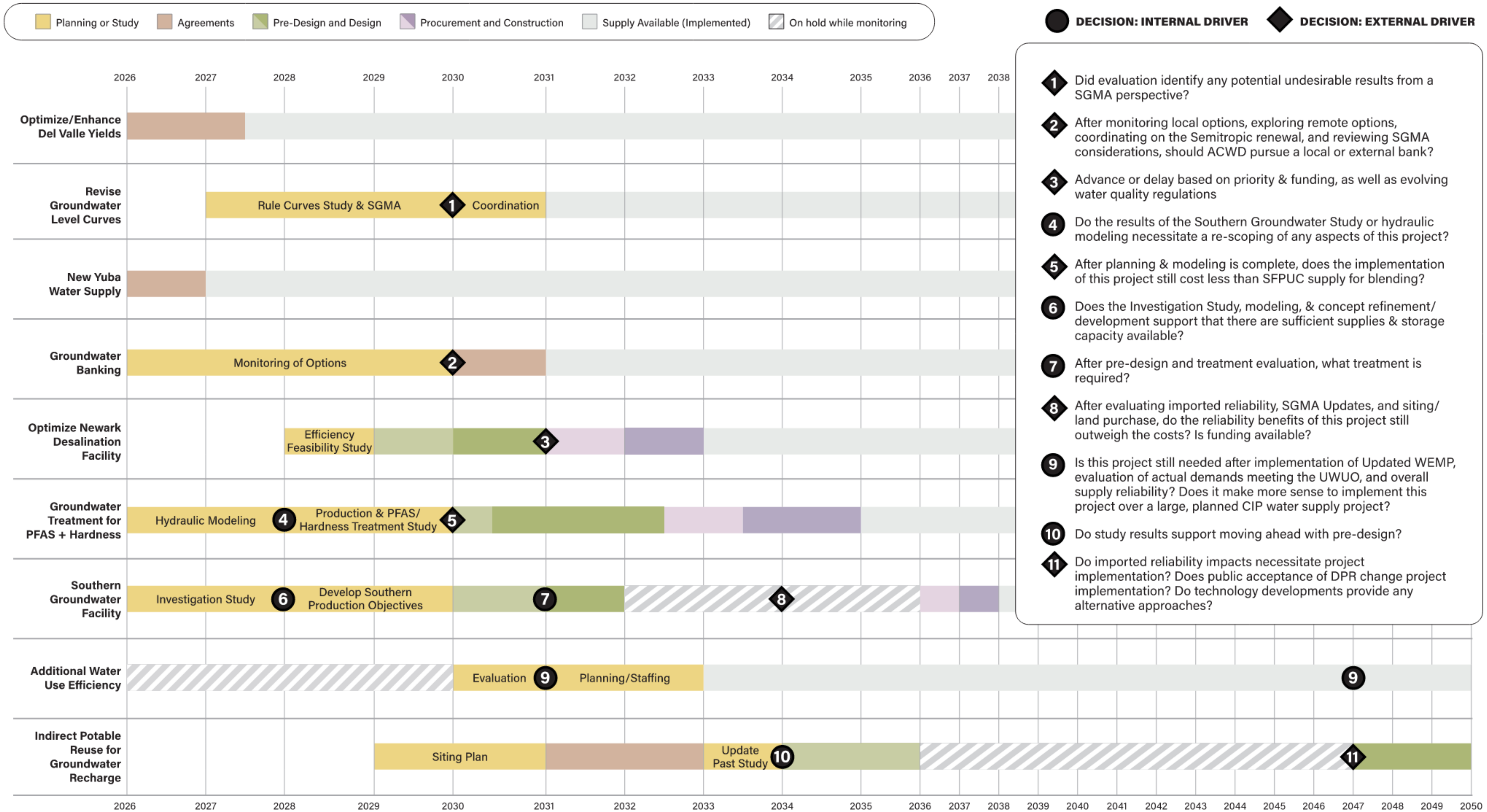


FIGURE 20: PROJECT IMPLEMENTATION RELATIONSHIPS

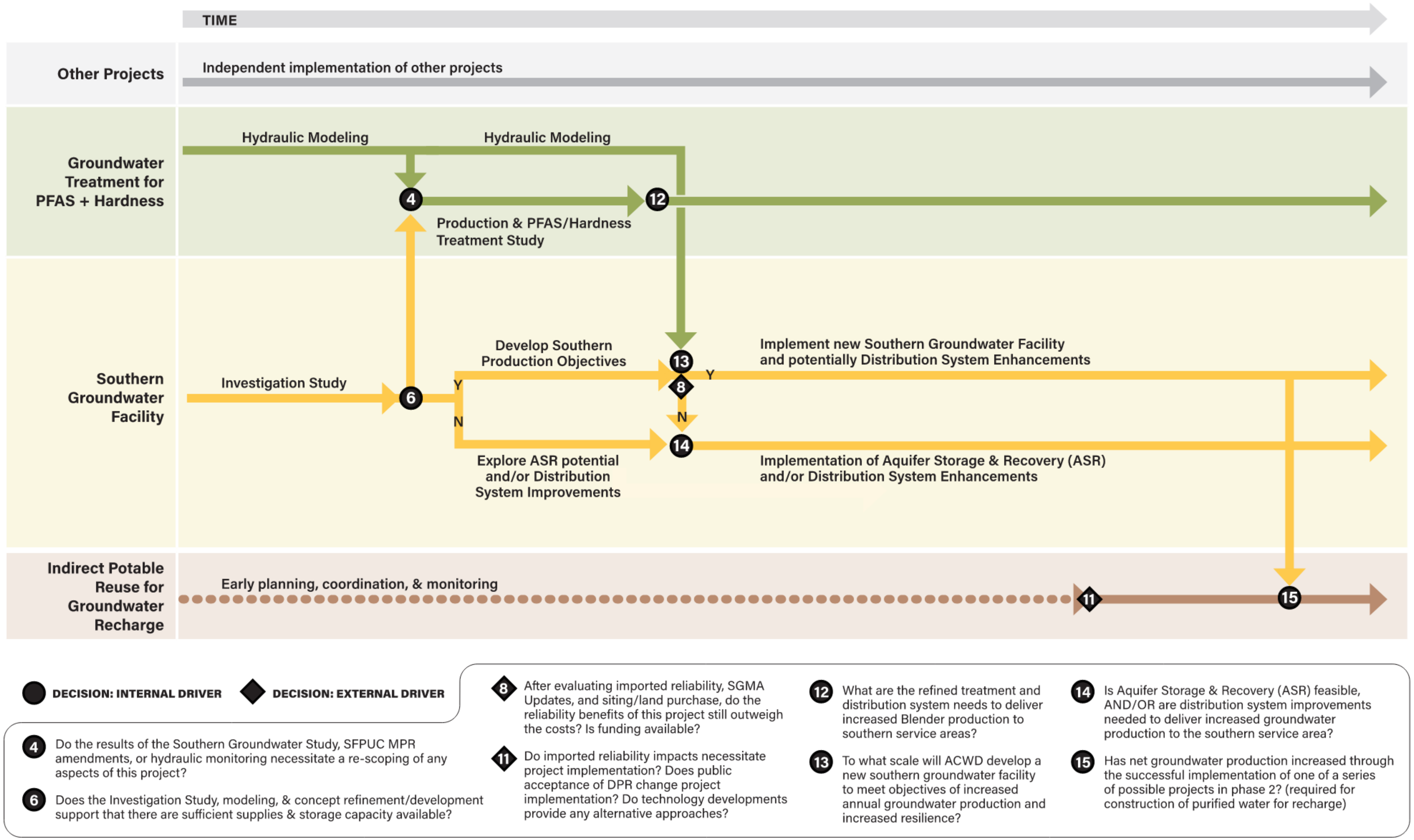


TABLE 58: IMPLEMENTATION PLAN DETAILS

Option	Next Steps					Potential Triggers, Dependencies, and Timing
	Additional Planning or Study	Partnership or Contracting Coordination	Regulatory Agency Coordination	Policy Changes	Design and Construction	
Baseline						
Optimize and enhance Del Valle Yields (LW.3)	Assess whether modifying Forecast-Informed Reservoir Operations rules or lowering minimum operating levels is acceptable to other agencies with rights at Del Valle Review existing operations to identify opportunities to optimize existing water right permit volume	Coordinate with East Bay Regional Parks District (EBRPD), Zone 7, Valley Water, others on the South Bay Aqueduct	Coordinate with USACE; File petition and coordinate with the State Water Resources Control Board (SWRCB) & DWR	Implement changes to Del Valle Operations	Not applicable	Begins immediately; requires coordination with other Del Valle users, including Zone 7 and DWR, Valley Water
Phase 1						**Triggers are project-specific. Assumes most studies will begin immediately or in next few years.**
Revise groundwater rule curves (GW.2)& lower minimum operating levels (GW.3) in the Niles Cone Groundwater Basin	Conduct groundwater modeling (IRPM and NEBIM) to evaluate optimized rule curves, including benefits, risks, and operational impacts Develop District management changes to implement rule curve and minimum operating level changes	Conduct outreach with SWRCB, DWR, Adjacent GSAs, EBRPD, and the City of Fremont, including coordination related to quarry lake recharge operations	Coordinate with updates to ACWD's Alternative to a Groundwater Sustainability Plan (GSP, Alternative) regarding basin management under SGMA, as needed; evaluate potential undesirable results from SGMA perspective	Implement groundwater level management changes	Not applicable	Low regret option – No direct capital cost (though will require staff/consultant support effort), can be implemented as water supply becomes more constrained. ACWD must confirm that changes to rule curves are compliant with SGMA objectives prior to implementation.
Augment wet year recharge (LW.1)	None	Not applicable	Not applicable	Not applicable	Not applicable	Low regret option – No direct capital cost (though will require some staff effort), can be implemented opportunistically to optimize recharge operations.

Option	Next Steps					Potential Triggers, Dependencies, and Timing
	Additional Planning or Study	Partnership or Contracting Coordination	Regulatory Agency Coordination	Policy Changes	Design and Construction	
Optimize Newark Desalination Facility operations (GW.5)	Identify and study alternatives to increase recovery rate, which may include a review of the 2021 ACWD Desalination Recirculation Concept Memorandum, and assessment of modern RO facility designs. Conduct an NDF efficiency feasibility study, and if necessary, design work and bench testing Identify needed modifications to increase NDF recovery rate Consider identification of NDF as a critical facility	Not applicable	Ensure changes in brine concentration do not conflict with existing permits; coordinate with East Bay Dischargers Authority, SWRCB	Not applicable	Hire a treatment design specialist to review concept feasibility and perform preliminary design. Coordinate with ACWD Project Engineering to confirm when this fits into the CIP schedule.	Feasibility study to assess alternatives for improving treatment efficiency to be started in next few years, coordinate with ongoing PFAS planning work so that operational changes are consistent with ACWD's broader PFAS goals. Future NPDES requirements/regulations may limit amount of PFAS allowable in concentrate. Place estimate of project costs into CIP and begin look for grant funding – assumed to be highly eligible. Advance or delay based on PFAS regulations, CIP priority and grant availability.
Enhance groundwater treatment for PFAS and hardness (GW.4)	Complete a groundwater production and PFAS/hardness treatment study at Blender Facility to refine treatment needs. Conduct hydraulic modeling study to refine distribution system needs to deliver increased Blender production to southern service areas (in coordination with planning and objective development for the Southern Groundwater Facility GW.1)	Coordinate with BAWSCA and SFPUC on minimum purchase quantity (MPQ) re-assessment	(Typical project permitting considerations) SWRCB-DDW, and San Francisco RWQCB	Not applicable	Engage with a treatment design specialist for concept selection and pre-design guidance.	Size and refined design of PFAS and hardness treatments will rely on the investigation results of southern GW basin. PFAS treatment and hardness treatment can be considered independently of each other, depending on ACWD's PFAS goals. Project may depend on outcome of negotiations with SFPUC on future minimum purchase requirements. Availability of funding for treatment of contaminants of emerging concern (PFAS)
Purchase new imported water supply through the Yuba Accord (IW.3)	Review Yuba Water Agreements (Agreement between Yuba and DWR, Agreement between DWR and ACWD), and CEQA needs	Sign on Agreement with DWR on dry year water purchase program	Prepare Notice of Determination to join the program	Not applicable	Not applicable	Begins immediately (already ongoing in 2026)
Groundwater banking (IW.1 and/or IW.5)	Conduct an alternatives analysis to evaluate terms of alternative groundwater banking opportunities; monitor local groundwater bank options Complete modeling to determine sensitivity to bank size	Engage with Semitropic to discuss amendments to existing agreement Monitoring progress of potential local banking opportunities	Ongoing coordination with DWR for sending imported water to water bank as water is available	Review need for updating internal policy/operating guidelines with addition of a second groundwater bank	Not applicable	Recommendation for where and how to expand groundwater banking should result from alternatives analysis; will depend on terms of the opportunities. 2035 marks expiration of current Semitropic agreement and may drive some decision-making. May improve reliability of imported water supply, decreasing urgency of some more costly future water supply projects.

Option	Next Steps					Potential Triggers, Dependencies, and Timing
	Additional Planning or Study	Partnership or Contracting Coordination	Regulatory Agency Coordination	Policy Changes	Design and Construction	
Phase 2						Climate change trends towards Scenario B conditions by 2045 or other conditions result in similar supply reliability levels seen in Scenario C. Reduced storage ability. Reduced availability of imported supplies
Southern Groundwater Facility (GW.1)	Complete Supplemental Southern Basin investigation: • Install test and monitoring wells at several alternative sites • Groundwater model updates based on estimated aquifer parameters. (Potentially greater model-wide re-calibration, depending on findings) • Refine concept based on water quality (Fresh water? Brackish? Blending or onsite softening? etc.) • Well siting in tandem with land acquisition. (Some InfoWater modeling performed in tandem) Based on study results, scope the effort to clarify whether the project objective is to • Simply increase net annual groundwater production (primarily a water-supply objective), or • Provide supply during SWP outages through added production and/or conveyance capacity (supply and resilience objective).	Not applicable	Coordinate with RWQCB (NPDES permitting), Division of Drinking Water, Alameda County Flood Control District, Groundwater Sustainability Agencies of adjacent basins; Coordinate updates to Alternative regarding basin management under SGMA, as needed with DWR	Not applicable	Land purchase for new wells and treatment plant, if needed Predesign for wells and treatment plant, if needed (define capacities, treatment technologies, identify alignments)	If study indicates sufficient groundwater is available for production, ACWD should consider implementing the project based on cost effectiveness of constructing a new production facility(ies). Treatment selection should stem from results of the study; treatment required will inform overall cost effectiveness of the supply. Availability of suitable land for well and treatment facility siting and funding may influence scheduling. If no water available, conduct holistic study on groundwater facility and distribution system recommendations, which might include exploring ASR potential, advancing the IPR project, and/or incorporating potential enhancements to existing groundwater production facilities (including hydraulic system improvements).
Additional Water Use Efficiency (DM.1)	Prepare a Water Efficiency Master Plan Addendum in line with what the Board has previously approved related to compliance with the UWUOs Complete additional systems modeling to determine sensitivity of shortages to conservation and build a business case Evaluate rate structure options for better alignment of costs with cost drivers	Not applicable	Not applicable	Implement new conservation measures; approve Water Efficiency Master Plan Amendment	Not applicable	Evaluate the implementation of additional water use efficiency at multiple possible steps when triggered by other factors (e.g., if demand reduction from other efforts is not sufficient to meet UWUOs, more information available on next steps for the Southern Groundwater Facility, and/or other factors indicate earlier Scenario C conditions)

Option	Next Steps					Potential Triggers, Dependencies, and Timing
	Additional Planning or Study	Partnership or Contracting Coordination	Regulatory Agency Coordination	Policy Changes	Design and Construction	
Phase 3						Climate change trends towards Scenario C conditions by 2045 or other conditions result in similar supply reliability levels seen in Scenario C[1]
Indirect Potable Reuse for Groundwater Recharge (PW.3a)	Develop public awareness and education materials Update past study, prepare a siting plan, and scope land acquisition need	Engage with USD to assess availability of wastewater for treatment and enter into agreement Form Ad Hoc committee as an interim governance structure Consider formation of JPA or other governance structure	Coordinate with RWQCB and SWRCB for development of purified water system	Not applicable	Develop more detailed implementation plan Complete pre-design report Acquire land (potential link to strategy for affordability)	Project depends on agreements with partners for influent supply. If water supply reliability trends towards more extreme scenario and/or if demand grows at a different rate with additional water conservation efforts than assumed or other external factors shift, resulting potential water supply shortages, may need to move up timeline on purified water implementation. As approach implementation, consider public acceptance and re-evaluate technologies and monitoring for optimal use of purified water.

1. ACWD's modeling indicates that an SWP long-term average availability of approximately 35-40% of Table A[1] contract amount represents a threshold below which a new supply would likely be needed, triggering Phase 3 of the WRMP. Below this threshold, Phase 1 and Phase 2 can no longer maintain the District's offsite storage target[2], even with maximized SFPUC purchases, indicating that long-term reliability objectives can no longer be met.

[1] This analysis assumes no additional loss of system performance, such as reduced stored-water recovery or declines in SFPUC or local supplies beyond those currently assumed. Periodic updates to this analysis should be conducted to reassess and refine the identified critical thresholds.

[2] ACWD currently uses approximately 100,000 AF as a target volume to maintain in groundwater banks or other offsite storage to support recovery during a multi-year drought.

5.2 Water Supply Projects

Program phasing and considerations

Portfolio 12 was developed as three programmatic phases to allow for adaptive management and implementation of the WRMP:

- Phase 1 (12A): A series of no- and low-regret projects that can be readily implemented with minimal future decision points including:
    - Augment wet year recharge (LW.1)
    - Optimize and enhance Del Valle Yields (LW.3)
    - Revise groundwater rule curves (GW.2) & lower minimum operating levels (GW.3) in the Niles Cone Groundwater Basin
    - Enhance groundwater treatment for PFAS and hardness (GW.4)
    - Optimize Newark Desalination Facility operations (GW.5)
    - Groundwater banking (IW.1 and/or IW.5)
    - Purchase new imported water supply through the Yuba Accord (IW.3)
- Phase 2 (12B): Implementation of the Southern Groundwater Facility (GW.1) project and consider Additional Water Use Efficiency (DM.1) based upon the results of initial feasibility analyses and planning and water supply reliability.
- Phase 3 (12C): Implementation of the Indirect Potable Reuse for Groundwater Recharge (PW.3a) project , if imported supplies become increasingly unreliable, or if imported water supply is no longer cost-effective. Since the project will require years to develop and requires close partnership with USD, initial planning should be completed well in advance.

Table 58 summarizes the implementation needs and key considerations for each of these projects.

Project implementation stages and schedule

As **Figure 19** shows, each water supply project has been divided into implementation stages. These stages are presented relative to the anticipated sequence and time needed for completion for each project over a twenty-five year planning horizon (2026-2050). The timeline assumes that a project will move forward to completion and be brought online. There are, however, several internal and external drivers, triggers, and decision points that may result in off-ramping the project or delaying implementation.

Figure 20 shows a different version of the implementation schedule for projects that are inter-related. Outcomes from results and/or decision points in one project may shape the timing or pathway of other projects. While every potential pathway cannot be envisioned at this point, this implementation schedule highlights some of those that are known, impact the synergistic nature of the projects, and have the ability to influence the overall portfolio implementation.

Specific project implementation drivers and inter-relationships are described below:

- **Augment wet year recharge (LW.1):** Maximize annual capture and recharge of local water supplies through adaptive management. This can begin immediately, as it aligns with ACWD's current operations.
- **Optimize and enhance Del Valle Yields (LW.3):** Improve utilization of ACWD's existing water rights at Del Valle Reservoir by exploring alternative operational strategies, consistent with practices of other agencies. Initiate the petition process and coordinate with other Del Valle users; these steps can begin immediately.
- **Revise groundwater rule curves (GW.2) & lower minimum operating levels (GW.3) in the Niles Cone Groundwater Basin:** Lower minimum operating levels in the Niles Cone Groundwater Basin by modifying groundwater rule curves. This requires further analysis via groundwater modeling to evaluate optimized rule curves, including benefits, risks, and operational impacts . Before proceeding, assess how modifications align with SGMA objectives for the basin, and incorporate findings and proposed changes into the SGMA Alternative to a Groundwater Sustainability Plan (GSP).
- **Enhance groundwater treatment for PFAS and hardness (GW.4):** Conduct a Blender Facility groundwater production and PFAS/hardness treatment study to refine treatment needs, policy goals, and distribution system needs. Separately, evaluate the need for hardness removal, particularly if groundwater is to be used without blending with SFPUC supplies. The hardness removal component may depend on changes to ACWD's minimum purchase requirement with SFPUC. Following these assessments, perform an alternatives analysis to identify viable treatment technologies before advancing to design, procurement, and construction. Conduct a hydraulic modeling study to refine distribution system needs to deliver increased Blender production to southern service areas.
- **Optimize Newark Desalination Facility operations (GW.5):** Conduct feasibility analyses to identify a preferred project for optimizing NDF operations. Consider treatment implications from evolving water quality regulations. Once a preferred approach is selected and funding is identified, proceed with standard implementation steps.
- **Groundwater banking (IW.1 and/or IW.5):** Explore three potential groundwater banking options: expanding participation in Semitropic, joining a new remote groundwater bank, or engaging with a local bank in the Alameda Creek Watershed. Evaluate each option independently, focusing on participation terms such as leave-behind volumes and withdrawal capacity. Select and pursue the opportunity that best meets ACWD's needs.
- **Purchase new imported water supply through the Yuba Accord (IW.3):** Initiate preparation for an agreement with DWR—this process may take up to two years.
- **Southern Groundwater Facility (GW.1):** Investigate and assess the water quality and groundwater yield of the southern portion of the basin. Conduct groundwater modeling to evaluate potential impacts on existing operations and any potential undesirable results (as defined in ACWD's Alternative). If results indicate the basin can support supply or storage, then refine objectives and develop project concepts. Determine if the project will meet an objective of increasing net groundwater production, or will be expanded in size to meet a resilience objective of providing supply during a SWP outage through added production and/or conveyance capacity. In tandem with objective refinement, conduct a holistic groundwater facility capacity enhancement study after the investigation, to refine the treatment option and capacity for both GW.4 and GW.1. As project boundaries become clearer, proceed with well and treatment siting studies, treatment technology

selection, and preliminary design. Before implementation, evaluate how the project supports SGMA objectives for the basin.

  - If the investigation study determines no feasible facility options exist (e.g. no sufficient supply), then ACWD will explore the potential for Aquifer Storage and Recovery and/or improvements to the distribution system that would increase the ability to move water south within the service area, with the ultimate goal of increasing net groundwater production.

- **Additional Water Use Efficiency (DM.1):** Implement the existing Water Efficiency Master Plan (WEMP) and monitor the performance of water supply reliability projects. Evaluate the effectiveness of WEMP in reducing long-term demand, in conjunction with updated supply forecasts. If further demand reduction is needed, implement additional measures to achieve additional water use efficiency.
- **Indirect Potable Reuse for Groundwater Recharge (PW.3a):** Conduct siting studies and explore opportunities to acquire land for a future purified water treatment facility. Establish long-term agreements with USD for access to wastewater treatment effluent as a source for purified water. Update previous studies to reflect advancements in treatment technologies or changes in project assumptions. Continuously monitor the reliability of imported water supplies, regulation changes, and technology development; proceed with further implementation if conditions indicate a need for expanded local supply development. Implementation of this project requires that net groundwater production has increased through the successful implementation of one of a series of possible projects in phase 2 that either implements a new southern groundwater facility or otherwise improves the ability to move water south within the service area.

5.3 Resource Strategy Projects

In addition to the water supply projects included in Portfolio 12, ACWD selected a suite of resource strategy projects that could help meet WRMP goals without producing a unit of supply. Groupings of these strategies are summarized below, with implementation considerations shown in **Table 59**. The individual water resource strategy projects within each grouping are described in greater detail in TM5 (Water Supply Options and Water Resources Strategies). Note that a separate set of water resource strategies in the form of policies (instead of projects) are described later in **Section 5.7**.

As **Table 59** shows, the implementation plan for these projects is less developed to allow flexibility for ACWD to determine if and when implementation makes the most sense to respond to opportunities for partnerships and funding as they arise. The strategies are complementary to the core water supply projects described earlier in this chapter. ACWD plans to revisit progress on achieving WRMP goals are part of implementation of this WRMP at least every five years which will include a review of water resource strategies.

- **Implement Updated Water Efficiency Master Plan:** Ongoing as ACWD is already implementing its Water Efficiency Master Plan (WEMP) to meet UWUOs. Without implementation of this strategy, projected demands are expected to exceed UWUOs in 2050.
- **Develop Resilience/Emergency Response Plan:** This plan would study and document areas of risk and develop response plans for the ACWD's current water infrastructure system, as well as develop response plans to address risk. It would also identify areas where future planned water supply projects could be developed in such a way to mitigate or reduce that identified risk.

- **Establish Multi-Benefit Land Trust:** Purchase land in the Upper Alameda Creek Watershed with the intent of establishing a land trust that protects both the quality of Alameda Creek's headwaters as well as species and habitats of concern, and potentially generate habitat credits to generate revenue for the District.
- **Maintain and Enhance Quarry Lakes Water Quality:** Encapsulates several projects to protect and improve water quality at Quarry Lakes through measures that reduce pollutants, manage ecological risks, and strengthen existing monitoring efforts. Together, these projects support the WRMP goal of healthy watersheds and aquifers that are managed to provide multiple-benefits.

TABLE 59: PROJECT STRATEGIES IMPLEMENTATION SCHEDULE AND TRIGGERS

Strategy Grouping	Strategy(ies)	Trigger	Timing/Implementation Steps
Implement Updated Water Efficiency Master Plan	WUE.2 - Implement Updated Water Efficiency Master Plan to Meet Urban Water Use Objectives	Ongoing	Ongoing, with full plan implementation by 2035-2040 when unconstrained demands are projected to match UWUO
Develop Resilience/ Emergency Response Plan	OI.3 Resilience/Emergency Response Plan	Based on Board direction, recommended start next 1-5 years	2 years to develop plan
Establish Multi-Benefit Land Trust	WS.1 Establish Multi-Benefit Land Trust	Phases 1 & 2: Decide to pursue Phase 3: An appropriate parcel is identified and available for purchase	Phase 1: Establish goals for the land trust Phase 2 (first 5 years): prepare a siting study to identify potential parcels, purchase strategies including funding mechanism(s),, and costs/benefits Phase 3 (years 5-10): Create management strategy, purchase land, develop management structure, administer land trust
Maintain and Enhance Quarry Lakes Water Quality	WS.2 Reduce Sediment Loading at Quarry Lakes WS.3 Enhance Trash Screening at Quarry Lakes WS.4 Reduce Algal Blooms and Prevent Golden Mussels at Quarry Lakes WS.5 Expand Sampling Program at Quarry Lakes WS.9 Continue Nutrient Sampling at Quarry Lakes	Continue existing program: WS.9 Partnership and funding identified: WS.2, WS.3, WS.4, WS.5	WS.9: Ongoing WS.5: Ongoing once started WS.2, 3, 4: Depends on program

5.4 Internal Monitoring, Analyses, Drivers and Decision Points

WRMP implementation is designed to be adaptable and responsive to new information and changing needs. Many WRMP projects will require initial studies, analyses and other planning in advance of key internal decision points (called out in **Figure 19**) to determine if project implementation should move forward or to allow for further project refinements prior to more costly design and construction stages. These analyses are described here and called out in **Figure 19**.

Customer Demands (Decision Point 9)

ACWD will monitor the actual annual water demands of customers to better inform demand forecasts calculated for future Urban Water Management Plan (UWMP) updates, as well as monitor implementation of the Water Efficiency Master Plan (WEMP). Together, this monitoring will enable ACWD to track progress on meeting the Urban Water Use Objectives (UWUOs) and analyze the impacts of other drivers that may result in changes to demand. Statewide changes to the UWUOs (e.g., delayed timeline or loosened standards) could also impact how the WEMP is implemented and the response of customer demands. ACWD would use these observations to determine whether to implement additional water use efficiency measures outlined in the WRMP for further water demand reduction or evaluate facility needs if demand increases.

Niles Cone Groundwater Quality (Decision Points 4 & 7)

ACWD is required to comply with maximum contaminant levels (MCL) for PFAS promulgated by the EPA and has voluntarily set a goal of 150 parts per million for hardness. Additionally, SWRCB DDW has issued PFAS Notification Levels which are sometimes below the MCLs. Currently, ACWD depends on treatment and blending groundwater with imported SFPUC supplies to meet these targets. However, with reductions in SFPUC supplies as one possible future scenario, ACWD must consider alternative treatment approaches for PFAS and hardness that can be adopted at the existing Blending Facility. ACWD should continue to study potential combined and separate treatment options and integrate their findings into the CIP budget. The need for PFAS and hardness treatment will also be influenced by the results of ACWD's study of the southern Niles Cone Groundwater Basin, which may prompt ACWD to consider the construction of a southern groundwater production facility which may need PFAS, chloride, hardness, or other water quality treatment technology, as needed.

Watershed and Quarry Lakes Water Quality

Maintaining acceptable environmental and recreational water quality within Quarry Lakes is critical to ACWD's ability to meet regulations and manage surface flows and recharge into the Niles Cone Groundwater Basin. Ongoing and expanded water quality monitoring implementation will help to inform future ACWD staff on what, if any, additional projects or programs will be needed to maintain water quality and flows.

Southern Basin Groundwater Production Viability (Decision Poins 6, 8, 10, & 13)

ACWD is currently beginning investigation of the previously uncharacterized southern portion of the Niles Cone Groundwater Basin to determine the potential volume of supplies available for production as part of the Southern Groundwater Facility (GW.1) project. If the study indicates sufficient groundwater yield, then ACWD's groundwater team will conduct further modeling and other analyses to develop and refine project concepts, including well and treatment siting studies, treatment technology selection, and preliminary design. This will also include scoping the effort to clarify whether the project objective is to simply increase net annual groundwater production (primarily a water-supply objective), or provide supply during SWP outages through added production and/or conveyance capacity (supply and resilience objective).

However, if this region does not have sufficient available supply, ACWD may still consider additional studies to determine if there is available groundwater storage capacity and if there is potential for ACWD to operate a small groundwater bank within the Niles Cone Groundwater Basin (e.g., aquifer storage and recovery, ASR). ACWD will also consider, through hydraulic modeling, whether distribution system enhancements are needed. Decision points and resulting implementation pathway options are shown with further detail in **Figure 20**.

Establish Goals & Determine Siting Potential for Land Trust

Creating a multi-benefit land trust within the Alameda Creek Watershed is dependent on first setting goals for the land trust to define desired outcomes. Once goals are determined, setup will depend on being able to purchase land that is suitable for the purpose of improving watershed function and quality. By conducting a siting study early, including consideration of benefits and costs, ACWD can be well positioned and financially ready to purchase meaningful parcels of land as they become available in future years.

5.5 External Triggers and Decision Points

ACWD should monitor a variety of external triggers, outside of ACWD control, that could provide opportunities or challenges to implement WRMP projects. These triggers are also shown in **Figure 19** and should be taken in concert with the result of internal drivers highlighted in **Section 5.4** above.

External Groundwater Banking (Decision Point 2)

ACWD currently banks excess SWP supplies with Semitropic Water Storage District (Semitropic), but storage and pump-back capacity are limited during dry years. The Kern County Subbasin's GSP was deemed inadequate in 2023. As of December 8, 2025, the SWRCB determined that the revised plan, submitted in 2025, satisfactorily resolved the prior deficiencies and thus returned the Subbasin to DWR's jurisdiction. However, the regulatory uncertainty of state intervention (which threatened to restrict pump-back capacity), along with similar SGMA risks in other basins, underscore the need for ACWD to monitor developments and prioritize pump-back flexibility and conveyance capacity in future negotiations—whether through extending its Semitropic agreement beyond 2035 or pursuing alternative groundwater banking partnerships.

State Water Project Reliability (Decision Points 8 & 11)

As noted in the District's Climate Action Plan, disruptions from variable hydrology, saltwater intrusion, and Delta infrastructure vulnerabilities create significant uncertainty around the SWP's ability to deliver reliable supplies. Long-term planning assumptions and sensitivity analyses consistently show declining SWP reliability driven by climate change, along with persistent regulatory uncertainty. Because SWP represents approximately 40 percent of the District's current total supply, changes in SWP availability have an outsized effect on overall system reliability, making it both a major dependency and a major vulnerability. ACWD's modeling indicates that an SWP long-term average availability of approximately 35-40% of Table A[1] contract amount represents a threshold below which a new supply would likely be needed, triggering Phase 3 of the WRMP. Below this threshold, Phase 1 and Phase 2 can no longer maintain the District's offsite storage target[2], even with maximized SFPUC purchases, indicating that long-term reliability objectives can no longer be met.

Due to these considerations, ACWD will monitor SWP reliability and the progress of the Delta Conveyance Project as key indicators for advancing WRMP projects. Additionally, implementation of the Bay Delta Plan could increase environmental flow requirements, further reducing SWP deliveries during dry years and accelerating the need for alternative supply strategies.

Niles Cone Saltwater Intrusion (Decision Point 8)

While saltwater intrusion from San Francisco Bay remains a risk, ACWD has reduced this threat through managed aquifer recharge and its Aquifer Reclamation Program. ACWD's Climate Action Plan defines qualitative triggers for operational adaptive actions to address sea level rise impacts on Niles Cone water quality; however, ACWD has not yet identified specific quantitative thresholds (e.g., a defined increase in mean sea level). Establishing refined thresholds, triggers, and a supporting monitoring program will require additional data and further groundwater modeling to evaluate sea level rise-driven impacts; this is planned in the next several years under the District's Groundwater SGMA Enhancement efforts.

The WRMP proposes projects to optimize pumping in the Niles Cone during dry years, paired with enhanced recharge in wet years. ACWD will study the feasibility of these projects and, if pursued, closely monitor basin conditions to ensure long-term sustainability and continued compliance with SGMA.

Permit and Regulatory Coordination (Decision Points 1 and 8)

Some projects proposed in the WRMP will require close coordination with the SWRCB, and potentially other state and federal environmental regulatory agencies, regarding the modification of existing permits or acquisition of new permits. Once studies have been completed and project descriptions have been developed, ACWD should begin early communications with SWRCB and others, as appropriate, to determine permitting needs and to develop proposed WRMP projects in a manner that assure successful implementation.

Technology Advancements (Decision Point 11)

ACWD should monitor advancements in treatment technologies, specifically for PFAS and advanced water purification; improvements in desalination energy efficiency; the proliferation of new clean energy sources; and the continued development of artificial intelligence. These advancements could accelerate or modify project implementation.

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[1] This analysis assumes no additional loss of system performance, such as reduced stored-water recovery or declines in SFPUC or local supplies beyond those currently assumed. Periodic updates to this analysis should be conducted to reassess and refine the identified critical thresholds.

[2] ACWD currently uses approximately 100,000 AF as a target volume to maintain in groundwater banks or other offsite storage to support recovery during a multi-year drought.

Funding Availability (Decision Points 3, 5, & 8)

External funding opportunities may become available for specific WRMP projects which could prioritize one type of project over another or accelerate the timing of project implementation.

Project Partnerships & Coordination (Decision Point 11)

Some of the capital-intensive WRMP projects could be adapted to incorporate regional partners or even abandoned if ACWD were invited to join a partner's existing project. ACWD's ongoing coordination with regional agencies could provide insight into potential issues for planned project implementation by acquiring important lessons learned from other agencies, or benchmarking of project operations.

Public Acceptance (Decision Point 11)

ACWD should continue to gauge the public's level of acceptability for purified water projects, particularly direct potable reuse (DPR). The WRMP includes plans for potential implementation of a purified water project in the case of more severe climate change or insufficient supplies from other prior planned projects. Implementation of purified water projects by other agencies and a shifting regulatory landscape may result in changes in public acceptance around DPR and thus result in an updated evaluation of the scope of ACWD's purified water project.

5.6 WRMP Implementation Costs

Note that cost-related figures are intended to be used for high-level planning purposes only, and are expected to shift based on the ongoing adaptive planning in response to changing conditions informed by monitoring and decisions described in earlier sections.

Figure 21 shows a breakdown of the annual costs (supply purchases plus O&M) for baseline (assuming no projects) in 2050, as well as the cost breakdown for Phases 1-3 of the selected portfolio. All costs are shown in 2025 dollars with no escalation. While the O&M, staffing, and new imported water supply costs increase in Phases 1 and 2 compared to baseline, they are nearly equally offset by the decreases in SFPUC supply purchases as a result of bringing new projects online, such that the total annual cost is nearly the same. Phase 3 further offsets SFPUC supply purchases, but also includes a relatively higher increase in O&M and staffing costs.

FIGURE 21: ANNUAL (O&M + SUPPLY PURCHASE) COSTS BY PORTFOLIO PHASE

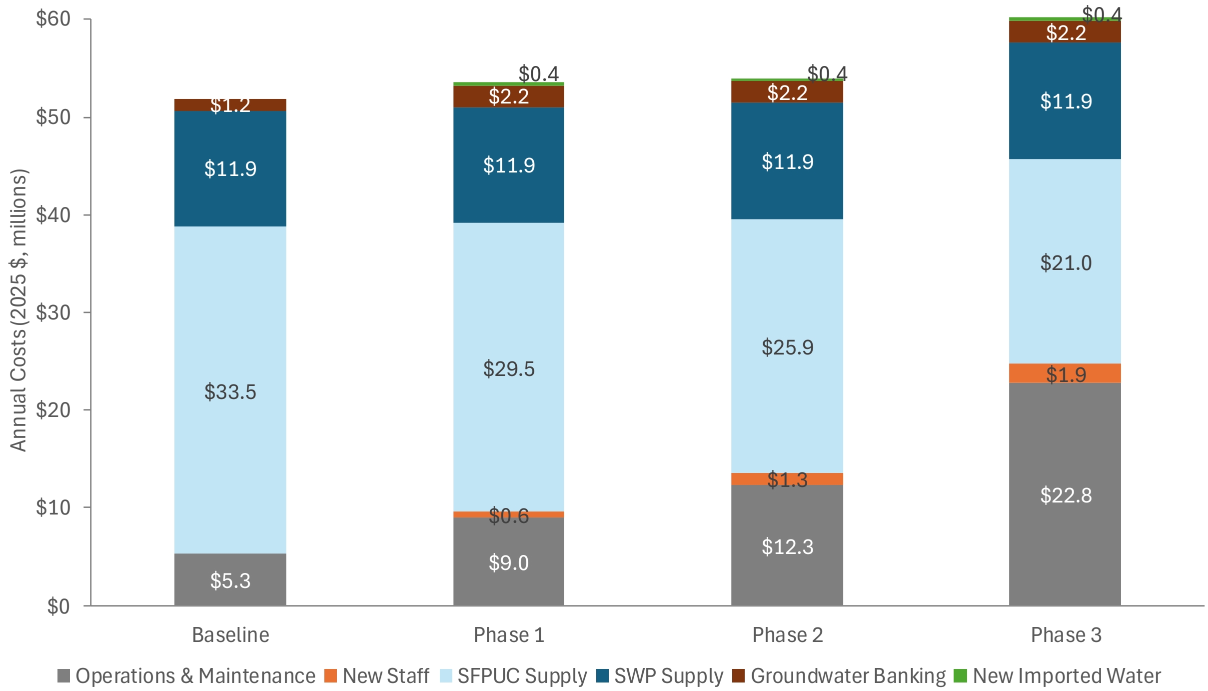


Figure 22 projects the timing of capital cost expenditures required to meet the water supply project implementation schedule shown in **Figure 19**. This chart has no annualization of costs and exists solely to demonstrate an initial projection of the timing of estimated costs associated with high-level implementation steps of planning, design, and construction. Key assumptions behind the breakdown of costs for each implementation step type are noted below the chart.

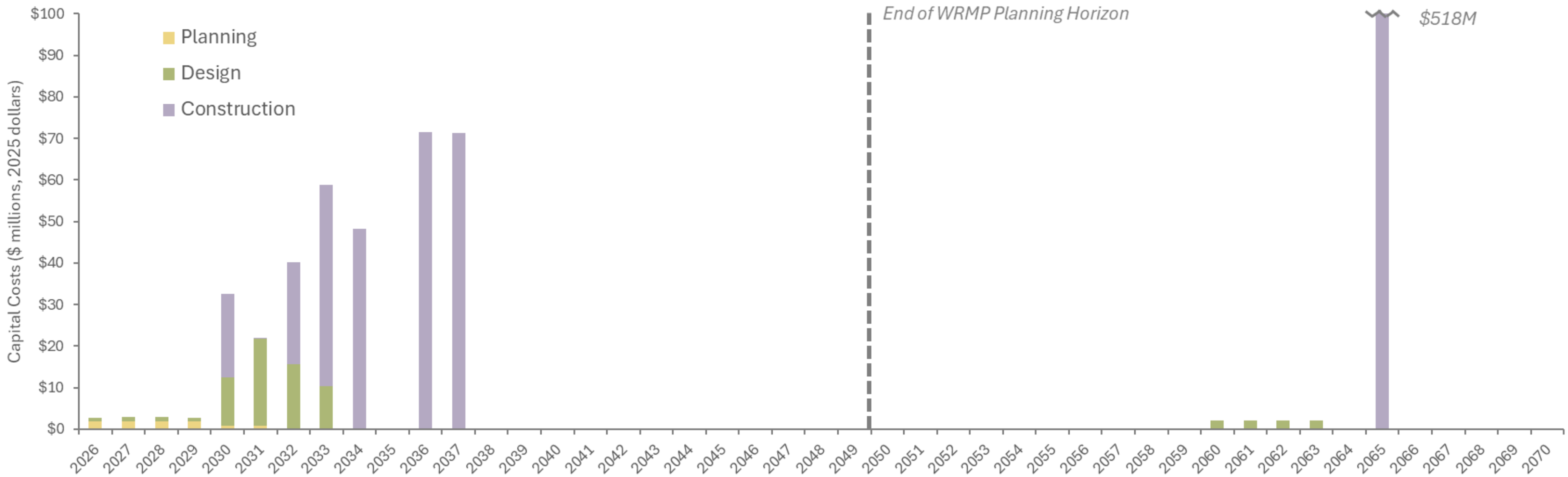
Figure 23 shows a cost-loaded schedule that forecasts the timing of both capital and annual (O&M and supply purchase) cost expenditures required to meet the water supply project implementation schedule shown in **Figure 19**. Costs associated with implementation of water resources strategies have not been included because they are anticipated to be implemented on a more opportunistic basis in response to funding and partnerships, with a less-defined implementation schedule. Additionally, many strategies have either no cost, an undetermined cost, or an estimated low cost relative to the capital costs of supply projects.

The solid light blue bars in **Figure 23** represent the annual costs required to produce the supply mix needed to meet buildout (2050) demands under Scenario B conditions. Combined, the solid dark blue bars and the hatched dark blue bars represent the total expected capital costs for WRMP supply projects. Alone, the solid dark blue bars represent WRMP supply project capital costs that are already accounted for in ACWD's existing CIP; alone, the hatched dark blue bars represent the additional capital costs required to implement WRMP supply projects. Approximately 23% of the total capital needed for Phases 1 and 2 is already covered by elements in the existing CIP.

All costs in both charts are shown in 2025 dollars with no escalation.

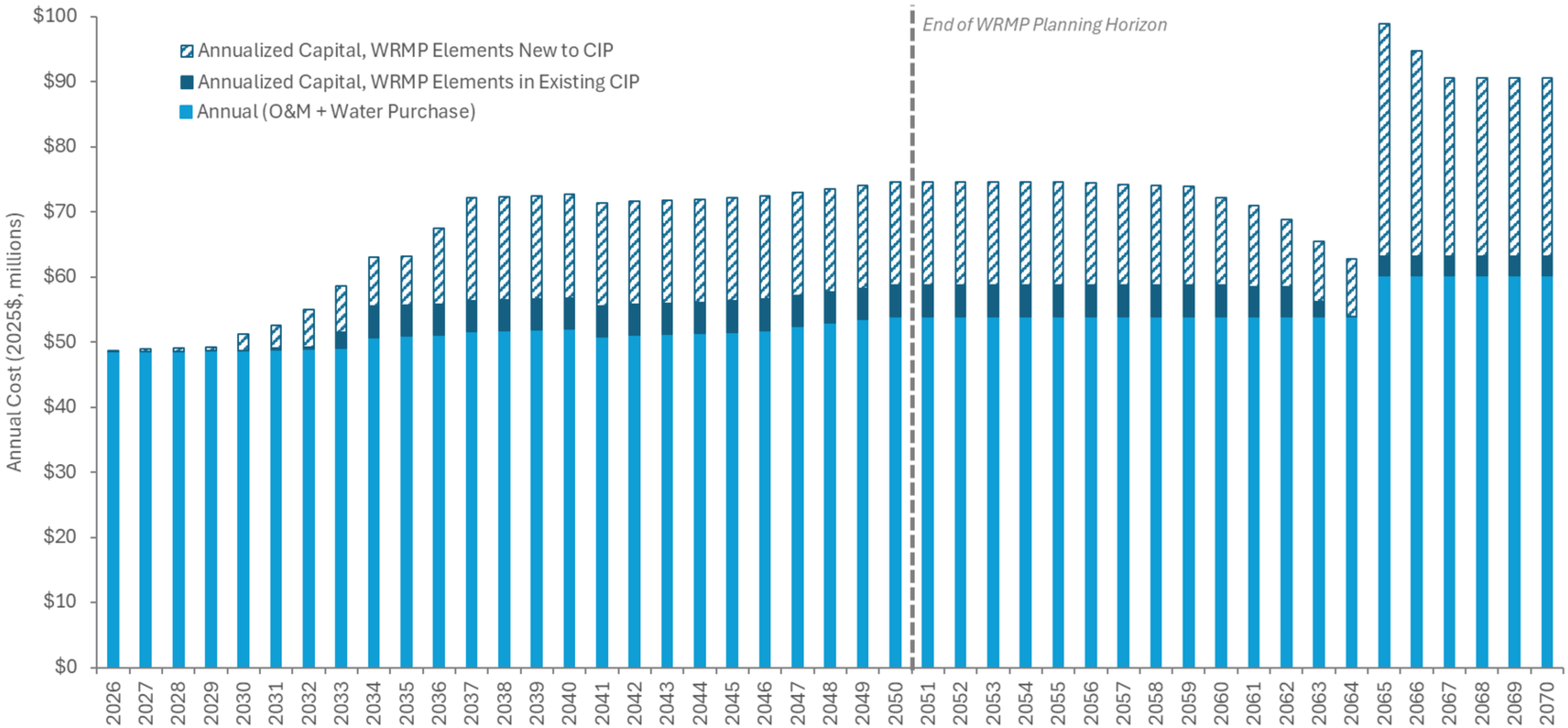
Implementing any of the projects outlined in the WRMP would require varying levels of funding, both in capital and annual O&M costs. The funding strategies available to ACWD may include connection fees, water rates, grants or low-interest loans, and bonds. As the WRMP implementation period progresses, ACWD staff should also begin integrating planned WRMP projects into ACWD's Capital Improvement Planning (CIP) budget windows. This will aid ACWD in assessing the fiscal impacts of proposed WRMP projects and help determine financing strategy for implementation.

FIGURE 22: CAPITAL COSTS BY YEAR OF IMPLEMENTATION



1. *Capital costs are presented as the total capital investment needed, and not as annualized costs based on project financing (see next figure).*
2. *Key assumptions behind the estimated breakdown of costs by high-level implementation steps:*
   a) *2.5% of total capital costs are allocated to planning*
   b) *17.5% of total capital costs are allocated to design*
   c) *80% of total capital costs are allocated to construction*
   d) *Exception: for Purified Water for Recharge, a custom split of 0.1% planning, 1.5% design, and 98% construction was applied.*
3. *The timing of Phase 3 (Purified Water for Recharge) implementation is highly uncertain and depends on several factors described elsewhere in the WRMP. It is unlikely to be needed before 2050. Modeling under Scenario C suggests a significant supply project may be required under expected 2075 climate change conditions. For conservative planning and illustrative purposes only, this chart assumes Phase 3 implementation occurring in 2065.*

FIGURE 23: ANNUALIZED COSTS (CAPITAL + O&M + SUPPLY PURCHASE)



1. *"Annual (O&M + Water Purchase)" represents the annual costs required to produce the supply mix needed to meet buildout (2050) demands under Scenario B conditions, which assume a greater share of SFPUC deliveries compared to 2026 conditions. These costs are scaled to reflect the modest increase in total demands between 2026-2050.*

2. *"Annual (O&M + Water Purchase)" costs shift over time as the major phases of the selected portfolio come online, as shown in **Figure 21**. Net changes in total annual cost between Baseline, Phase 1, and Phase 2 are projected to be minimal, with a more noticeable increase occurring when Phase 3 is implemented.*

3. *The "Annualized Capital" bars represent the total expected capital costs for WRMP supply projects. For high-level planning purposes, the chart assumes that capital costs incurred in a particular year, as shown separately in* ***Figure 22****, are financed through 30-year bonds beginning in the year in which the cost is incurred. In reality, some capital investments may be financed through other mechanisms or bundled into multi-year bond issuances. The chart is intended to illustrate the relative increase in capital-related costs over time.*

4. *Some WRMP supply project capital costs are already accounted in ACWD's existing CIP, shown as "Annualized Capital, WRMP Elements in Existing CIP." The remaining portion, "Annualized Capital, WRMP Elements New to CIP," reflects additional capital costs required to implement WRMP supply projects. Approximately 23% of the total capital needed for Phases 1 and 2 is covered by elements in the existing CIP.*

5. *The timing of Phase 3 (Indirect Potable Reuse for Groundwater Recharge) implementation is highly uncertain and depends on several factors described elsewhere in the WRMP. It is unlikely to be needed before 2050. Modeling under Scenario C suggests a significant supply project may be required under expected 2075 climate change conditions. For conservative planning and illustrative purposes only, this chart assumes Phase 3 implementation occurring in 2065.*

5.7 Programmatic Policies and Strategies

The water resource strategies described below take the form of programmatic policies that can help meet WRMP goals without producing a unit of supply. They are supplemental to the project-based strategies described in **Section 5.3**. Groupings of these strategies are summarized below, with implementation considerations shown in **Table 60.** The individual water resource strategy policies within each grouping are described in greater detail in TM5 (Water Supply Options and Water Resources Strategies).

As **Table 60** shows, the implementation plan for these policies is less developed to allow flexibility for ACWD to determine if and when implementation makes the most sense to respond to opportunities for partnerships and funding as they arise. The strategies are complementary to the core water supply projects described earlier in this chapter. ACWD plans to revisit progress on achieving WRMP goals are part of implementation of this WRMP at least every five years which will include a review of water resource strategies.

- **Support Watershed Monitoring, Studies, Restoration:** Includes several supporting actions that would maintain existing water quality monitoring in the watershed, continue support of organizations studying ecosystem benefits, and maintain support for ecological and fisheries restoration programs in the Lower Alameda Creek Watershed.
- **Maximize Local Surface Water Supplies:** Continue to monitor data as fishery operation matures to determine the optimal times and volumes for scheduling bypass flows, as well as advocate for Forecast-Informed Reservoir Operations (FIRO) and reoperation at Lake Del Valle.
- **Implement Affordability Plan:** Complete ongoing efforts to develop and implement an Affordability Plan that formulates policies designed to enhance the affordability of water for all direct and indirect customers.
- **Establish Water Trading Partnerships:** Expand water market participation beyond dry-year needs by making opportunistic, cost-effective purchases in average and wet years to supplement groundwater bank storage and offset declining imported supplies, as well as selling surpluses to generate revenue (through either Bay Area partnerships, or among SWP partners).
- **Build Public Outreach and Partnerships:** Expand partnerships with schools, cities, community groups, and the public to educate about water efficiency and drinking water quality. Partnerships may also provide insights into new water use efficiency technologies, implementation strategies, and outreach avenue to support additional water efficiency as outlined in DM.1.

TABLE 60: POLICY STRATEGIES IMPLEMENTATION SCHEDULE AND TRIGGERS

Strategy Grouping	Strategies	Trigger	Timing/Implementation Steps
Support Monitoring, Studies, and Restoration Work in the Watershed	WS.7 Continue Water Quality Monitoring in the Upper Alameda Creek Watershed WS.8 Continue Studying Benefits of Ecosystem Enhancements WS.11 Support Wetland Restoration in the Alameda Creek Watershed	Ongoing: WS.7 and WS.8 Program is initiated: WS. 11	Ongoing
Maximize Local Surface Water Supplies	WS.6 Adaptive Management of Bypass Flow Requirements WS.10 Support Use of FIRO to Inform Reservoir Releases	Advance based on priority of Board: WS.6 Program is initiated: WS.10	Ongoing
Implement Affordability Plan	PL.2 Develop an ACWD Affordability Plan CE.2 Identify New Revenue Streams to Fund Affordability Programs CE.4 Construct Water Filling Stations	PL.2: Ongoing CE.3: After completion of PL.2 CE.4: At direction of Board and based on PL.2 recommendations	PL.2: Completed in 2026 CE.3: 2026-2027 CE.4: 2-3 years once initiated
Establish Water Trading Partnerships	PL.3 Establish Bay Area Water Market Partnerships PL.4 Establish SWP Water Market Partnerships	Ongoing, or accelerate under advanced priority of Board	Escalating effort may include the following: 1. Continue to explore willing partners and opportunities for mutually beneficial exchanges, transfer and sales within existing associations (SWC, BAWSCA, BARR) 2. Consider long-term agreements with existing partners 3. Expand with contract services to find new venues, partner, and opportunities.
Build Public Outreach and Partnerships	CE.1 Expand Partnerships with Schools CE.3 Conduct Public Outreach on Drinking Water Quality WUE.1 Partner with Cities and Community Groups on Water Use Efficiency Programing	Ongoing/Near-Term as staffing allows	Ongoing

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