Part 1

Pure Water Southern California

PROGRAM TITLE

Large-Scale Recycled Water Project Feasibility Study

U.S. Department of Interior, Bureau of Reclamation

January 19, 2024

PURE WATER SOUTHERN CALIFORNIA

Partnering Agencies:

THE METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

LOS ANGELES COUNTY SANITATION DISTRICTS

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Pure Water Southern California Project

Los Angeles County | State of California

WaterSMART Large-Scale Water Recycling Project Feasibility Study

Project Partners:
Metropolitan Water District of Southern California
Los Angeles County Sanitation Districts

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List of Acronyms and Abbreviations

μg/L	microgram(s) per liter
μm	micrometer(s)
AB	Assembly Bill
ADONA	4,8-dioxia-3H-perflourononanoic acid
AF	acre-feet
AFY	acre-feet per year
AGR	agricultural supply
AOP	advanced oxidation process
ARC	Albert Robles Center for Water Recycling and Environmental Learning
Authority	Los Angeles County Sanitation Districts Financing Authority
AWPF	Advanced Water Purification Facility
Azusa pipeline	Devil Canyon–Azusa pipeline
B&V	Black & Veatch
BAC	biological activated carbon
Basin	South Coast Air Basin
Basin Plan	Water Quality Control Plan
Bay-Delta	San Francisco Bay–Sacramento–San Joaquin River Delta
BCR	benefit-cost ratio
BEA	Basin Equity Assessment
BIM	building information modeling
BPP	Basin Production Percentage
BRIC	Building Resilient Infrastructure and Communities
CAMP4Water	climate adaptation management plan for water
CAP	Climate Action Plan
CCL3	Contaminant Candidate List 3
CCL4	Contaminant Candidate List 4 (current)
CCR	California Code of Regulations
CDFW	California Department of Fish and Wildlife
CDS	Congressionally Directed Spending
CEC	constituent of emerging concern
CEQA	California Environmental Quality Act
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CRA	Colorado River Aqueduct
CRHR	California Register of Historical Resources
CRSS	Colorado River Simulation System
CVP	Central Valley Project
CWC	California Water Code
CWSRF	Clean Water State Revolving Fund

D&S	Directives and Standards (Reclamation)
D/DBP	Disinfectants and Disinfection Byproducts
DBE/MBE	Disadvantaged Business Enterprise / Minority-owned Business Enterprise
DBP	disinfection byproduct
DCP	Drought Contingency Plan
DDW	Division of Drinking Water
DiPRRA	direct potable reuse responsible agency
DLR	detection limit for purposes of reporting
DPR	direct potable reuse
DRA	Drought Risk Assessment
DVL	Diamond Valley Lake
DWR	California Department of Water Resources
DWSRF	Drinking Water State Revolving Fund
EA	Environmental Assessment
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
ELT	Early Long-Term
E.O.	Executive Order
FEMA	Federal Emergency Management Agency
Feasibility Study	Pure Water Southern California Feasibility Study
FONSI	Finding of No Significant Impact
FY	fiscal year
GHG	greenhouse gas
GIS	Geographic Information System
GWRS	Groundwater Replenishment System
HPOLE	high purity oxygen Ludzack-Ettinger
ICS	Intentionally Created Surplus
IND	industrial service supply
Innovation Center	Grace F. Napolitano Pure Water Southern California Innovation Center
IPR	indirect potable reuse
IRP	Integrated Water Resources Plan
IRWM	Integrated Regional Water Management
JOS	Joint Outfall System
Judgment	Main San Gabriel Basin Judgment
JWPCP	Joint Water Pollution Control Plant
LACDPW	Los Angeles County Department of Public Works
LACSD	Los Angeles County Sanitation Districts
LADWP	Los Angeles Department of Water and Power
LAEDC	Los Angeles Economic Development Corporation

LRP	Local Resources Program
LRV	log reduction value
LSWRP	Large-Scale Water Recycling Program
M&I	municipal and industrial
MAF	million acre-feet
MBR	membrane bioreactor
MBTA	Migratory Bird Treaty Act
MCL	Maximum Contaminant Level
MCLG	maximum contaminant level goal
Metropolitan	Metropolitan Water District of Southern California
mg/L	milligram(s) per liter
MGD	million gallons per day
MPN	most probable number
MSL	Mean Sea Level
MUN	municipal and domestic water supply
MWD	Municipal Water District
N-only	(tertiary) nitrification only
NAHC	Native American Heritage Commission
NDMA	N-nitrosodimethylamine
NdN	nitrification-denitrification
NEPA	National Environmental Policy Act
nitrate-N	nitrate as nitrogen
NL	Notification Level
nm	nanometer(s)
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NOP	Notice of Preparation
NPDES	National Pollutant Discharge Elimination System
NPR	non-potable reuse
NRHP	National Register of Historic Places
NTU	Nephelometric Turbidity Unit(s)
O&M	operation and maintenance
OCWD	Orange County Water District
OEHHA	Office of Environmental Health Hazard Assessment
OM&R	operation, maintenance, and replacement
PFAS	per- and polyfluoroalkyl substances
PFBS	perfluorobutane sulfonic acid
PFDA	perfluorodecanoic acid
PFHpA	perfluoroheptanoic acid
PFHxA	perfluorohexanoic acid
PFHxS	perfluorohexane sulfonic acid

PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PHG	public health goal
polyDADMAC	polydiallyldimethylammonium chloride
ppb	part(s) per billion
PPCP	pharmaceuticals and personal care product
ppt	part(s) per trillion
PRC	California Public Resources Code
PROC	industrial process supply
PWSC	Pure Water Southern California
QA/QC	quality assurance / quality control
QSA	Quantification Settlement Agreement
QTO	quantity take-off
RCRA	Resource Conservation and Recovery Act
Reclamation	U.S. Bureau of Reclamation
RL	response level
RO	reverse osmosis
RWA	raw water augmentation
RWC	Recycled Municipal Wastewater Contribution
RWQCB	Regional Water Quality Control Board
Sanitation Districts	Los Angeles County Sanitation Districts
SCADA	supervisory control and data acquisition
SDCWA	San Diego County Water Authority
SMCL	Secondary Maximum Contaminant Level
SME	subject matter expert
SNMP	Salt and Nutrient Management Plan
SNWA	Southern Nevada Water Authority
SRF	State Revolving Fund
state	State of California
SWFL	southwestern willow flycatcher (*Empidonax traillii extimus)*
SWP	State Water Project
SWRCB	State Water Resources Control Board
TAF	thousand acre-feet
TAFY	thousand acre-feet per year
TCP	trichloropropane
TCR	tribal cultural resource
TDS	total dissolved solids
TOC	total organic carbon
U.S.	United States
UCMR 5	Unregulated Contaminant Monitoring Rule

UEAC	uniform equivalent annual costs
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
UV/AOP	ultraviolet advanced oxidation process
UWMP	Urban Water Management Plan
Warren Facility	A.K. Warren Water Resource Facility
WaterSMART	Sustain and Manage America's Resources for Tomorrow
WDR/WRR	Waste Discharge Requirements / Water Recycling Requirements
WIFIA	Water Infrastructure Finance and Innovation Act
WRFP	Water Recycling Funding Program
WRD	Water Replenishment District
WRF	Water Resource Facility
WRP	Water Reclamation Plant
WTP	water treatment plant

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Executive Summary

The Metropolitan Water District of Southern California (Metropolitan), in partnership with the Los Angeles County Sanitation Districts (Sanitation Districts), is making a major investment in a new drought-resilient water supply with the development of the Pure Water Southern California (PWSC) Program. The PWSC Program is an innovative, large-scale, regional recycled water project that has a goal of creating 155,000 acre-feet per year (AFY) of safe, reliable, and drought-resilient water supplies for the region. Long-term drought, climate change, and competing demands have impacted Metropolitan's water supply portfolio. Sustainable local water supplies are crucial to maintain the reliability of the water supply for the region's 19 million residents, reduce stress on local groundwater supplies, increase Metropolitan's water storage, and provide operational flexibility.

The program would be delivered in two phases. Phase 1 would provide 115 million gallons per day (MGD) (118,590 AFY) of non-potable reuse (NPR) / indirect potable reuse (IPR) and direct potable reuse (DPR). Phase 2 would provide an additional 35 MGD (36,410 AFY) of DPR. Phase 1 deliveries would consist of 24 MGD (24,750 AFY) of NPR and 66 MGD (68,060 AFY) of IPR in groundwater basins and 25 MGD (25,780 AFY) of DPR. PWSC Phase 1 consists of the following:

1. Improvements at the A.K. Warren Water Resource Facility (Warren Facility) (formerly the Joint Water Pollution Control Plant);
2. An Advanced Water Purification Facility (AWPF);
3. A 42-mile backbone conveyance pipeline to convey the purified water; and
4. Connections to partner systems or recharge facilities in four regional groundwater basins.

PWSC would provide initial NPR and IPR deliveries in 2030, reach build-out by 2033, and produce DPR by 2035. **Throughout this Feasibility Study, "PWSC" is used to refer to Phase 1, and "PWSC Program" is used to refer to Phases 1 and 2. This Feasibility Study focuses on Phase 1.**

The PWSC Feasibility Study (Feasibility Study) has been prepared to support funding through the Large-Scale Water Recycling Program (LSWRP). The United States (U.S.) Bureau of Reclamation (Reclamation) is leveraging federal and non-federal funding to support efforts to stretch scarce water supplies and avoid conflicts over water under the WaterSMART (Sustain and Manage America's Resources for Tomorrow) Program. PWSC supports the Biden-Harris Administration's priorities, including Executive Order (E.O.) 14008: Tackling the Climate Crisis at Home and Abroad and E.O. 13985: Advancing Racial Equity and Support for Underserved Communities Through the Federal Government. This study has been prepared in support of Metropolitan's application for funding assistance in response to Notice of

Funding Opportunity Number R23AS00433 and future LSWRP funding opportunities. Metropolitan's application was submitted on November 21, 2023.

This Feasibility Study has also been prepared consistent with the requirements set forth in Reclamation Manual: Directives and Standards WTR 11-01, Subject: Title XVI Water Reclamation and Reuse Program and Desalination Construction Program Feasibility Study Review Process (Reclamation 2007) and the additional requirements established in Reclamation Manual: Directives and Standards WTR TRMR-128 Temporary Release, Subject: Large-Scale Water Recycling Program Feasibility Study Review Process (Reclamation 2022). The chapters in this Feasibility Study are organized consistent with the requirements identified in WTR 11-01 and WTR TRMR-128.

ES-1 Introduction and Study Area

The colored areas in Figure ES-1 show the service area of the Metropolitan Water District of Southern California. Unlike local water recycling projects, PWSC would be a regional partnership between Metropolitan (a regional wholesale water provider) and the Sanitation Districts (a regional wastewater service provider).

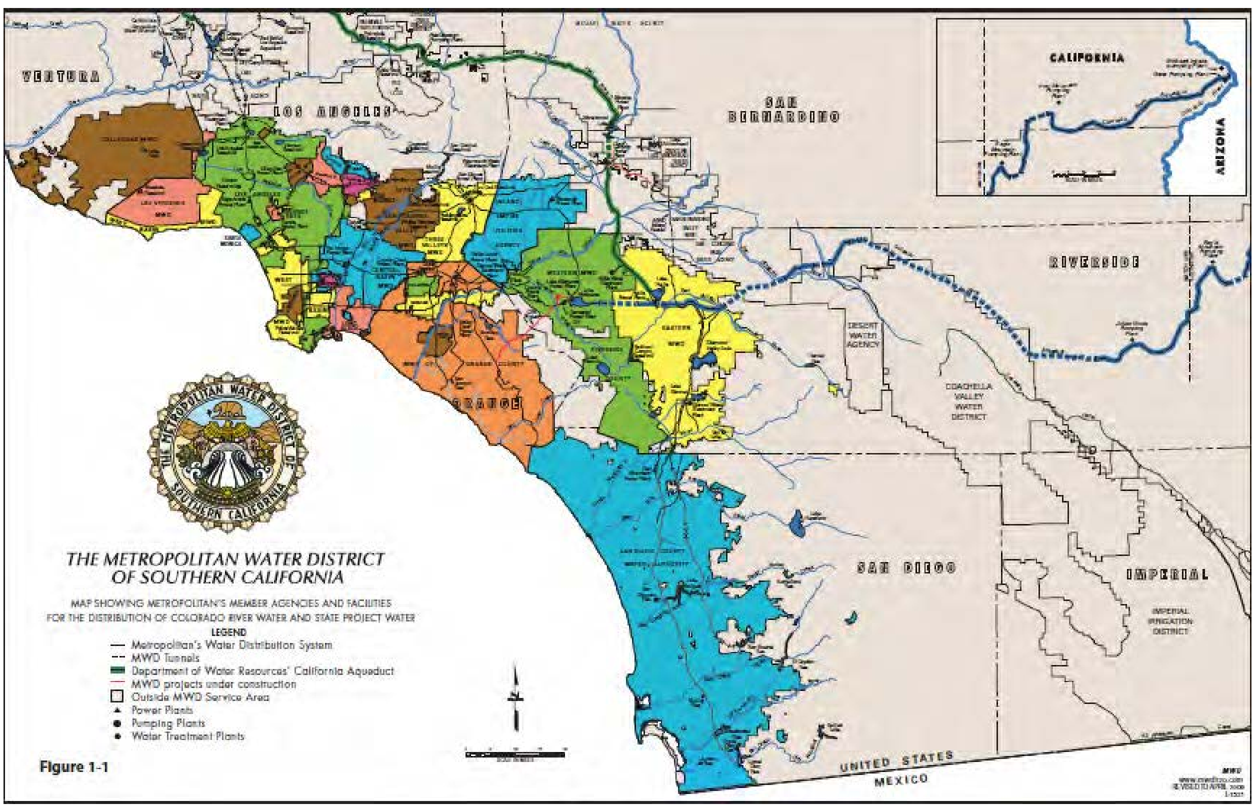

Figure ES-1. Extended Study Area for Distribution

The PWSC facilities would be located primarily within Los Angeles County, but some facilities would possibly extend into western San Bernardino County. However, the potential recipients of the purified water generated and delivered by these facilities are spread over a much wider geographic area.

ES-2 Problems and Needs

The water supplies for Metropolitan fluctuate significantly and are impacted by drought and climate change. The water conditions in the region are shaped by supply conditions and resource actions that occurred in the preceding years, including several extraordinary events that have introduced increasing variability into water supply management:

- Imported supplies (over 50 percent of Metropolitan's total supplies) have been highly variable, influenced by periods of extended drought that impact water supply. A historic drought in California led to record low supplies available from the State Water Project (SWP) in 2014 (5 percent of Metropolitan's Table A allocation), 2015 (20 percent of Metropolitan's Table A allocation), 2020 (20 percent of Metropolitan's Table A allocation), and 2021 (5 percent of Metropolitan's Table A allocation). After the driest January and February in more than 100 years, the allocation for 2022 was again limited to 5 percent of contract for Metropolitan's Table A allocation, but the allocation was returned to 100 percent in 2023.

- An extended drought in the Colorado River watershed decreased storage levels in Lake Mead and Lake Powell, and the first-ever shortage declaration for the lower Colorado River was issued in August 2021. Although storage levels increased in 2023, the Colorado River continues to operate under a Tier 1 shortage going into 2024.

- Groundwater basins and local reservoirs dropped by nearly 1.2 million acre-feet (MAF) due to record dry hydrology in Southern California between 2000 and 2022. In 2023, groundwater basins partially recovered due to record-breaking amounts of groundwater recharge.

- Metropolitan declared a regional drought emergency in November 2021, when SWP-dependent areas within the district faced shortages.

In recent years, supplies have been highly variable, and Metropolitan's existing infrastructure is vulnerable to shortages. Extended periods with dry hydrologic conditions and reduced imported water supplies have recently required Metropolitan to take a water allocation and make significant withdrawals from storage reserves, including Diamond Valley Lake, and its groundwater banking and conjunctive use programs to meet scheduled water deliveries.

Groundwater basins have been in decline since about 2000. Groundwater storage levels are important because they impact how the basins can be used during times of shortage or emergencies. If the groundwater storage levels continue to decline, groundwater basins may not be able to serve as a source of water when needed by the region. For the basins to continue to provide benefits for regional reliability, water deliveries to the groundwater basins for recharge are essential. Metropolitan needs a more drought-resilient type of supply in its water supply portfolio, including the ability to replenish depleted aquifers.

The 2020 Integrated Water Resources Plan (IRP)—Regional Needs Assessment (Metropolitan 2022a) estimated the likelihood of future shortages in Metropolitan's water supply at 66 percent under the high demand/reduced imports scenario and recommended an additional core supply of 650,000 acre-feet (AF) to provide adequate reserves for shortages and emergencies. Local supply is less vulnerable than imported supplies and provides an opportunity to recharge declining aquifers. Furthermore, providing this additional water as local supply would reduce the risk of a protracted outage in the delivery of imported water supplies in the event of an earthquake that severely damages the SWP and/or Colorado River Aqueduct (CRA) infrastructure.

ES-3 Water Recycling Opportunities

Within Metropolitan's jurisdiction, there is approximately 1,770 MGD of primary treated wastewater and 1,169 MGD of secondary treated wastewater. By 2040, these capacities are expected to increase to 3,139 MGD and 2,708 MGD respectively. Tertiary and advanced treatment processes could be utilized to provide further treatment to these flows to increase recycled water production.

The Warren Facility, with a permitted capacity of 400 MGD, is the Sanitation Districts' largest wastewater treatment plant. Effluent from the Warren Facility was identified as an untapped source of water because 100 percent of its wastewater flows are discharged to the Pacific Ocean. With an average daily flow of approximately 235 MGD, the facility's effluent flows can provide a significant portion of the water needed to meet regional needs. The centralized nature of the Warren Facility provides a unique opportunity for Metropolitan and the Sanitation Districts to implement a large-scale recycled water project while leveraging economies of scale for an efficient, environmentally sound, and cost-effective operation. Capturing and treating the wastewater effluent discharged from the Warren Facility for beneficial reuse would be a significant opportunity to address the region's problems and needs.

ES-4 Description of Alternatives

Three alternatives were developed and evaluated to address the region's problems and needs: the No-Action Alternative; treatment centralized at the Warren Facility to produce recycled water (Alternative 1); and distributed treatment to produce recycled water (Alternative 2). The alternatives were developed to achieve the following objectives:

- Provide a new high-quality local water source that is reliable, cost-effective, and climate-change resilient to help meet regional water demands, with phased deliveries of supplies.

- Diversify Metropolitan's water supply portfolio, increase regional operational flexibility, and provide opportunities for improved coordination with other water supply and distribution systems.
- Contribute to the water supply and water quality of local groundwater basins.
- Provide improved wastewater treatment to maximize beneficial reuse of wastewater that would otherwise be discharged into the ocean.
- Further statewide goals of increasing use of recycled water as a sustainable, environmentally sound water source for indirect and direct potable reuse.
- Reduce reliance on imported water supplies and increase the resilience of local water supplies.
- Increase the locally available water supply to protect against seismic events and service disruptions.

No-Action Alternative: The No-Action Alternative characterizes the without-project condition and provides a baseline for the analysis of the other alternatives. Under this alternative, imported water supplies would continue in accordance with existing agreements. Local supplies such as groundwater would face significant uncertainties and stress under the No-Action Alternative. Groundwater basin yields are the result of local rainfall, replenishment with imported supplies, and locally recycled water. The replenishment provided by imported supplies has decreased in recent years, due in part to the reduced supply reliability of the SWP and CRA, and natural replenishment has decreased due to years of drought. Supplies of existing recycled water for groundwater recharge have not prevented a decline in the availability of this vital regional supply. Under the No-Action Alternative, these conditions would be expected to persist or worsen.

Alternative 1: PWSC with Centralized Treatment: PWSC would produce 115 MGD (118,590 AFY) of purified water by beneficially reusing wastewater that is currently discharged to the Pacific Ocean. This alternative would provide enough water for close to half a million households per year. PWSC's total delivery would consist of 24 MGD (24,750 AFY) for NPR for application at parks, and industries; 66 MGD (68,060 AFY) for IPR for the recharge of four regional groundwater basins, and 25 MGD (25,780 AFY) of DPR for the direct augmentation of raw water supplies at two regional water treatment plants (WTPs). PWSC would initially plan to deliver up to 30 MGD (39,940 AFY) of IPR/NPR by November 2030, with delivery of 90 MGD of IPR/NPR by 2033 and 25 MGD (25,780 AFY) of DPR by 2035.

The Grace F. Napolitano Pure Water Southern California Innovation Center (Innovation Center), constructed in 2019, produces 0.5 MGD of purified water per day to facilitate regulatory approval of the innovative purification technology being proposed for full-scale implementation. The Innovation Center is also generating information that will enable optimal design of the AWPF.

PWSC's treatment processes would be located at the Warren Facility (Figure ES-2), which would have an AWPF capable of producing 115 MGD (118,590 AFY) of purified water and provide ready access to an ocean outfall system for management of concentrate from the advanced treatment process. Modifications to and upgrades of the Warren Facility (Figure ES-3) are intended to lower influent ammonia and nitrogen concentrations to the proposed AWPF and to meet water quality objectives for the optimal performance of the AWPF. Up to 25 MGD of purified water would be conveyed to augment raw water supplies at the Weymouth and Diemer WTPs. This purified water would require additional treatment and DPR treatment facilities would be constructed at the Weymouth WTP.

Figure ES-2. Alternative 1: PWSC with Centralized Treatment

The purified water would be conveyed via new backbone pipeline to the Cities of Azusa and La Verne. IPR water would be used to recharge the West Coast, Central, Main San Gabriel, and Orange County Groundwater Basins through spreading facilities and injection wells and to augment raw water supplies at Metropolitan's Weymouth WTP and Diemer WTP for DPR.

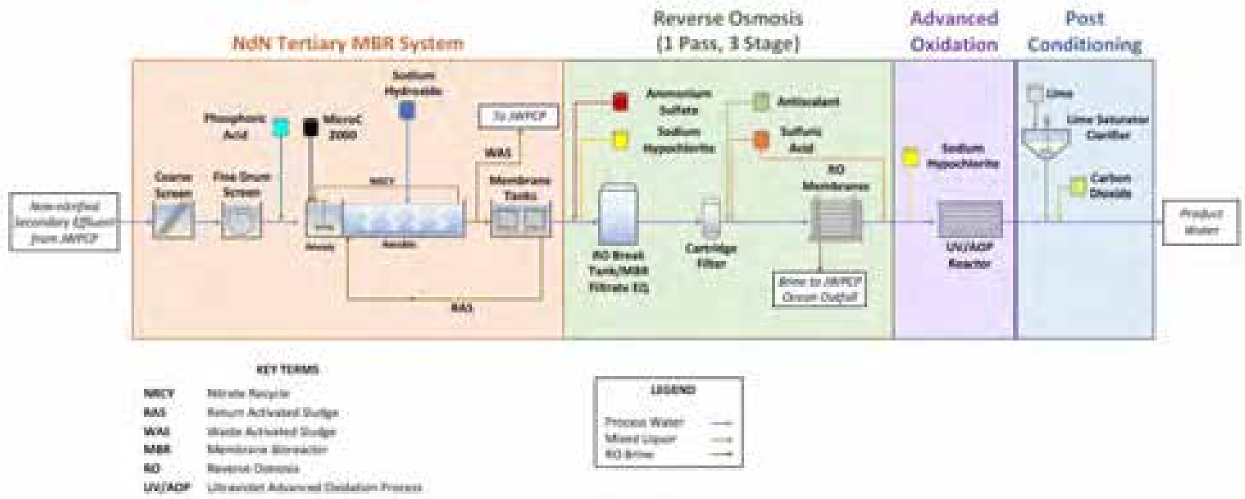

Figure ES-3. Flow Schematic for AWPF Treatment Facilities

Alternative 2: Distributed Recycled Water Treatment Plants: This alternative also includes an AWPF and new regional conveyance facilities but, the centralized AWPF at the Warren Facility would be downsized and supplemented with one additional distributed treatment facility. The primary benefit anticipated from the use of a distributed treatment plant is reduced pumping (water treated at the distributed plant would be pumped a shorter distance). Metropolitan and the Sanitation Districts have studied this alternative (Stantec 2022b), including the identification and evaluation of candidate treatment sites and prepared a comparative assessment of centralized and distributed treatment. Purified water flow from any alternative site would be piped directly to the backbone conveyance distribution system and treated to a level consistent with that in the backbone system.

Alternative 2 would include the following facilities in addition to those described for Alternative 1:

- **Wastewater Interception/Diversion:** These facilities are the physical improvements needed to intercept raw wastewater flows within the existing conveyance system, divert a portion of these flows from the existing conveyance network, and convey the diverted raw wastewater to the new distributed treatment plant site.
- **Treatment:** Treatment would require the procurement of a parcel of land with sufficient area to construct and operate the distributed treatment system that is required to provide full secondary treatment and an AWPF, to purify water to IPR standards.
- **Purified Water Conveyance:** These facilities would convey treated high purity water to the backbone conveyance of the purified water distribution system.
- **Reverse Osmosis (RO) Concentrate Conveyance:** These facilities would convey RO concentrate to the Warren Facility. Solids residuals would also be disposed of or conveyed to a sewer in accordance with the Sanitation Districts' sewer requirements.

Multiple sites were considered and evaluated as candidates to construct a distribution facility. The alternative as studied would provide 107 MGD for Phase 1 (including water produced at the reduced-size Warren Facility) with expansion in Phase 2 up to 139 MGD. Alternative 2 is shown on Figure ES-4.

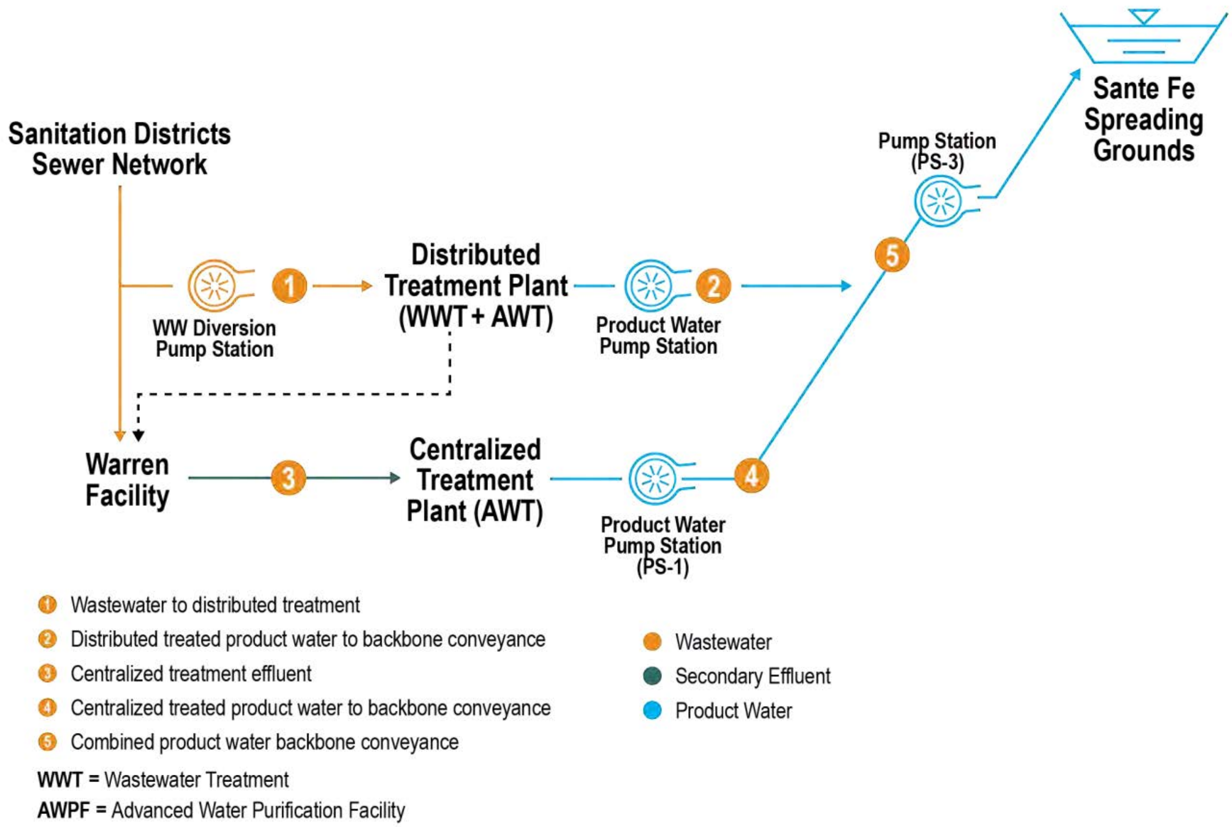

Figure ES-4. Alternative 2: Decentralized Recycled Water Treatment Plant

Evaluation of Alternatives: The action alternatives are evaluated for effectiveness, efficiency, completeness, and acceptability. The No-Action Alternative provides a baseline for without-project conditions and the performance of the action alternatives is measured in terms of with-project conditions minus without-project conditions.

- **Effectiveness of Alternatives:** Effectiveness is the extent to which each alternative alleviates problems and needs (see Chapter 2, Problems and Needs) and accomplishes the planning objectives (Council on Environmental Quality 2013).

  The No-Action Alternative would not provide any additional local water supply or recharge for local aquifers.

  Alternative 1 would provide water directly to certain member agencies for non-potable and industrial uses and groundwater replenishment through IPR. These deliveries would replace portions of current and future imported deliveries and increase Metropolitan's storage reliability for everyone. In addition, deliveries to the Weymouth and Diemer WTPs via DPR would deliver purified water to most of Los Angeles and Orange Counties. Alternative 2 would provide water in a similar fashion. Six categories of physical effects/benefits were considered in evaluating the effectiveness of the alternatives:

- Reducing the risk of regional shortages
- Reducing the risk of outages due to earthquakes
- Reducing the risk of a loss of groundwater production capability
- Providing additional local supply development to reduce reliance on imported water
- Improving resilience to climate change and drought
- Adding the benefit of DPR with raw water augmentation

- **Efficiency of Alternatives:** Efficiency is the extent to which an alternative plan is the most cost-effective means of alleviating specified problems and realizing specified opportunities while being consistent with protecting the nation's environment (Council on Environmental Quality 2013).

  The No-Action Alternative would not meet any of the project objectives and would not provide a cost-effective solution.

  The use of a single, centralized facility for Alternative 1 reduces capital costs, operating and maintenance costs, and is anticipated to be permitted and constructed in less time.

  The disadvantage of the distributed facilities in Alternative 2 is the additional infrastructure that would need to be permitted, constructed, operated, and maintained. Additional conveyance, including RO concentrate disposal lines, would need to be permitted. Distributed facilities would introduce inefficiencies that may require additional staffing. The additional facilities would need either a separate new laboratory or transportation of water samples from one site to a central laboratory. The additional facilities that would be needed would include two treatment facilities and associated buildings, new wastewater pump stations and wastewater, purified water, and RO concentrate conveyance lines. The additional assets and redundant facilities needed under Alternative 2 would require Metropolitan and/or the Sanitation Districts to operate and maintain additional facilities, manage additional staff, and coordinate the additional operations. Alternative 2 would likely take longer to implement for these reasons.

- **Completeness of Alternatives:** Completeness is the extent to which an alternative provides and accounts for all features, investments, and/or other actions necessary to realize the planned effects, including any necessary actions by others (Council on Environmental Quality 2013).

  The No-Action Alternative would be incomplete and would require numerous actions to attempt to increase imports or local supplies in response to long-term water shortages.

  Alternative 1 would provide the target water supply of 115 MGD and the aquifer recharge anticipated under Phase 1 of the PWSC Program. Alternative 2 would provide less water (107 MGD). Both alternatives would require additional investment by individual water agencies to construct the laterals needed to incorporate the water into their local distribution systems.

- **Acceptability of Alternatives:** Acceptability is the viability and appropriateness of an alternative from the perspective of the nation's general public and consistency with existing state and federal laws, authorities, and public policies. Acceptability does not include local or regional preferences for particular solutions or political expediency (Council on Environmental Quality 2013).

  Due to the severity of the effects of long-term drought, the No-Action Alternative is not considered to be an acceptable approach to the region's water supply challenges.

  Alternatives 1 and 2 are both consistent with California's Water Quality Control Policy for Recycled Water, which encourages the beneficial use of recycled water to meet the definition in California Water Code (CWC) Section 13050(n) in a manner that complies with State of California (state) and federal water quality laws and protects public health and the environment.

  Beneficial reuse of wastewater from the existing Warren Facility would not introduce the National Pollutant Discharge Elimination System (NPDES) permitting requirements associated with introducing a new source of water (e.g., a desalination facility). Furthermore, the use of recycled water consistent with Alternatives 1 and 2 would avoid new impacts to marine life.

  Alternative 2 would require additional real estate. Alternative 1, because of its smaller footprint, would result in smaller impacts, thereby streamlining regulatory compliance and reducing construction impacts to the general public. By centralizing facilities at the Warren Facility, Alternative 1 would avoid the impacts associated with a larger footprint.

Summary of Evaluation of Alternatives: Table ES-1 shows a summary of the comparative evaluation of the effectiveness, efficiency, completeness, and acceptability of the two action alternatives (Alternatives 1 and 2) considered.

Table ES-1. Comparative Evaluation of No-Action Alternative and Alternatives 1 and 2

CRITERION	CONCLUSIONS OF EVALUATION					
	Reduce risk of regional shortages	Reduce risk of earthquake outages	Reduce loss of groundwater production	Reduce imported water reliance	Climate change resilience	Benefit of DPR
Effectiveness	Alternative 1 highest Alternative 2 second No Action – lowest	Alternative 1 highest Alternative 2 second No Action – lowest	Alternative 1 highest Alternative 2 second No Action – lowest	Alternative 1 highest Alternative 2 second No Action – lowest	Alternative 1 highest Alternative 2 second No Action – lowest	Alternative 1 highest Alternative 2 second No Action – lowest
Efficiency	**Alternative 1** would be more efficient than Alternative 2. Alternative 2 would have a higher construction cost and annual cost for OM&R than Alternative 1. No Action would be least efficient.					
Completeness	**Alternatives 1 and 2** are essentially equal in terms of completeness. Both alternatives require additional actions to meet the target of 650,000 AFY identified in the IRP.					
Acceptability	**Alternative 1** has a smaller footprint for disturbed areas than Alternative 2. The smaller footprint would reduce the project impacts, streamline regulatory compliance, and reduce impacts to the public during construction. Therefore, Alternative 1 would have higher acceptability. No Action would be the least acceptable.					

Notes:
DPR = direct potable reuse
OM&R = operation, maintenance, and replacement

As shown in Table ES-1, although Alternatives 1 and 2 are both considered complete, Alternative 1 is the more effective, efficient, and has higher acceptability. Alternative 1 produces more high purity water to effectively meet the project objectives. Alternative 1 also has lower capital and operation and maintenance costs and is, thereby, more efficient. The smaller footprint for Alternative 1 reduces environmental impacts and results in higher acceptability.

ES-5 Economic Analysis of Alternatives

Table ES-2 provides a summary of the estimated benefits of the PWSC alternatives by benefit category. For periodically occurring events or conditions (e.g., avoided costs of water shortage after a major earthquake event), the benefit is shown both as a monetized benefit per event occurrence and as an average annual benefit factoring in the expected frequency of the event during the 30-year period of annualization.

The PWSC alternatives would result in many unquantified benefits that are difficult to monetize but would nonetheless provide an economic or other type of benefit to the regional water system and/or economy.

Table ES-2. Monetized Benefits of Alternatives 1 and 2

Category	Benefit Description	PWSC (Alternative 1)		Distributed Recycling Plants (Alternative 2)	
		Monetized Benefit ($/Occurrence)	Annualized Benefit ($/Year)	Monetized Benefit ($/Occurrence)	Annualized Benefit ($/Year)
Water supply	Value of supplied water based on the cost of the Distributed Recycled Water Treatment Plants Alternative because water imports and groundwater are not available	$530,809,000	$530,809,000	$478,932,000	$478,932,000
Water shortage avoidance	Value to water users from avoided water supply shortage	$151,677,000	— [a]	$136,853,000	— [a]
Water supply reliability	Savings from avoided purchases of imported water to offset local groundwater losses and reduced storage capabilities	$151,677,000	$151,677,000	$136,853,000	$136,853,000
Water quality	Avoided cost of treating groundwater supplies due to water quality degradation from declining groundwater tables	$35,577,000	$35,577,000	$32,100,000	$32,100,000
Avoided groundwater costs	Reduced groundwater pumping cost from higher groundwater levels	$2,158,000	$2,158,000	$1,757,000	$1,757,000
	Avoided Metropolitan member agency costs for purchase of additional imported water to meet demands following critical aquifer over-depletion	$71,624,000 [b]	$71,624,000 [b]	$64,624,000	$64,624,000
Emergency supply benefit (e.g., major earthquake event)	Cost to purchase additional imported water or transfer water after a major earthquake or disaster to meet demands	$94,872,000 [c]	$1,897,000 [d]	$85,600,000	$1,712,000
Interagency transfers of imported water	Potential to sell CRA and SWP allocations to other water contractors during drought due to Metropolitan's improved capacity to meet its demand with local groundwater and recycled water supplies	$94,872,000 [c]	$4,744,000 [e]	$85,600,000 [c]	$4,280,000 [e]
Benefits for economic stability and development	Avoided residential welfare decreases.	$132,228,000	$132,228,000	$119,305,000	$119,305,000

Category	Benefit Description	PWSC (Alternative 1)		Distributed Recycling Plants (Alternative 2)	
		Monetized Benefit ($/Occurrence)	Annualized Benefit ($/Year)	Monetized Benefit ($/Occurrence)	Annualized Benefit ($/Year)
Construction job creation and tax generation	Total labor income (direct, indirect and induced) from PWSC construction activities.	$6,300,000,000	$210,000,000	$7,276,295,000	$242,543,000
	State and local tax income from PWSC construction activities.	$736,600,000	$24,550,000	$850,749,000	$28,358,000
OM&R job creation and tax generation	Total labor income (direct, indirect and induced) from PWSC OM&R activity.	$158,000,000	$158,000,000	$159,386,000	$159,386,000
	State and local tax income (direct, indirect and induced) from PWSC OM&R activity.	$47,000,000	$47,000,000	$47,412,000	$47,412,000
Total	—	—	**$1,370,270,000**	—	**$1,317,264,000**

Notes:
a. Water shortage avoidance benefit not assigned since it is recognized by the water supply reliability benefit.
b. Based on future permanent 10 TAFY groundwater aquifer failure.
c. Based on Metropolitan's $800/AF imported water transfer surcharge allowance.
d. Annualized for SOD/NOD failure assuming 1 in 50 years major earthquake or other major disaster occurrence rate.
e. Annualized assuming 1 in 20 years critical drought year event occurrence rate.
— = not applicable
AF = acre-feet
CRA = Colorado River Aqueduct
OM&R = operation, maintenance, and replacement
PWSC = Pure Water Southern California
state = State of California
SWP = State Water Project

Table ES-3 provides a comparison of the benefits and costs of the PWSC (Alternative 1) and the distributed treatment (Alternative 2) alternatives. The individual benefits monetized for each PWSC alternative are shown in terms of both their annualized value and their total net present value over the 30-year analysis period. Table ES-3 also shows the estimated net benefits and benefit-cost ratio (BCR) of each alternative.

Table ES-3. Benefit and Cost Comparison of PWSC Alternatives

Category	PWSC (Alternative 1)		Distributed Recycled Water Treatment Plants (Alternative 2)	
	Annual Value	Net Present Value (30 years)	Annual Value	Net Present Value (30 years)
Benefits				
Water Supply	$530,809,000	$8,420,001,000	$478,932,000	$7,597,100,000
Water Shortage Avoidance	—[a]	—[a]	—[a]	—[a]
Water Supply Reliability	$151,677,000	$2,405,981,000	$136,853,000	$2,170,840,000
Water Quality Improvement	$35,577,000	$564,343,000	$32,100,000	$509,189,000
Increased Groundwater Levels	$2,158,000	$34,237,000	$1,757,000	$30,891,000
	$71,624,000[b]	$1,136,141,000	$64,624,000[b]	$1,025,104,000
Major Earthquake Event	$1,897,000[c]	$30,098,000	$1,712,000[c]	$27,157,000
Imported Water and Interagency Transfers	$4,744,000[d]	$75,252,000	$4,280,000[d]	$67,898,000
Economic Stability and Development	$132,228,000	$2,097,474,000	$119,305,000	$1,892,484,000
Construction Job and Tax Generation	$210,000,000	$3,331,140,000	$242,543,000	$3,005,582,000
	$24,550,000	$389,479,000	$28,358,000	$351,415,000
OM&R Job and Tax Generation	$158,000,000	$2,506,286,000	$159,386,000	$2,261,343,000
	$47,000,000	$745,541,000	$47,412,000	$672,678,000
Total	**$1,370,270,000**	**$21,735,972,000**	**$1,317,264,000**	**$19,611,680,000**
Costs				
Construction [e]	$215,500,000	$5,538,519,000	$248,900,000	$6,396,809,000
OM&R	$228,000,000	$3,616,666,000	$230,000,000	$3,648,391,000
Total	**$443,500,000**	**$9,155,185,000**	**$478,900,000**	**$10,045,200,000**
Cost-Effectiveness				
Net Benefits	$926,770,000	$12,580,787,000	$838,364,000	$9,566,480,000
Benefit-Cost Ratio	—	2.37	—	1.95

Notes:
a. Water shortage avoidance benefit not assigned since it is offset by the water supply reliability benefit.
b. Based on future permanent 10 TAFY groundwater aquifer failure.
c. Annualized assuming 1 in 50 years' major earthquake or other major disaster occurrence rate.
d. Annualized assuming 1 in 20 years' critical drought year event occurrence rate.
e. Does not include interest and amortization for project financing.
— = not applicable
OM&R = operation, maintenance, and replacement
PWSC = Pure Water Southern California

Table ES-3 indicates that PWSC is estimated to result in the maximum net benefits to the public (with an average annual value of $926.8 million [undiscounted]). Over the 30-year operating period considered, PWSC would result in higher total net benefits (an estimated $12.6 billion net present value in 2023). PWSC is also the most cost-effective of the PWSC alternatives with an estimated BCR of 2.37 compared with the distributed recycled water treatment plants alternative, which has a lower estimated BCR (1.95) and would result in lower total net benefits (an estimated net present value of approximately $9.6 billion).

ES-6 Selection of the Proposed Water Recycling Project

The evaluation of alternatives (Section ES-4) determined that Alternative 1 is the most effective, efficient, and acceptable alternative. The cost effectiveness of Alternative 1 is confirmed in the economic evaluation (Section ES-5). Alternative 1 has the highest benefit-cost ratio. PWSC with centralized treatment was selected as the most effective, efficient, and acceptable alternative. The costs for Alternative 1 are presented in Table ES-4.

Table ES-4. Estimated Construction and Annual Costs for Alternative 1: PWSC

Item	Cost
Construction Cost (2023 $)	
Total construction cost (includes mobilization, bonds, and insurance)	$3,339,700,000
Noncontract costs (contingency, soft costs, community benefits)	$2,804,500,000
Environmental mitigation	$30,000,000
Grand total (including mitigation)	$6,174,200,000
Investment Cost (2023 $)	
Escalation to midpoint of construction (to 2028)	$291,800,000
Total Investment Cost	$6,466,000,000
Interest Repayment Cost	$3,166,200,000
Total Investment Cost (including Interest)	$9,632,200,000
Annual Cost (2023 $)	
Construction (with interest and amortization) [1]	$321,100,000
Operation, maintenance, and replacement	$228,000,000
Total Annual Cost [2]	$549,100,000
Construction (excluding interest and amortization) [1]	$215,500,000
Operation, maintenance, and replacement	$228,000,000
Total Annual Cost [2]	**$443,500,000**

Notes:
1. Annualized construction cost based on a 30-year repayment period.
2. Totals may not sum exactly due to rounding.
PWSC = Pure Water Southern California

ES-7 Environmental Consideration and Potential Effects

Metropolitan is the lead agency under the California Environmental Quality Act (CEQA) (California Public Resources Code [PRC] Section 21067) and is responsible for complying with the requirements of CEQA. An initial assessment of the PWSC indicated that the project may have a significant effect on the environment; therefore, Metropolitan has determined that preparation of an Environmental Impact Report (EIR) is appropriate per PRC Section 21082.2. The environmental documents would do the following: (1) inform decision makers and the public about the potentially significant environmental effects of the proposed activities; (2) identify ways that the significant environmental effects can be avoided or reduced; and (3) identify alternatives to the project that would avoid or substantially lessen the proposed project's impacts.

On September 30, 2022, Metropolitan prepared a Notice of Preparation (NOP) of an EIR and filed the NOP with the California Office of Planning and Research, which initiated the Scoping phase for the PWSC Program under CEQA. The NOP identified probable environmental effects in the following resource categories: air quality; biological resources; cultural resources; energy, geology and soils; greenhouse gas (GHG) emissions; hazards and hazardous materials; hydrology and water quality; land use and planning; noise; transportation; tribal cultural resources; and utilities and service systems. The resource categories not anticipated to have potentially significant environmental impacts are aesthetics, agriculture and forestry resources, mineral resources, population and housing, public services, recreation, and wildfire. The Scoping phase ended on November 14, 2022, and Metropolitan received comments covering a range of topics, including biological resources, archaeological and tribal cultural resources; water quality, reliability, and accessibility; energy, GHG emissions, and air pollutants; continued coordination on planning process and future activities; regional operational flexibility; and future integration with other water supply and distribution systems.

Metropolitan is currently conducting technical studies for various environmental resource categories. The technical studies will provide detailed information and documentation that will be used to analyze project impacts in the EIR. The Draft EIR is anticipated be completed in December 2024 and will be available for public review for 45 to 60 days. The Final EIR is anticipated to be completed and certified by Metropolitan's Board of Directors in October 2025.

The federal lead agency for the project will likely be Reclamation. Per WTR 11-01, review of a water reclamation, recycling, or desalination feasibility study report does not require National Environmental Policy Act (NEPA) compliance; however, providing federal funds for design or construction of a project does. Reclamation may consider the use of a Categorical Exclusion to comply with NEPA. Funding for construction of the project would require additional NEPA compliance by Reclamation. This compliance will likely require an Environmental Assessment (EA) / Finding of No Significant Impact (FONSI) or an Environmental Impact Statement (EIS). The EA would determine whether a federal action has the potential to cause significant environmental effects. If Reclamation determines that the proposed federal action would not have significant environmental impacts, the agency would issue a FONSI. If Reclamation determines that the environmental impacts of the proposed federal action would be significant, an EIS would be prepared.

ES-8 Legal and Institutional Requirements

Water Rights. Under the CWC, wastewater treatment plant owners hold the exclusive right to the treated wastewater from their plants (CWC § 1210). Users that discharge to the sanitary sewer system effectively "abandon" that water; therefore, those users do not have legal rights to it (unless otherwise provided by agreement). Accordingly, the Sanitation Districts hold the exclusive rights to the wastewater treated at the Warren Facility, and this wastewater would be used as source water for PWSC. In addition, under California Health and Safety Code Sections 4744 and 4745, the Sanitation Districts have the right to sell or beneficially use any recycled water produced at their treatment facilities.

Multijurisdictional and Interagency Agreements. The PWSC Program is a product of the creative and collaborative partnership between Metropolitan, a regional wholesale water provider, and the Sanitation Districts, a regional wastewater service provider. The PWSC Program has resulted in the development of a large-scale regional recycled water project that would benefit 19 million people in Southern California. The PWSC Program requires collaboration among many entities, and it has more than 15 program partners, including Metropolitan member agencies (Central Basin Municipal Water District [MWD], West Basin MWD, City of Torrance, Long Beach Utilities, Three Valleys MWD, Los Angeles Department of Water and Power, Upper San Gabriel Valley MWD, and others); groundwater basin managers (Water Replenishment District, Main San Gabriel Basin Watermaster); Colorado River partners (Southern Nevada Water Authority, Arizona Department of Water Resources, Central Arizona Project); and other key partners (U.S. Army Corps of Engineers, the State Water Resources Control Board's Division of Drinking Water [DDW], Southern California Edison, Los Angeles County Department of Public Works, California Department of Transportation, and other regulators) (see Figure ES-5).

Figure ES-5. PWSC Program Partners

Letters of intent and agreements (including funding agreements) have been developed with partnering project agencies. Memoranda of understanding will be developed with the agencies involved as the project progresses.

Waste Discharge Requirements: Currently, the Warren Facility must meet secondary treatment standards for discharge to the Pacific Ocean. Generally, the constituent levels in the Warren Facility's effluent are far below the effluent limits prescribed by the *Water Quality Control Plan: Ocean Waters of California* (SWRCB 1972 [2019]). In addition, the side-stream centrate treatment system that is part of PWSC will reduce nitrogen levels in the effluent discharged to the ocean. The AWPF will be designed to comply with requirements in water recycling permits, which are based on applicable Basin Plans, including applicable Salt and Nutrient Management Plans and the regulations in Title 22 California Code of Regulations (CCR) for NPR, IPR, and DPR. A new AWPF would provide a proven, state-of-the-art purification process consisting of RO and ultraviolet / advanced oxidation process (UV/AOP) that would produce near-distilled quality water (exceeding California standards for IPR). The stabilized water would then be conveyed for recharge or surface spreading into groundwater basins, which would improve basin water quality through long-term recharge operations.

ES-9 Financial Capability

Metropolitan is financially capable of funding PWSC's cost. Metropolitan currently recovers revenues to cover its operating and capital costs through an existing rate structure that includes various rate design elements. Metropolitan charges volumetric-based rates to its member agencies, including the following:

- A Supply Rate consists of a two-tiered charge on water sales that recovers Metropolitan's cost for water purchases and transfers.
- A System Access Rate recovers the costs of conveyance, distribution, and storage.
- A System Power Rate recovers the cost of energy required to pump water to Southern California through the SWP and the CRA.
- A Treatment Surcharge recovers the cost of providing treatment capacity and operations applied to all transactions involving treated water.
- Metropolitan also imposes a fixed charge to its member agencies; this charge includes a Capacity Charge and a Readiness-to-Serve Charge:
    - A Capacity Charge recovers the cost of peak capacity within the distribution system.
    - A Readiness-to-Serve Charge recovers the cost for the portion of the system that is available to provide emergency service and available capacity during outages and hydrologic variability.

Metropolitan is currently considering three cost recovery alternatives:

- Consistent with existing rates and charges
- With a functionalized fixed charge
- Through member agency subscriptions as direct investors

In addition to its existing and future ability to recover sufficient revenues to cover PWSC's future capital repayment and operation, maintenance, and replacement (OM&R) expenses, Metropolitan also has the ability to secure capital funding for PWSC construction from a variety of sources. Metropolitan can use funds from its annual operating budget to cover a portion of the PWSC construction but would also use debt funding through revenue bond issuance in full accordance with its existing debt policy and debt coverage requirements. Metropolitan has consistently received excellent credit ratings from the nation's top rating agencies (Standard & Poors, Moody's, and Fitch Ratings). All three of their bond ratings qualify as a "high acceptable" score per Reclamation's D&S WTR 11-02 Table A criteria and demonstrate Metropolitan's strong borrowing potential.

Grant and loan funding opportunities are available from one or a combination of sources, including the Federal Government, state governments, and potentially from non-profit research funds, public-private partnerships, and local agency partnering. Federal grant funding for PWSC is primarily likely to be available through Reclamation. Funding from U.S. Environmental Protection Agency (USEPA), the Federal Emergency Management Agency

(FEMA), the National Oceanic and Atmospheric Administration (NOAA), or other federal sources may be available for the PWSC in the future. The State Water Resources Control Board is the primary state agency that funds recycled water projects, and it administers the Water Recycling Funding Program (WRFP), the State Clean Water and Drinking Water State Revolving Fund programs, and the Groundwater Grant Program. Funding for groundwater replenishment is also available through the California Department of Water Resources (DWR).

Metropolitan currently anticipates prioritizing grant opportunities, followed by federal and state loan funding. The USEPA's Water Infrastructure Finance and Improvement Act (WIFIA) provides low-interest financing (secured loans or loan guarantees) for the construction of water and wastewater infrastructure, including water recycling projects. WIFIA is intended to provide subsidized financing for large-dollar-value projects that are nationally or regionally significant and cost at least $20 million. The maximum amount of the loan is 49 percent of the eligible project costs. Funding through the Clean Water State Revolving Fund (CWSRF) low-interest loan program will also likely be pursued. The size of the loan is up to 100 percent of the project cost, the interest rate is half the general obligation bond rate (~2 percent), and repayment is up to 30 years. However, CWSRF loan funding is likely to be limited to a maximum of $50 million per project.

ES-10 Research Needs

PWSC will largely rely on proven technology and conventional system components. Many of the ongoing research activities support optimization of the facility design. Further research is required to confirm the performance the DPR component of the PWSC Program; these activities will target demonstrating the equivalency of the alternative approaches to ozone / biological activated carbon (BAC) in reducing low-molecular-weight compounds. This research is intended to prove the technology. Alternative approaches to ozone/BAC could be a potential satellite facility located downstream that treats only flow to be used for DPR. The Innovation Center will be fully utilized and expanded for future DPR research activities, with testing of additional treatment processes that are part of alternative approaches to ozone/BAC.

The following objectives are to be accomplished with further research related to the DPR aspect of the PWSC Program:

- Evaluate, based on bench-scale and pilot-scale testing, the performance and efficacy of alternative technologies and process trains that can be utilized in lieu of ozone/BAC upstream of RO for meeting the 1-log (90 percent) removal of target chemicals listed in Text of Proposed DPR Regulations (DDW 2023a), including acetone, formaldehyde, sulfamethoxazole, and carbamazepine.

- Demonstrate that the alternative approaches provide equivalent chemical reduction and public health protection and meet the intent and requirements of the DPR regulations.

- Develop a comparative analysis of the various alternative approaches that focuses on the key criteria, including capital cost, operations and maintenance cost, impact to the environment, carbon emissions, and operational flexibility.

ES-11 Independent Review Process

The approach and findings for this project have included extensive review, with additional review processes anticipated throughout the remainder of the planning and design process. This Feasibility Study has been based on several reports, opinions of probable costs, and technical memoranda that were reviewed in advance of their incorporation into this report. Reviews to confirm the information and findings of this Feasibility Study have included reviews by Metropolitan and Sanitation Districts staff, Metropolitan's consultants, and an independent panel of reviewers.

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1. Introduction and Study Area

Introductory Information (red text from WTR 11-01 guidance).

Provide the following introductory information.

(a) identification of the non-Federal project sponsor(s);

(b) a description of the study area and an area/project map; and

(c) a definition of the study area in terms of both the site-specific project area where the reclaimed water supply will be needed and developed, and any reclaimed water distribution systems.

The Metropolitan Water District of Southern California (Metropolitan), in partnership with the Los Angeles County Sanitation Districts (Sanitation Districts), is making a major investment in a new drought-resilient water supply with the development of the Pure Water Southern California (PWSC) Program. The PWSC Program is an innovative, large-scale, regional recycled water project that has a goal of creating 155,000 acre-feet per year (AFY) of safe, reliable, and drought-resilient water supplies for the region. Long-term drought, climate change, and competing demands have impacted Metropolitan's water supply portfolio. Sustainable local water supplies are crucial to maintain the reliability of the water supply for the region's 19 million residents, reduce stress on local groundwater supplies, increase Metropolitan's water storage, and provide operational flexibility.

The program would be delivered in two phases. Phase 1 would provide 115 million gallons per day (MGD) (118,590 AFY) of non-potable reuse (NPR) / indirect potable reuse (IPR) and direct potable reuse (DPR). Phase 2 would provide an additional 35 MGD (36,410 AFY) of DPR. Phase 1 deliveries would consist of 24 MGD (24,750 AFY) of NPR and 66 MGD (68,060 AFY) of IPR in groundwater basins and 25 MGD (25,780 AFY) of DPR. PWSC Phase 1 consists of the following:

1. Improvements at the A.K. Warren Water Resource Facility (Warren Facility) (formerly the Joint Water Pollution Control Plant);
2. An Advanced Water Purification Facility (AWPF);
3. A 42-mile backbone conveyance pipeline to convey the purified water; and
4. Connections to partner systems or recharge facilities in four regional groundwater basins.

PWSC would provide initial NPR and IPR deliveries in 2030, reach build-out by 2033, and produce DPR by 2035. **Throughout this Feasibility Study, "PWSC" is used to refer to Phase 1, and "PWSC Program" is used to refer to Phases 1 and 2. This Feasibility Study focuses on Phase 1.**

The PWSC Feasibility Study (Feasibility Study) has been prepared to support funding through the Large-Scale Water Recycling Program (LSWRP). The United States (U.S.) Bureau of Reclamation (Reclamation) is leveraging federal and non-federal funding to support efforts to stretch scarce water supplies and avoid conflicts over water under the WaterSMART (Sustain and Manage America's Resources for Tomorrow) Program. PWSC supports the Biden-Harris Administration's priorities, including Executive Order (E.O.) 14008: Tackling the Climate Crisis at Home and Abroad and E.O. 13985: Advancing Racial Equity and Support for Underserved Communities Through the Federal Government. This study has been prepared in support of Metropolitan's application for funding assistance in response to Notice of Funding Opportunity Number R23AS00433 and future LSWRP funding opportunities. Metropolitan's application was submitted on November 21, 2023.

This Feasibility Study has been prepared consistent with the requirements set forth in Reclamation Manual: Directives and Standards WTR 11-01, Subject: Title XVI Water Reclamation and Reuse Program and Desalination Construction Program Feasibility Study Review Process (Reclamation 2007) and the additional requirements established in Reclamation Manual: Directives and Standards WTR TRMR-128 Temporary Release, Subject: Large-Scale Water Recycling Program Feasibility Study Review Process (Reclamation 2022). The chapters in this Feasibility Study are organized consistent with the requirements identified in WTR 11-01 and WTR TRMR-128.

1.1. Pure Water Southern California

The PWSC Program would take cleaned wastewater and further purify it to produce a new, sustainable source of high-quality water for Southern California. This project, which is being performed in partnership with the Sanitation Districts, would ultimately produce up to 150 million gallons of water daily when completed and provide purified water for up to 1.5 million people, making it one of the largest water reuse programs in the world. This Feasibility Study is focused on Phase 1 of the project, which would provide 66 MGD for IPR, 24 MGD for NPR, and 25 MGD for DPR. **Throughout this Feasibility Study, "PWSC" is used to refer to Phase 1, and "PWSC Program" is used to refer to Phases 1 and 2. This Feasibility Study focuses on the Phase 1 project.**

This Feasibility Study evaluates the feasibility of a program to create a new water resource with regional benefits for Southern California. Phase 1 of PWSC would include the following: (1) an AWPF adjacent to the Sanitation Districts' Warren Facility, formerly known as the Joint Water Pollution Control Plant (JWPCP), in Carson, California, that would produce up to 115 MGD of purified water; (2) conveyance of purified water via approximately 60 miles of pipelines; and (3) delivery of purified water to up to four groundwater basins (Central, West Coast, Main San Gabriel, and Orange County) within the Metropolitan service area. PWSC would provide up to 68,000 AFY to recharge these basins, replacing existing and projected demand for imported water for recharge and enabling the basins to serve their vital storage function that helps meet regional water demands during dry periods and emergencies.

1.2. Project Sponsors

PWSC is a partnership between Metropolitan and the Sanitation Districts.

Metropolitan serves the 26-member public water agencies—cities, municipal water districts, and one county water authority—that then deliver supplies directly or indirectly to 19 million people in Los Angeles, Orange, Riverside, San Bernardino, San Diego, and Ventura Counties. The mission of Metropolitan is to provide its 5,200-square-mile service area with an adequate and reliable supply of high-quality water to meet present and future needs in an environmentally and economically responsible way. Metropolitan owns and operates an extensive range of facilities, including the Colorado River Aqueduct, 15 hydroelectric plants, nine reservoirs, 830 miles of large-diameter pipes, and five water treatment plants. Four of these treatment plants are among the largest plants in the nation. Metropolitan is the largest distributor of treated drinking water in the United States. The district imports water from the Colorado River and Northern California to supplement local supplies and helps its member agencies develop increased water conservation, recycling, storage, and other local resource programs.

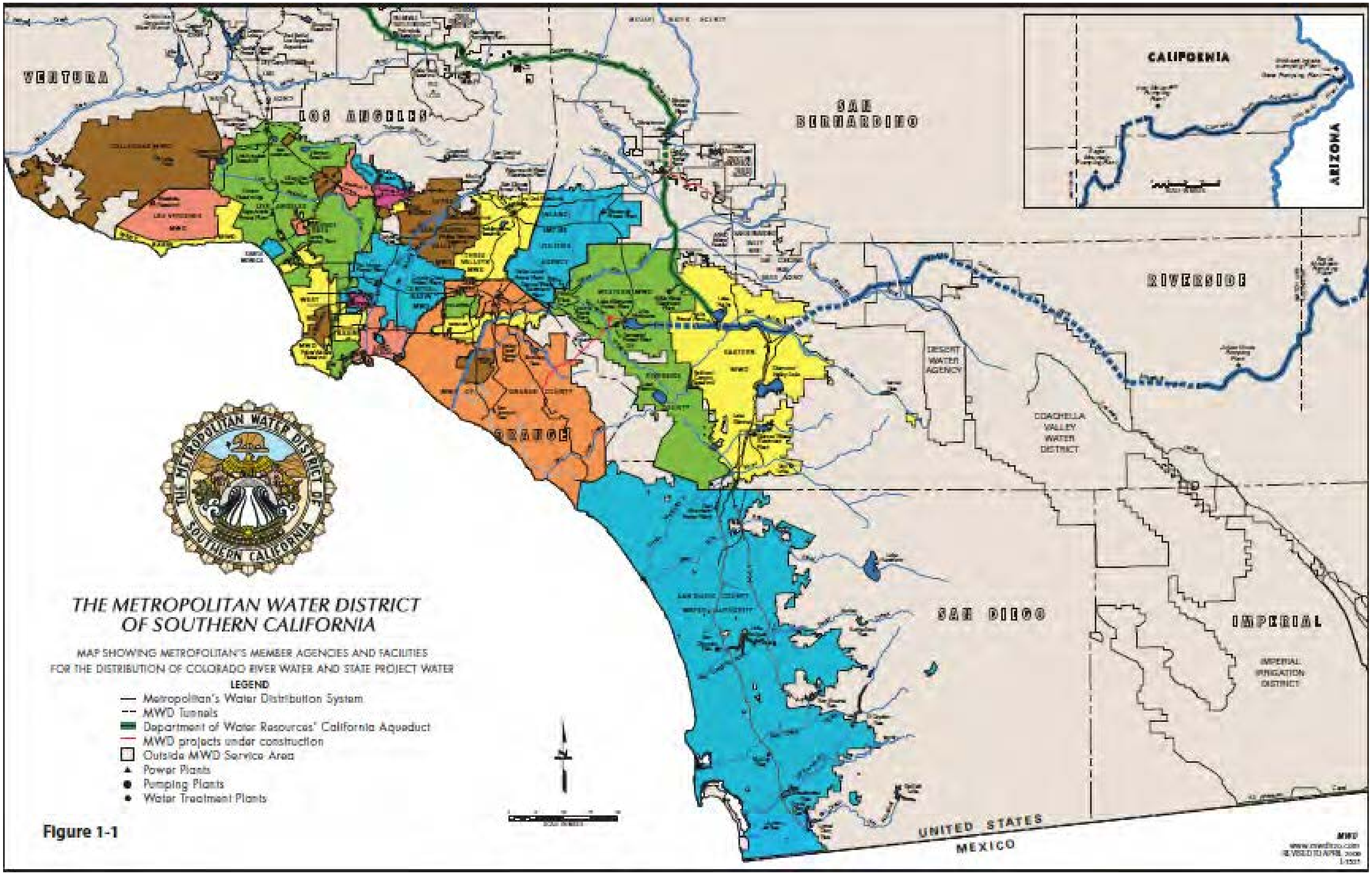
The Sanitation Districts is a public agency that consists of 24 independent special districts that serve about 5.5 million people in Los Angeles County. The service areas cover approximately 850 square miles and encompass 78 cities and unincorporated areas in the county. The Sanitation Districts were created in 1923 to construct, operate, and maintain facilities that collect and treat domestic and industrial wastewater (sewage). The agency operates and maintains a regional wastewater collection system that includes approximately 1,400 miles of sewers, 49 pumping plants, and 11 wastewater treatment plants that transport and treat about half the wastewater in Los Angeles County. Collectively, the Sanitation Districts treat about 400 million gallons of water per day. Over the last 60 years, the Sanitation Districts have been the nation's largest producer of recycled water.

1.3. Study Area

Figure 1-1 shows the area where the recycled water supply would be developed and the affected groundwater basins potentially recharged by PWSC.

Figure 1-2 shows the service area for the Metropolitan Water District of Southern California. Unlike local water recycling projects, the PWSC Program would be a regional partnership between Metropolitan (a regional wholesale water provider) and the Sanitation Districts (a regional wastewater service provider).

Figure 1-1. Primary Study Area



Source: Metropolitan 2021a, Figure 1-1.

Figure 1-2. Extended Study Area for Distribution

The PWSC Program facilities would be primarily within Los Angeles County, with some facilities possibly extending into western San Bernardino County. However, the potential recipients of the purified water generated and delivered by these facilities are spread over a much wider geographic area. At project completion, the PWSC Program would provide 155,000 AFY of sustainable, high-quality water to supplement existing supplies in the Southern California region.

Metropolitan has long recognized climate change and other threats to the reliability of its water supplies and has been preparing to address this threat since 1996 through its Integrated Water Resources Plans (the most recent is Metropolitan 2022a), Climate Adaptation Master Plan for Water, Climate Action Plan (Metropolitan 2022b), and other planning processes. Metropolitan has invested in local supplies, developed new storage, and increased system flexibility. The PWSC Program supports these efforts by further diversifying the region's water supply. The PWSC Program also supports the State of California's Water Resiliency Portfolio initiative, which provides a roadmap for California to build resilience to extreme droughts, floods, and rising temperatures while addressing over-reliance on groundwater by diversifying the region's water supply. In addition, the PWSC Program serves to support Strategy #8 (Increase Water Conservation and Local Water Supply) of Metropolitan's Climate Action Plan (Metropolitan 2022b), which was developed through a highly collaborative regional process.

2. Problems and Needs

Statement of Problems and Needs (WTR 11-01).

Describe key water resource management problems and needs for which a water reclamation, recycling or desalination project will provide a solution, including the following information. All projections shall be reasonable and applicable for a minimum of 20 years.

(a) Description of the problem and need for a water reclamation, recycling or desalination project.

(b) Description of current and projected water supplies, including water rights, and potential sources of additional water other than the proposed water reclamation, recycling or desalination project, and plans for new facilities other than the proposed project, if any.

(c) Description of current and projected water demands, including a description of the current and projected water supply and demand imbalances.

(d) Description of any water quality concerns for the current and projected water supply.

This section describes the problems and needs that would be addressed by PWSC. As this section demonstrates, the water supplies for Metropolitan fluctuate significantly and are impacted by drought and climate change. Surface water supplies that are imported into the region are especially vulnerable to drought. Groundwater basins, another key component of the water supply portfolio, have been in decline since about 2000. Despite historic levels of groundwater recharge in 2023, many of the region's groundwater basins remain in long-term decline. Groundwater storage levels are important because they impact how the groundwater basins can be used during times of shortage or emergencies. If the groundwater storage levels continue to decline, groundwater basins may not be able to serve as a source of water when needed by the region. For the basins to continue to provide benefits for regional reliability, water deliveries to the groundwater basins for recharge are essential. For these reasons, Metropolitan needs a more drought resistant type of supply in its water supply portfolio, including the ability to replenish depleted aquifers.

The analysis of water supplies, demands, and water quality issues provided in this section to characterize the problems and needs relies on information from the *2020 Urban Water Management Plan* (Metropolitan 2021a), the *2020 Integrated Water Resources Plan (IRP)–Regional Needs Assessment* (Metropolitan 2022a), and *Pure Water Southern California: Addendum to White Paper No. 2, Planning, Financial Considerations, and Agreements* (Metropolitan 2023a). The 2020 Urban Water Management Plan (UWMP) provided an evaluation of the sources of water supply, efficient uses of water, demand management measures, and an implementation strategy. The 2020 IRP is an ongoing, forward-looking planning effort that evaluates climate change and demand scenarios to better forecast regional water supply needs. The 2020 IRP is the most recent of the two studies and is heavily relied on in this report in considering future supplies and demands and evaluating the likelihood of future shortages. *Pure Water Southern California: Addendum to White Pater No 2, Planning, Financial Considerations, and Agreements* is based largely on the 2020 IRP and focuses more specifically on the problems and needs driving the PWSC Program.

2.1. Current and Projected Water Supplies

2.1.1. Overview of Water Supply Conditions

Water conditions facing the region are shaped by supply conditions and resource actions that occurred in prior years, including several extraordinary events that have introduced increasing variability into water supply management:

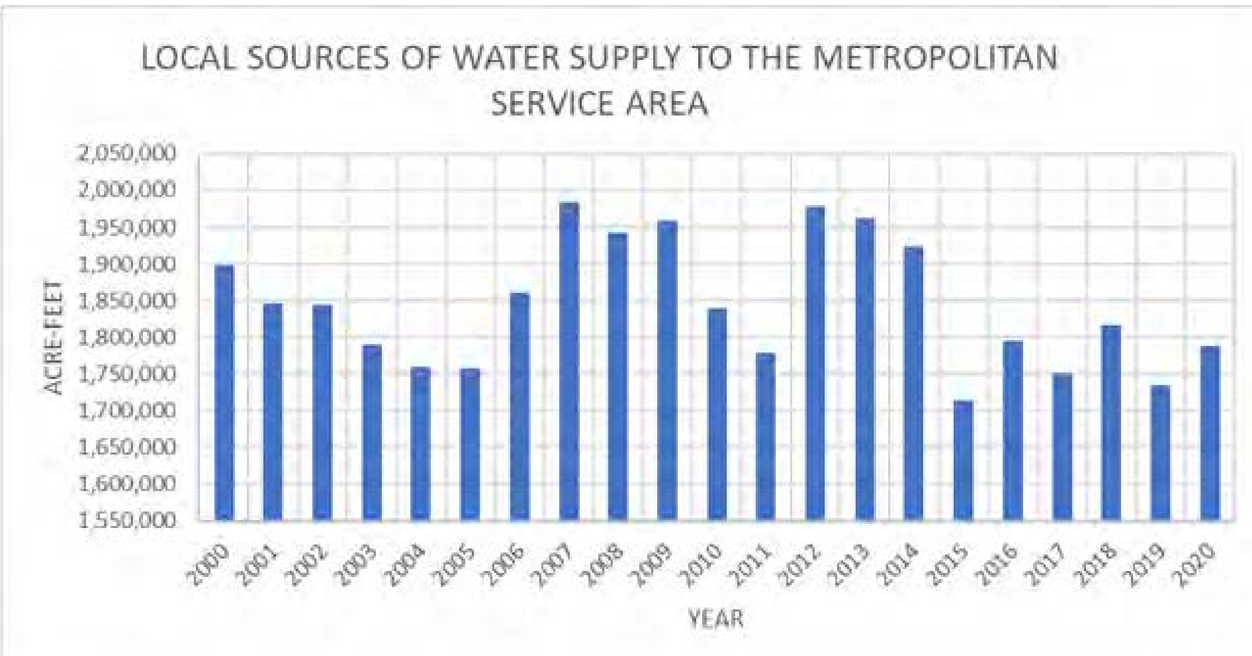
- Imported supplies have been highly variable, influenced by periods of extended drought that impact water supply. A historic drought in California led to record low supplies available from the State Water Project (SWP) in 2014 (5 percent of Metropolitan's Table A allocation), 2015 (20 percent of Metropolitan's Table A allocation), 2020 (20 percent of Metropolitan's Table A allocation), and 2021 (5 percent of Metropolitan's Table A allocation). After the driest January and February in more than 100 years, the allocation for 2022 was again limited to 5 percent of contract for Metropolitan's Table A allocation but returned to 100 percent in 2023.
- An extended drought in the Colorado River watershed decreased storage levels in Lake Mead and Lake Powell, and the first-ever shortage declaration for the lower Colorado River was issued in August 2021. Although storage levels increased in 2023, the Colorado River continues to operate under a Tier 1 shortage going into 2024.
- Groundwater basins and local reservoirs dropped by nearly 1.2 million acre-feet (MAF) due to record-dry hydrology in Southern California between 2000 and 2022. In 2023, groundwater basins partially recovered due to record-breaking amounts of groundwater recharge.
- Metropolitan declared a regional drought emergency in November 2021, when SWP-dependent areas within the district faced shortages.

Supplies in recent years have been highly variable, and Metropolitan's existing infrastructure is vulnerable to shortages. Extended periods with dry hydrologic conditions and reduced imported water supplies have recently required Metropolitan to take a water allocation and make significant withdrawals from storage reserves, including Diamond Valley Lake (DVL), and its groundwater banking and conjunctive use programs to meet scheduled water deliveries. Metropolitan is responding to the fluctuations in water supply availability by focusing planning efforts on more resilient water supply options. The variability in water supply is described in detail in the following subsections.

2.1.2. Summary of Current Available Supplies

Local Supply: Local supplies are produced to meet individual agency demands and are key to determining how much Metropolitan supply is needed. They include groundwater, surface water, the Los Angeles Aqueduct, recycled water, groundwater recovery, and seawater desalination. Approximately 50 percent of the region's water supplies come from resources separately controlled or operated by local water agencies. Figure 2-1 shows the historical annual use of local water supplies within Metropolitan's service area. Locally available supplies have historically been less variable than imported supplies.

There is an opportunity to further increase the use of recycled water as part of the local water supply. Wastewater within the region provides a sustainable supply of water that is not fully utilized at this time.



Source: Metropolitan 2021a, Table A.2-1.

Figure 2-1. Historical Local Water Supplies

Imported Supplies: Metropolitan receives water from the Colorado River through the Colorado River Aqueduct (CRA) and from the SWP through the California Aqueduct. Colorado River supplies include Metropolitan's basic Colorado River apportionment, along with supplies that result from existing and committed programs, including those from the Imperial Irrigation District–Municipal Water District (MWD) Conservation Program, the implementation of the Quantification Settlement Agreement (QSA) and related agreements, and the exchange agreement with San Diego County Water Authority (SDCWA). The QSA established the baseline water use for each of the agreement parties and facilitates the transfer of water from agricultural agencies to urban uses. Since the QSA, additional programs have been implemented to increase Metropolitan's supplies. These include the

Palo Verde Irrigation District Land Management, Crop Rotation, and Water Supply Program and the Lower Colorado River Water Supply Project. The 2007 Interim Guidelines provided for the coordinated operation of Lake Powell and Lake Mead and the Intentionally Created Surplus (ICS) program, which allows Metropolitan to store water in Lake Mead. These stored supplies can be used to supply additional water so that Metropolitan can deliver up to Metropolitan's CRA capacity of 1.25 MAF. Metropolitan has a priority right of 550,000 AF under the QSA and has a right to any unused rights from other priorities above.

Due to declining levels in Lake Mead (Figure 2-2), the Lower Basin Drought Contingency Plan (DCP) was signed in 2019. Metropolitan is to store certain volumes of water in Lake Mead as DCP ICS once Lake Mead is below elevation 1,045 feet. This agreement also increases Metropolitan's flexibility to take delivery of water stored as ICS at Lake Mead elevations below 1,075 feet. The goal of this

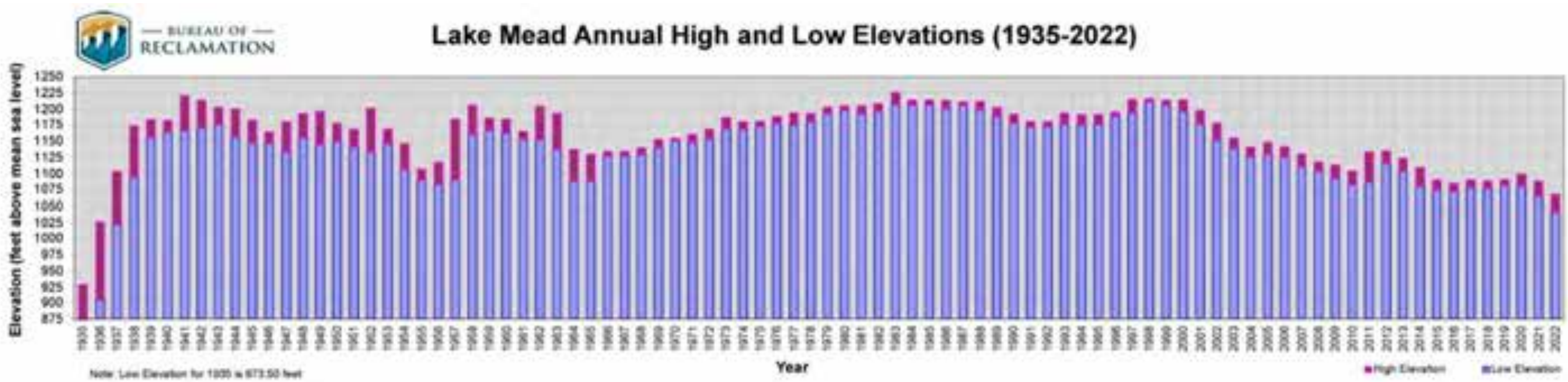


Figure 2-2. Annual Levels in Lake Mead

agreement is to keep Lake Mead above critical elevations, and overall, it increases Metropolitan's flexibility to store water in Lake Mead in greater volumes and to take delivery of stored water to fill the CRA as needed. This agreement will conclude in 2025/2026 and the requirements for storage and deliveries associated with the successor agreement are not known at this time.

Metropolitan also receives approximately 277,700 AFY of additional Colorado River supplies pursuant to an exchange agreement with SDCWA, a member agency.

Metropolitan imports water from the SWP, owned by the State of California and operated by the California Department of Water Resources (DWR). This project transports water conveyed through the San Francisco Bay–Sacramento–San Joaquin River Delta (Bay-Delta) as well as unregulated flows diverted directly from the Bay-Delta south via the California Aqueduct. Metropolitan is one of 29 agencies that have long-term contracts with DWR (these agencies are referred to as State Water Contractors) that are participants in the SWP, and Metropolitan is SWP's largest member agency in terms of the number of people it serves (19 million). Metropolitan has a Table A amount (the maximum amount allocated and delivered under a SWP contract) of approximately 2 MAF. Allocations based on Table A vary from year to year (Table 2-1).

Table 2-1. Recent SWP Allocations

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Percent Allocation	5%	20%	60%	85%	35%	75%	20%	5%	5%	100%

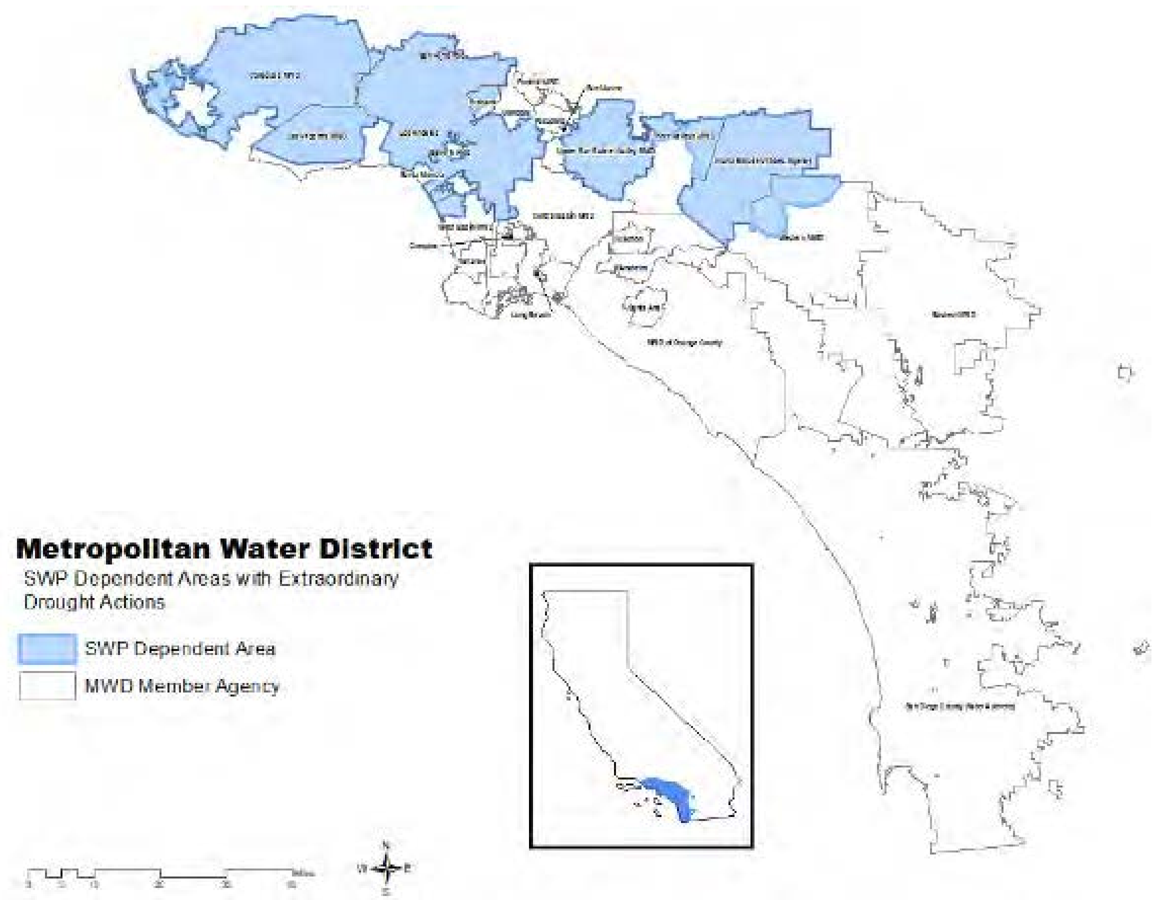
Source: DWR no date. SWP Management (Historical Table A Allocations). Available at: water.ca.gov/Programs/State-Water-Project/Management. Copyright 2024.

Figure 2-3 shows SWP facilities. This statewide water infrastructure provides water to 29 urban and agricultural agencies throughout California. More than two-thirds of California's residents receive some of their drinking water from the Bay-Delta.

Source: Metropolitan 2021a, Figure 3-2.

Figure 2-3. State Water Project Facilities

Figure 2-4 shows the parts of the Metropolitan service area where the local conveyance system is highly dependent on SWP deliveries (blue highlighting) because deliveries from sources other than the SWP are constrained. As a result, these areas had extraordinary drought actions in 2021; this figure also shows other Metropolitan member agencies.



Source: Metropolitan 2022a, Figure 1-2.

Figure 2-4. SWP Dependent Areas with Extraordinary Drought Actions in 2021

Figure 2-5 shows the historical annual SWP allocations and Metropolitan's storage capacities. The figure shows the significant degree of variability in the SWP allocations in recent years due to widely variable climatic conditions. Storage levels have also dropped during prolonged drought conditions (e.g., 2014 through 2016).

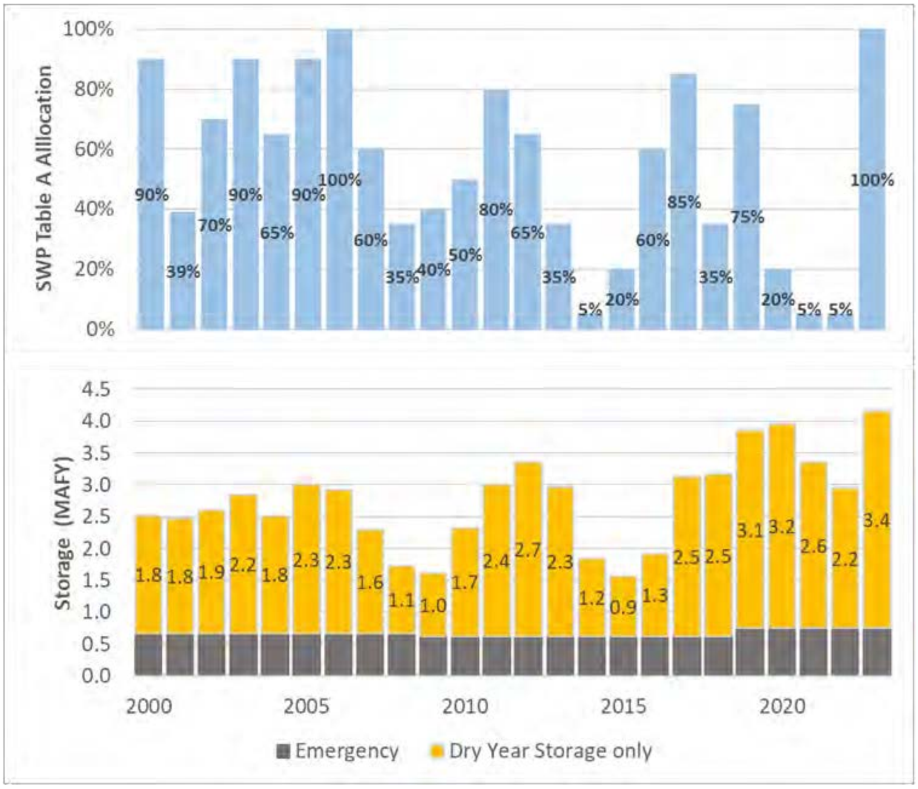
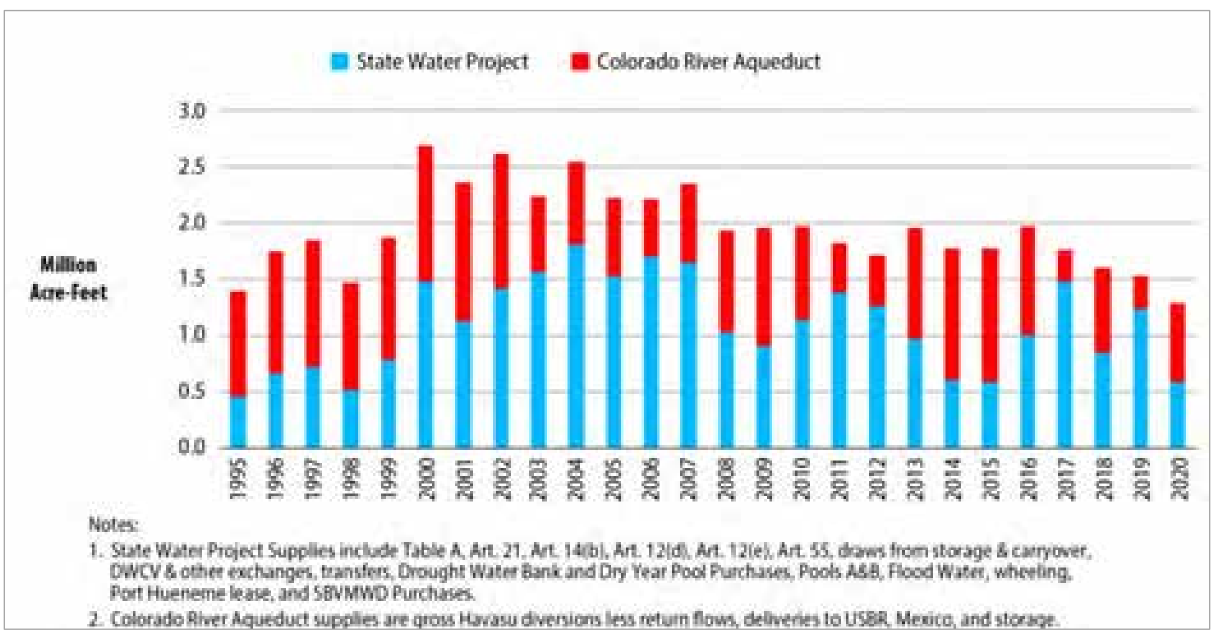


Figure 2-5. SWP Allocation and End-of-Year Balance

Figure 2-6 shows the historical annual use of imported water supplies within Metropolitan's service area.



Source: Metropolitan 2021a, Figure 1-6.

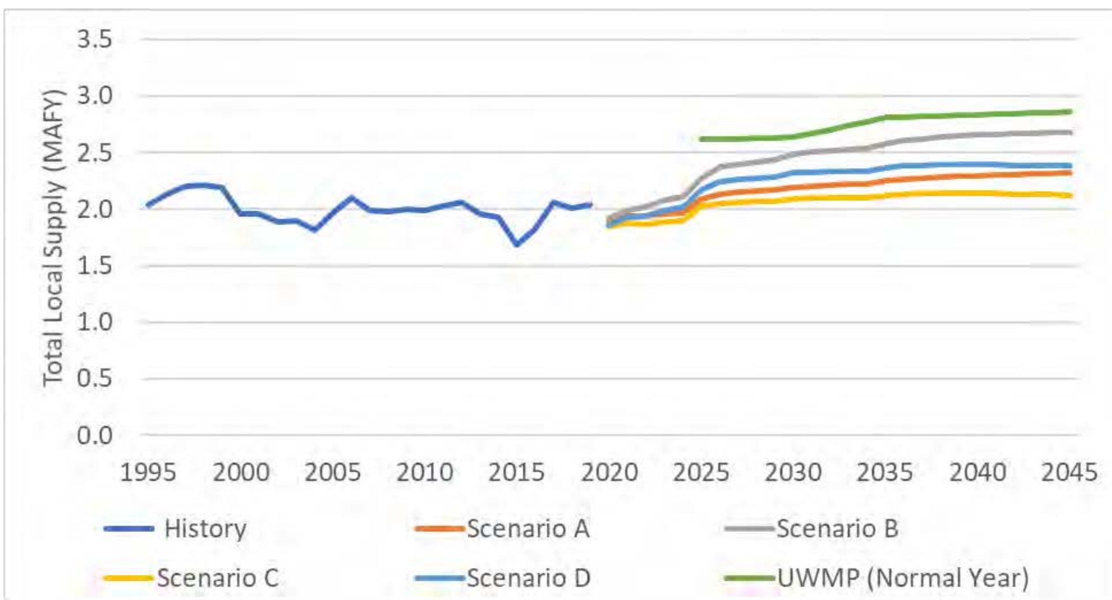
Figure 2-6. Historical Imported Supplies

2.1.3. Projected Future Supplies

Metropolitan considered multiple future scenarios for their 2020 IRP (Metropolitan 2022a). Specifically, the assessment considered four scenarios:

- Scenario A: Low demand with stable imports (gradual climate change impacts, low regulatory impacts, and slow economic growth)
- Scenario B: High demand with stable imports (gradual climate change impacts, low regulatory impacts, and high economic growth)
- Scenario C: Low demand with reduced imports (severe climate change impacts, high regulatory impacts, and slow economic growth)
- Scenario D: High demand with reduced imports (severe climate change impacts, high regulatory impacts, and high economic growth)

Local Supplies: Metropolitan developed local supply projections that examined the degradation of existing supplies in combination with different timing and implementation of future local supply projects by member agencies. Figure 2-7 demonstrates the broad range of potential outcomes of local supply production. Projections are shown for the four IRP water supply scenarios and for the data in the UWMP (green line).



Source: Metropolitan 2021b.

Figure 2-7. Total Local Supply Under Average Conditions

The local supplies shown on Figure 2-8 are highly dependent on groundwater. Groundwater production has declined over the past 20 years due to a loss of replenishment arising from changing precipitation patterns, reduced demand (e.g., return flows from outdoor irrigation), water quality concerns, and aging infrastructure (Figure 2-8). Although many local recycling projects have been implemented, the local supply has remained stagnant for the past 20 years. The yield from these smaller local recycling projects has been reduced by water conservation.

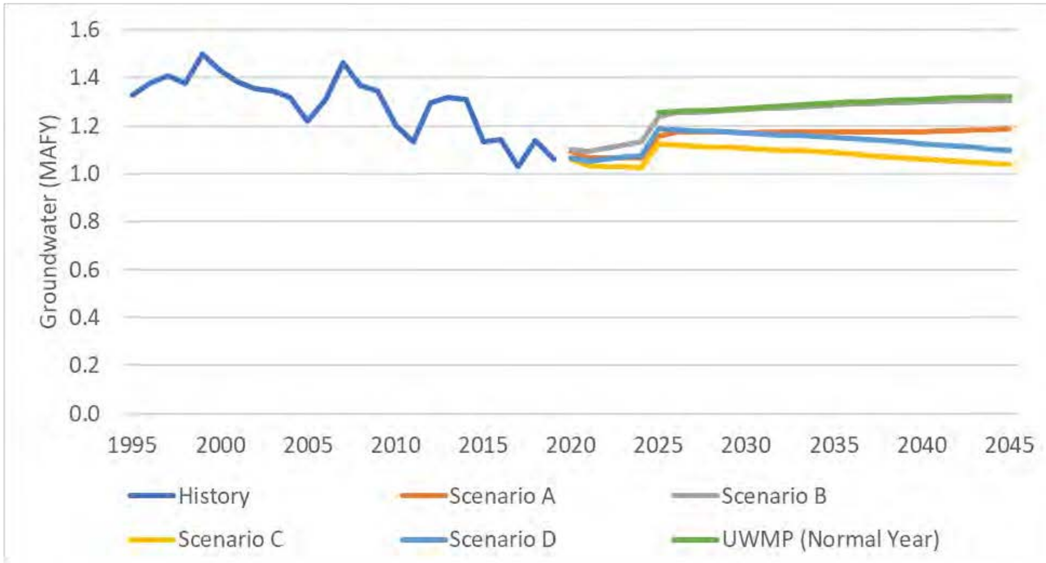


Figure 2-8. Groundwater Supplies

Projected local supplies for normal and dry years are summarized in Table 2-2 (corresponds to the green line in Figure 2-8).

Table 2-2. Local Supplies for Normal and Dry Years (acre-feet)

	2025		2035		2045	
	Normal Year [1]	Dry Year [2]	Normal Year	Dry Year	Normal Year	Dry Year
Local Groundwater						
From Natural Recharge [3]	939,000	985,000	964,000	988,000	991,000	1,011,000
Replenishment	316,000	255,000	332,000	327,000	335,000	334,000
Local Projects						
Groundwater Recovery	143,000	139,000	158,000	158,000	159,000	159,000
Recycling	550,000	491,000	687,000	658,000	706,000	703,000
Seawater Desalination	51,000	56,000	51,000	56,000	51,000	56,000
Local Runoff Stored	80,000	77,000	82,000	77,000	82,000	77,000
Los Angeles Aqueduct	257,000	118,000	258,000	118,000	258,000	118,000
Exchange with SDCWA	278,000	278,000	278,000	278,000	278,000	278,000
Total	**2,614,000**	**2,399,000**	**2,810,000**	**2,660,000**	**2,860,000**	**2,736,000**

Source: Metropolitan 2021a, Table 1-5.
Notes:
1. Normal Water Year is based on 1922 through 2017.
2. Dry Year is based on five consecutive years of drought: 1988–1992.
3. Estimate of natural recharge is based on basin balance considering projected local groundwater production and replenishment deliveries to the groundwater basins.
SDCWA = San Diego County Water Authority

Imported Water Supplies: Projections for the Colorado River supplies for the 2020 UWMP (Metropolitan 2021a) are based on Reclamation's Colorado River Simulation System (CRSS) modeling developed in January 2021, which is the latest available at the time this Feasibility Study was prepared. Reclamation modeling is used to estimate Metropolitan's basic apportionment and the availability of supplies from the QSA and other related programs. Although the official January 2021 CRSS run uses a full historical hydrology set, Reclamation also examines a stress test hydrology set as a proxy to show climate change impacts. For this reliability assessment, Metropolitan used the current methodologies that Reclamation employs in its official CRSS run.

SWP supplies for the 2020 UWMP are estimated using the 2019 SWP Delivery Capability Report (DWR 2020) and the Early Long-Term (ELT) Alternative described in the 2015 SWP Delivery Capability Report (DWR 2015). The 2019 SWP Delivery Capability Report presents current DWR estimates of the amount of water deliveries for current (2020) conditions and conditions 20 years in the future, assuming currently existing SWP facilities.

Imported supplies are also vulnerable to earthquakes. Both the CRA and the SWP cross the San Andreas fault, and a strong earthquake could result in protracted outages that would halt the delivery of imported water.

Total Supply Projections: Table 2-3 reports supplies under a normal water year represented by the average of the 96 historical hydrologies from 1922 to 2017. Table 2-4 provides a similar supply assessment for a 5-year drought.

Table 2-3. Normal Water Year Supply Capabilities: Average of 1922 through 2017 Hydrology (acre-feet)

Forecast Year [1]	2025	2030	2035	2040	2045
Current Programs					
In-Region Supplies and Programs	875,000	877,000	876,000	876,000	874,000
California Aqueduct [2]	1,774,000	1,766,000	1,764,000	1,762,000	1,761,000
Colorado River Aqueduct					
Total Supply Available [3]	1,453,000	1,390,500	1,390,500	1,339,500	1,367,750
Aqueduct Capacity Limit [4]	1,250,000	1,250,000	1,250,000	1,250,000	1,250,000
Capability of Current Programs	**3,899,000**	**3,893,000**	**3,890,000**	**3,888,000**	**3,885,000**

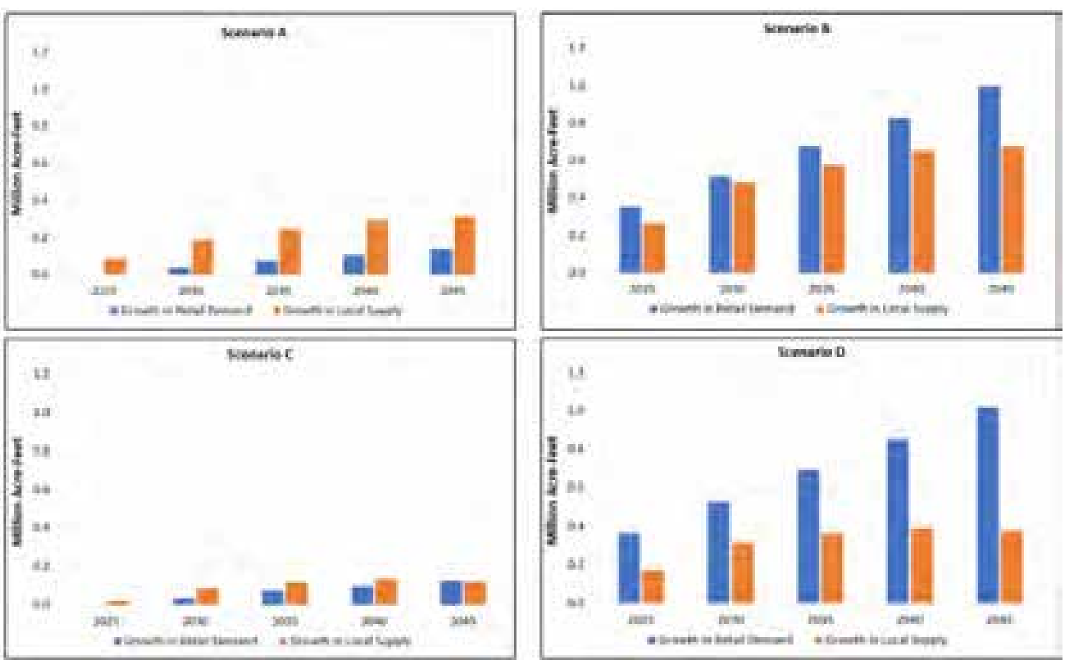
Source. Metropolitan 2021a, Table 2-6.
Notes:
1. Represents supply capability for resource programs under listed year type.
2. California Aqueduct includes Central Valley transfers and storage program supplies conveyed by the aqueduct.
3. Colorado River Aqueduct includes programs and exchange with SDCWA conveyed by the aqueduct.
4. Maximum CRA deliveries limited to 1.25 MAF including Exchange with SDCWA.
CRA = Colorado River Aqueduct
MAF = million acre-feet
SDCWA = San Diego County Water Authority

Table 2-4. Drought Lasting Five Consecutive Water Years: Supply Capability and Projected Demands, Repeat of 1988–1992 Hydrology (acre-feet per year)

Forecast Year [1]	2025	2030	2035	2040	2045
Current Programs					
In-Region Supplies and Programs	194,000	197,000	197,000	197,000	197,000
California Aqueduct [2]	734,800	772,000	794,000	816,000	792,000
Colorado River Aqueduct					
Total Supply Available[3]	1,410,000	1,403,500	1,403,500	1,365,000	1,380,750
Aqueduct Capacity Limit [4]	1,250,000	1,250,000	1,250,000	1,250,000	1,250,000
Capability of Current Programs	**2,178,800**	**2,219,000**	**2,241,000**	**2,263,000**	**2,239,000**

Notes:
1. Represents supply capability for resource programs under listed year type.
2. California Aqueduct includes Central Valley transfers and storage program supplies conveyed by the aqueduct.
3. Colorado River Aqueduct includes programs and Exchange with SDCWA conveyed by the aqueduct.
4. Maximum CRA deliveries limited to 1.25 MAF, including exchange with SDCWA.
CRA = Colorado River Aqueduct
MAF = million acre-feet
SDCWA = San Diego County Water Authority

Figure 2-9 shows projected growth in water demands and local supply production relative to 2020 in average conditions for IRP planning Scenarios A, B, C, and D. The greatest imbalance in supply and demand occurs under Scenario D.



Source: Metropolitan 2022a, Figure 3-5.

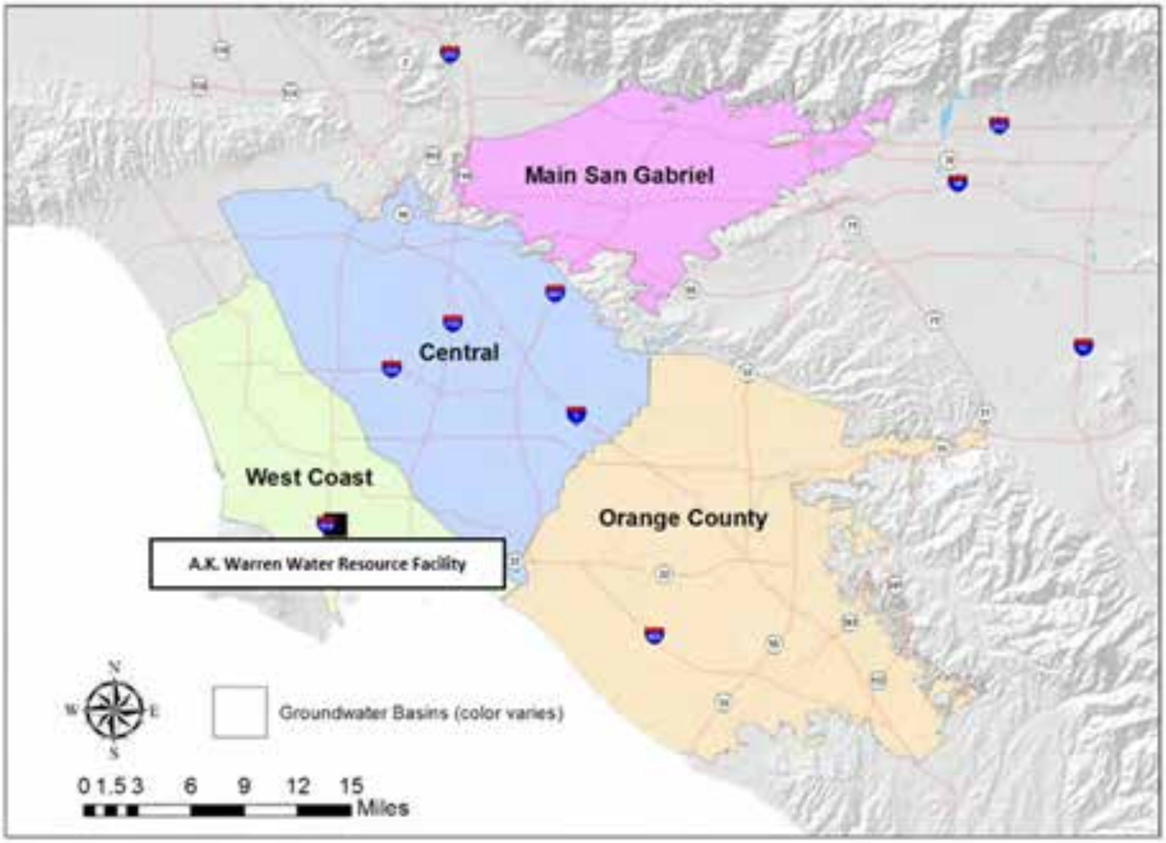
Figure 2-9. Growth in Demand vs. Growth in Local Supply Production Relative to 2020 in Average Conditions for Scenarios A, B, C, and D

Actions and New Facilities to Improve Water Supply: Metropolitan is progressively addressing the challenges of water shortages caused by the dramatic swings in annual hydrologic conditions that have characterized the past decade on the SWP. Metropolitan's actions include (1) increasing water conservation by expanding outreach, adding water-saving devices, and increasing incentives to residents; (2) increasing local resources by providing incentives for on-site recycled water hookups and increasing incentives for the Local Resources Program (LRP); (3) augmenting water supplies through water transfers and exchanges; (4) improving the return capability of storage programs; (5) modifying Metropolitan's distribution system to enhance the use of Colorado River water; and (6) implementing the Water Supply Allocation Plan to distribute the limited imported supplies and preserve storage reserves.

Metropolitan is providing up-front capital costs to its water management program partners to build infrastructure to improve the return capabilities of several storage programs. System modifications have also been implemented to increase system flexibility to use Colorado River water and DVL water for service to new areas of the system.

2.1.4. Groundwater Basin Conditions

The Central, Main San Gabriel, West Coast, and Orange County Basins are among the largest basins in Metropolitan's service area (Figure 2-10). The ability of these basins to continue to serve as a vital resource in Metropolitan's service area depends on increasing groundwater storage levels and stabilizing the long-term balance between pumping and recharge.

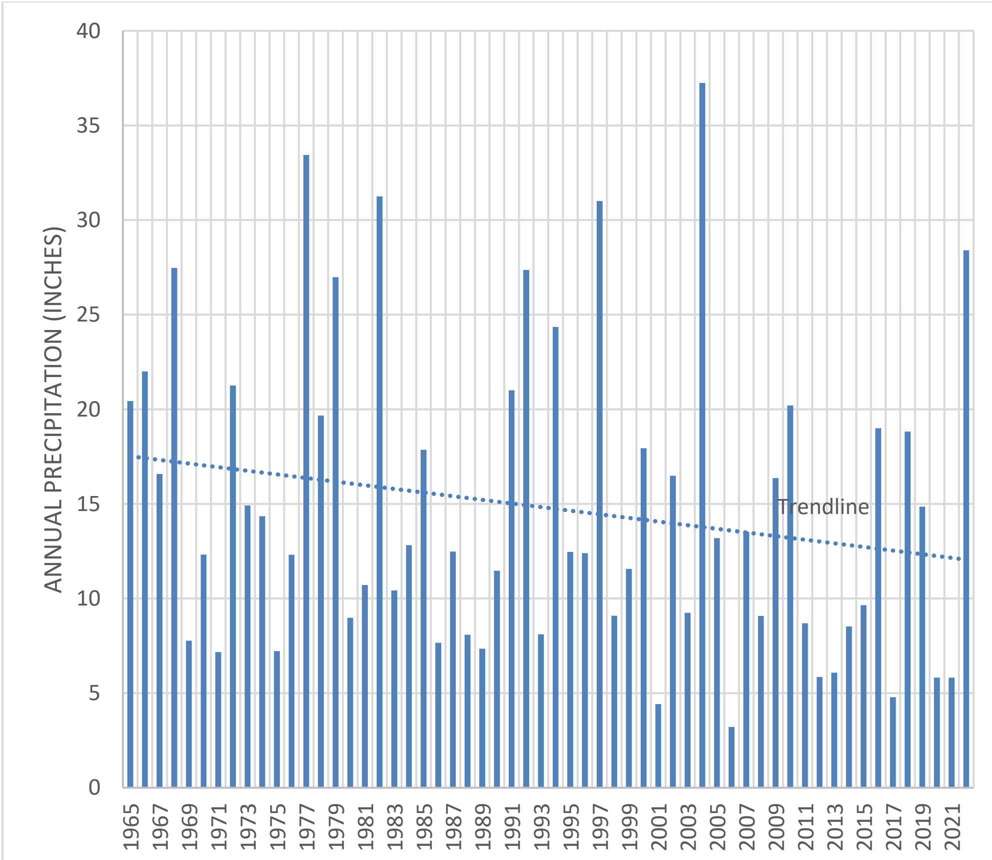


Source: Metropolitan 2023d.

Figure 2-10. Groundwater Basins in Primary Study Area

The storage levels of several groundwater basins in Metropolitan's service area have been experiencing a decreasing trend since the 1970s due to several factors. First, natural safe yields for many of the region's groundwater basins were established in the late 1950s and 1960s, when urban land use was significantly different from today. As more impervious development occurred (buildings, road pavement, parking lots), less incidental groundwater recharge from rainfall occurred. Second, population growth and increased water demands have put additional pressure on groundwater supplies. Third, rainfall patterns are changing, as shown on Figure 2-11. Regional precipitation shows a decreasing trend over the past 50 years. Furthermore, overdrafting of groundwater basins may cause seawater intrusion and reduce groundwater quality.

To deal with reduced incidental recharge, lower rainfall, and increased urbanization, several actions have been taken to improve basin stability. These include (1) developing centralized spreading grounds to facilitate greater recharge of captured stormwater by channeling runoff to areas with high soil permeability; (2) using imported water from Metropolitan for supplemental groundwater recharge; (3) using highly purified recycled water as a resource for groundwater recharge; and (4) implementing water conservation and water-use efficiency practices to reduce pumping demands.



Source: Los Angeles Almanac No date. Available at: https://www.laalmanac.com/weather/we13.php. Copyright 2024.

Figure 2-11. Annual Precipitation at Los Angeles Civic Center Weather Station

Main San Gabriel Basin: The Main San Gabriel Basin is an adjudicated basin. The Main San Gabriel Basin Judgment (Judgment) was recorded in January 1973. The Judgment adjudicated water rights; developed the concept of operating safe yield; established assessments to pay for administration, replenishment, and management programs; and created the Main San Gabriel Basin Watermaster. The Watermaster is a nine-person board appointed by the Los Angeles County Superior Court that administers and enforces the provisions of the Main San Gabriel Basin Judgment, which established water rights and responsibility for efficient management of the quantity and quality of the Basin's groundwater. The Watermaster manages and controls the withdrawal of groundwater/surface water and replenishment of imported water supplies in the basin and determines the amount that can be safely extracted. The Watermaster manages imported water deliveries and recharges and coordinates local involvement in efforts to preserve and restore the quality of groundwater in the basin.

Any entity, public or private, desiring to spread and store supplemental water within the basin for subsequent recovery and use for Watermaster credit must have a cyclic storage agreement pursuant to the Watermaster's Rules and Regulations. Cyclic storage agreements are for a term of 5 years and may extend for additional terms, not to exceed

5 years. The cyclic storage agreement notes the maximum amount of supplemental water that may be stored at any point in time by a particular storing entity.

The Main San Gabriel Basin is bounded by the San Gabriel Mountains to the north, San Jose Hills to the east, Puente Hills to the south, and by a series of hills and the Raymond Fault to the west. The watershed is drained by the San Gabriel River and Rio Hondo, a tributary of the Los Angeles River. Principal water-bearing formations of the basin are unconsolidated and semi-consolidated sediments that range in size from coarse gravel to fine-grained sands. The surface area of the groundwater basin is approximately 167 square miles. The freshwater storage capacity of the basin is estimated to be about 8.6 million acre-feet (AF) (Main San Gabriel Watermaster 2023).

The major sources of natural recharge to the Main San Gabriel Basin are infiltration of rainfall on the valley floor and percolation of runoff from the adjacent mountains in spreading basins. The basin also receives imported water and return flow from irrigation. Average groundwater recharge over the past 10 years in the Main San Gabriel Basin is about 47,000 AFY, about half of the historical average (Main San Gabriel Watermaster 2022a).

About 85 percent of Main San Gabriel Basin demand is satisfied by local groundwater, 10 percent from treated imported water, and 5 percent from other local supplies (Metropolitan 2007). Groundwater pumping over the past 10 years has averaged about 210,000 AFY in the Main San Gabriel Basin, with an average operating safe yield of 163,000 AFY. Each year, the Watermaster determines the operating safe yield, which is the amount of water that can be pumped in the basin without incurring a replenishment obligation. The current operating safe yield in the basin is 150,000 AFY (Main San Gabriel Watermaster 2022a, 2022b).

About 17 spreading basins in the Main San Gabriel Basin cover more than 1,100 acres, which are operated by the Los Angeles County Department of Public Works (LACDPW) or other agencies capable of capturing stormwater runoff from adjacent canyons and/or imported water. The spreading capacity of existing facilities is more than 850 cubic feet per second, or 457 MGD.

Figure 2-12 shows groundwater production (in thousand acre-feet per year [TAFY]) and key well groundwater elevations (in feet above Mean Sea Level [MSL]) for the Main San Gabriel Basin. As shown on Figure 2-12, a 45-year linear trend indicates that groundwater production has decreased by 11 percent, although the groundwater levels at the key well have decreased by 22 percent. The groundwater elevation could have been substantially lower without the efforts of the Watermaster and its many stakeholders to manage the basin for regional water supply reliability through conservation, stormwater capture, and other programs.

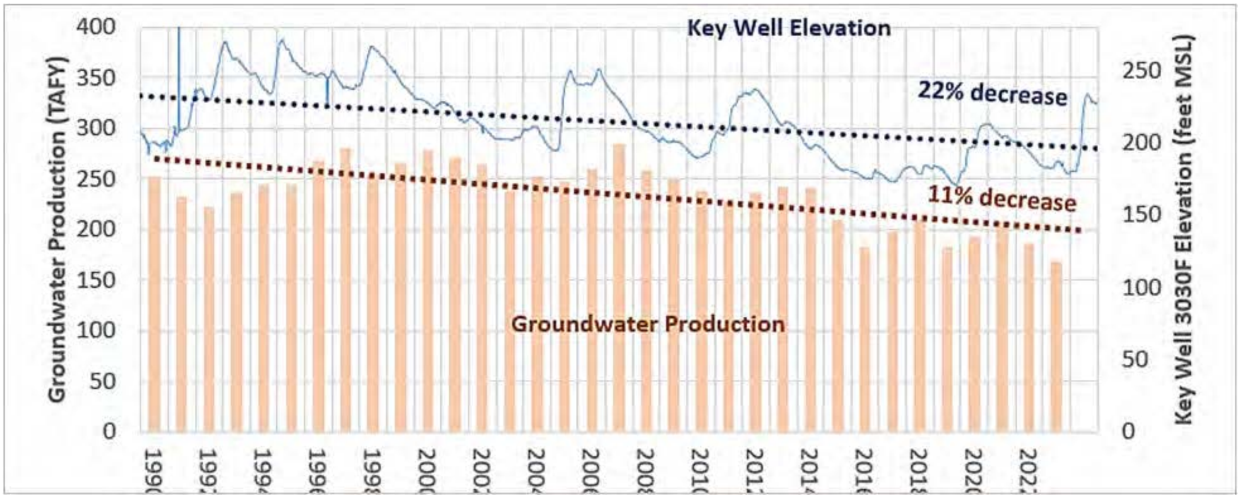


Figure 2-12. Historical Groundwater Production and Key Well Groundwater Elevations for the Main San Gabriel Basin

Central Basin: The Central Basin lies within central Los Angeles County. It underlies the service areas of Metropolitan member agencies Central Basin Municipal Water District (Central Basin MWD), West Basin Municipal Water District (West Basin MWD), the City of Compton, the City of Los Angeles, and the City of Long Beach. The Cities of Artesia, Bellflower, Cerritos, Compton, Downey, Huntington Park, Lakewood, Los Angeles, Long Beach, Montebello, Paramount, Pico Rivera, Norwalk, Santa Fe Springs, Signal Hill, South Gate, Vernon, and Whittier overlie the basin (Metropolitan 2007).

More than 60 years ago, groundwater overdraft and declining water levels in the Central Basin threatened the area's groundwater supply and caused the intrusion of seawater into the aquifers in the southern part of the basin. However, timely legal action and adjudication of the water rights halted the overdraft and prevented further damage to the Central Basin. Since that time, groundwater extraction from the Central Basin is limited to the amounts set by a Superior Court Judgment and monitored by a Court-appointed Watermaster.

The Third Amended Judgment, finalized on December 23, 2013, created three separate bodies that continue to assist the court in the administration and enforcement of the provisions of the Judgment. The first body is the Administrative Body, which administers the Watermaster accounting and reporting functions. The Water Replenishment District (WRD) was appointed by the court to fulfill this role. The second body is the Water Rights Panel, which enforces issues related to pumping rights within the adjudication. The Water Rights Panel is made up of seven water rights holders who are elected by rights holders in the Central Basin. Members of the Water Rights Panel during the 2020–2021 water year included the Bellflower-Somerset Mutual Water Company, City of Downey, Golden State Water Company, City of Lakewood, City of Long Beach, City of Paramount, and City of Signal Hill. The third body is the Storage Panel, which comprises the Water Rights Panel and the

WRD Board of Directors; together they review and approve certain groundwater storage efforts (WRD 2023).

The Central Basin is bounded to the northeast and east by the Elysian, Repetto, Merced, and Puente Hills. The southeast boundary of the Central Basin is along Coyote Creek, which is used to separate the Central Basin from the Orange County Basin, although there is no physical barrier between the two basins. The southwest boundary is the Newport and Inglewood fault system, which also separates the Central Basin from the West Coast Basin. The depth of the Central Basin ranges from 1,600 to more than 2,200 feet. The main source of potable groundwater in the Central Basin is from the deeper aquifers of the San Pedro Formation (including from top to bottom, the Lynwood, Silverado, and Sunnyside aquifers), which generally correlate with the Main and Lower San Pedro aquifers of Orange County. The shallower aquifers of the Alluvium and the Lakewood Formation (including the Gaspur, Exposition, Gardena-Gage, Hollydale, and Jefferson aquifers) locally produce smaller volumes of potable water.

Over the past 10 years, the average pumping in the Central Basin is about 183,000 AFY, which is about 85 percent of the Allowable Pumping Allocation. Water levels fluctuate with hydrologic conditions (rising in wet years, declining in dry years). Water levels have increased more than 50 feet since the beginning of the 2023 water year.

Natural replenishment of the groundwater in the Central Basin occurs largely from surface flow and underflow through the Whittier Narrows from the San Gabriel Valley. In addition, rainfall over the Central Basin infiltrates into deeper aquifers of the basin. Intentional replenishment of groundwater in the Central Basin is accomplished by capturing and spreading water at the Rio Hondo and the San Gabriel Coastal Spreading Grounds in the Montebello Forebay. The sources of this replenishment water include local storm runoff, local dry weather urban runoff, imported water purchased from Metropolitan, and recycled water purchased from the Sanitation Districts. About 17,000 AFY of imported water has been replenished in the Central Basin in the past 10 years. WRD's Albert Robles Center for Water Recycling and Environmental Learning (ARC) advanced water treatment facility began operation in 2019. The purpose of ARC was to reduce the need for the historical, and variable, imported water recharge in the Montebello Forebay, replacing it with advanced treated recycled water.

Figure 2-13 shows the 45-year trend for groundwater production (3 percent decrease) and groundwater levels (56 percent decrease) for the Central Basin.

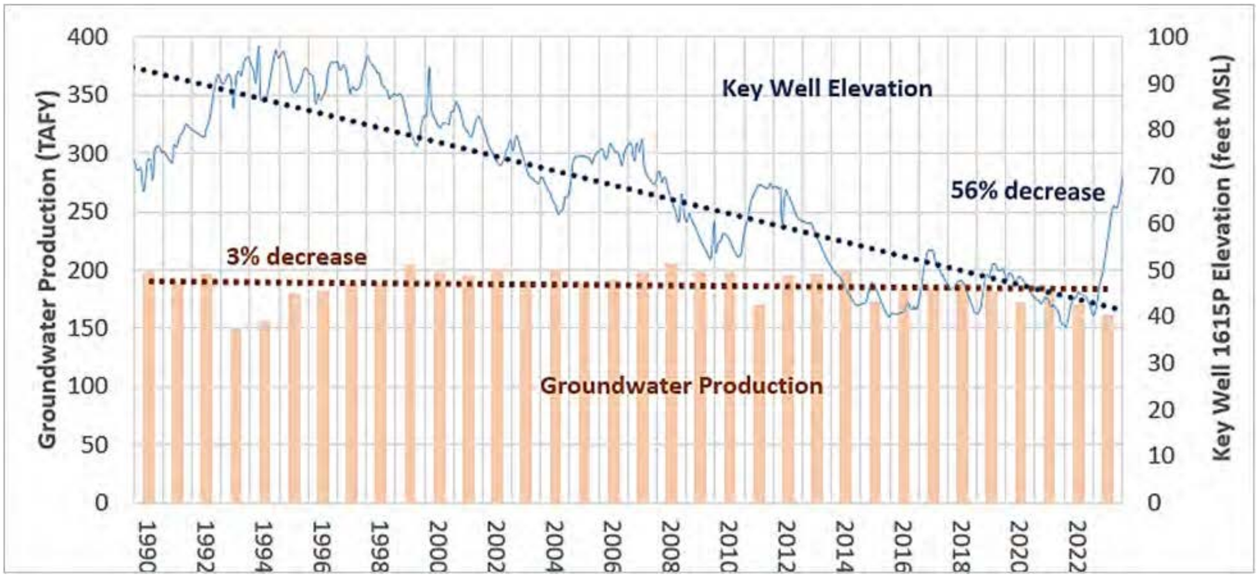


Figure 2-13. Historical Groundwater Production and Key Well Groundwater Elevations for the Central Basin

Seawater intrusion in the Alamitos Gap near the mouth of the San Gabriel River poses a threat to the groundwater in the Central Basin. The Alamitos Gap Seawater Barrier Project (Alamitos Barrier Project) is designed to prevent seawater intrusion into the freshwater aquifers and is situated both in the Central Basin and Orange County Basin. WRD's Leo J. Vander Lans advanced water treatment facility provides advanced treated recycled water to the Alamitos Barrier Project. The LACDPW operates the Alamitos Barrier Project, which consists of 43 injection wells that create a groundwater pressure ridge to halt seawater intrusion. The project includes 220 observation wells that are used to monitor groundwater levels and quality in the area. The seawater intrusion problem is contained by the Barrier Project (LACDPW 2023).

West Coast Basin: The West Coast Basin lies along the coast in western Los Angeles County. It underlies the service areas of Metropolitan member agencies: West Basin MWD, City of Los Angeles, City of Torrance, and the City of Long Beach. The Cities of El Segundo, Manhattan Beach, Hermosa Beach, Redondo Beach, Torrance, Inglewood, Hawthorne, Gardena, Lomita, Carson, and Long Beach overlie the basin.

The West Coast Basin adjudication (i.e., Judgment) was finalized in 1961 and capped annual production at 64,468 AFY. The Judgment allows annual carryover of unpumped adjudicated right, not to exceed 20 percent, and allows up to 20 percent excess production to be made up by under-production the following year. The Judgment also allows up to 10,000 AF of emergency over-pumping under specified conditions. DWR serves as Watermaster. WRD, established in 1959, has the statutory authority to replenish the groundwater basin and address water quality issues. LACDPW owns and operates the seawater intrusion barrier, including the West Coast Barrier Project and the Dominguez Gap

Barrier Project in the West Coast Basin. WRD procures imported and recycled water to be recharged by LACDPW at these facilities.

The West Coast Basin is bounded on the south and west by the Pacific Ocean, on the north by the Ballona Escarpment, on the east by the Newport-Inglewood Uplift, and on the south by the Palos Verdes Hills. Groundwater in the West Coast Basin is generally confined. The Silverado aquifer underlying most of the West Coast Basin is the most productive aquifer in the basin. It ranges from 100 to 500 feet thick and yields 80 to 90 percent of the groundwater extracted annually.

Over the past 10 years, an average of about 34,000 AFY has been pumped from the West Coast Basin, which is about 50 percent of their adjudicated rights. The groundwater levels in the West Coast Basin have varied from about 30 feet below MSL to 46 feet below MSL over the past 10 years.

Two seawater intrusion barriers were developed in the West Coast Basin. The first barrier is the West Coast Basin Barrier Project which is in the Cities of Manhattan Beach and Hermosa Beach. The second is the Dominguez Gap Barrier, which is located along the Dominguez Channel in the Cities of Wilmington and Carson. Both barriers currently utilize high-quality recycled water.

Figure 2-14 shows the 45-year trends for the West Coast Basin, including a 41 percent decrease in production, but a 73 percent increase in water elevation.

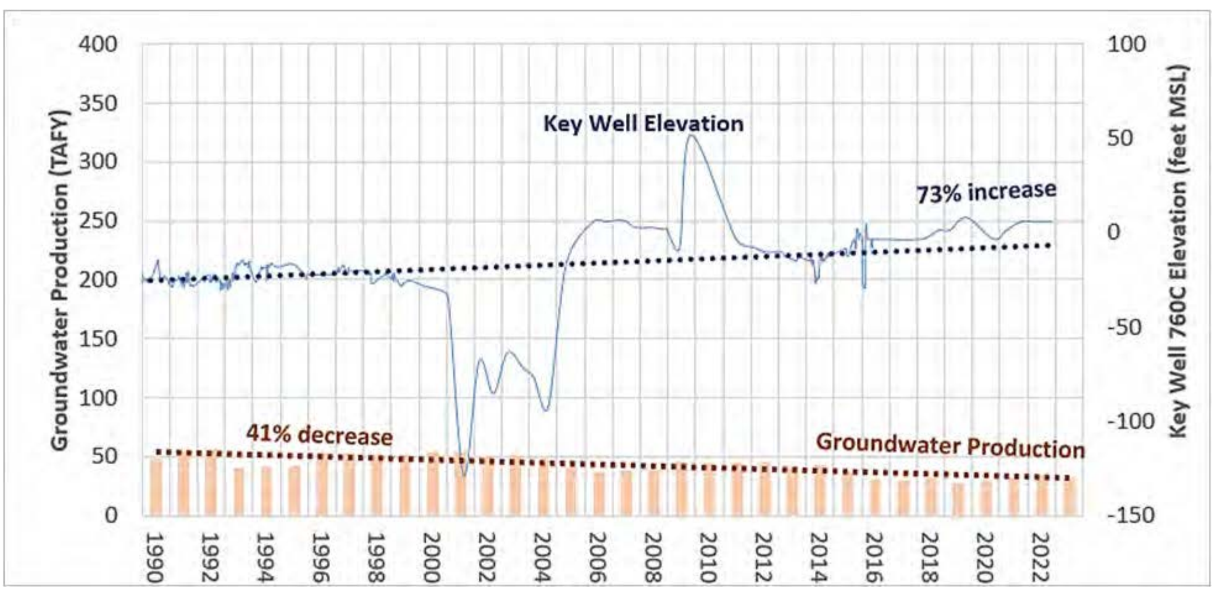


Figure 2-14. Historical Groundwater Production and Key Well Groundwater Elevations for the West Coast Basin

Orange County Basin: The Orange County Basin is in north and central Orange County within the lower Santa Ana River watershed. Member agencies within the Orange County Basin include Anaheim, Fullerton, Santa Ana, and the Municipal Water District of Orange County. The Orange County Basin has been divided into three sub-basins: Yorba Linda, Main, and Irvine.

The Orange County Basin is a managed basin. The Orange County Water District (OCWD) has managed the Orange County Basin since 1933 pursuant to a special act of the State of California (state). OCWD has managed the basin based on the principle of seeking to increase supply rather than restricting access and to provide for uniformity of cost.

The basin groundwater pumping is not operated on a safe-yield basis each year. Rather, the goal is to maintain an approximate balance over a period of several years. The amount of production from the basin is governed through financial incentives based on establishing an annual Basin Production Percentage (BPP), which is the percentage of groundwater production out of the total water demand for the Orange County Basin. Pumping up to the BPP is charged a fee on a per AF basis (i.e., the Replenishment Assessment). Groundwater production above the BPP is charged with the Replenishment Assessment plus the Basin Equity Assessment (BEA). The BEA is typically set so that the cost of groundwater production above the BPP is similar to the cost of purchasing alternative supplies. Pumping agencies do not accrue individual storage rights if they pump less than the BPP, which is a major difference compared to most adjudicated basins. In addition, agencies cannot transfer groundwater-pumping rights.

The Orange County Basin is bounded by the Coyote and Chino Hills on the north, the Santa Ana Mountains on the northeast, the San Joaquin Hills on the south, and the Pacific Ocean and the Newport- Inglewood fault zone on the southwest. The Orange County Basin is separated from the Central Basin along Coyote Creek and the county line, although there is no physical barrier between the two basins.

The Orange County Basin contains two seawater intrusion barriers. The first is the Alamitos Gap Seawater Barrier Project, which was previously discussed in the Central Basin section. The second is the Talbert Seawater Intrusion Barrier, which spans the Talbert gap in the Cities of Fountain Valley and Huntington Beach. OCWD also has a mid-basin injection well field, consisting of five wells, in the City of Santa Ana. Both the Talbert Barrier and the mid-basin injection well field utilize recycled water from OCWD's Groundwater Replenishment System (GWRS). The Newport-Inglewood fault zone acts as a complete barrier to flow from the ocean along most of its length in Orange County except at ancient river-crossing gaps, most notably the Alamitos Gap along the Los Angeles County line and the Talbert Gap in Huntington Beach and Costa Mesa. At these two locations, permeable river deposits cross the fault barrier, providing the opportunity for seawater to flow into the Orange County Basin. Recently, elevated chloride levels have been monitored in the Bolsa-Sunset Gap. OCWD has been evaluating the possibility of constructing a third seawater intrusion barrier for the Bolsa-Sunset Gap.

Figure 2-15 shows annual groundwater production (in TAFY) and basin overdraft (in AF) for the Orange County Basin from 1990 to 2022. In June 2022, the principal aquifer's water levels in the Orange County Basin ranged from a high of about 300 feet above MSL in the north portion of the basin upgradient of the spreading grounds to a low of about 80 feet below MSL in the coastal areas. Water levels and flow vary among the three aquifer systems.

Over the past 10 years, about 288,000 AFY was pumped from the Orange County Basin, an average of about 70 percent of the total demand during the past 10 years.

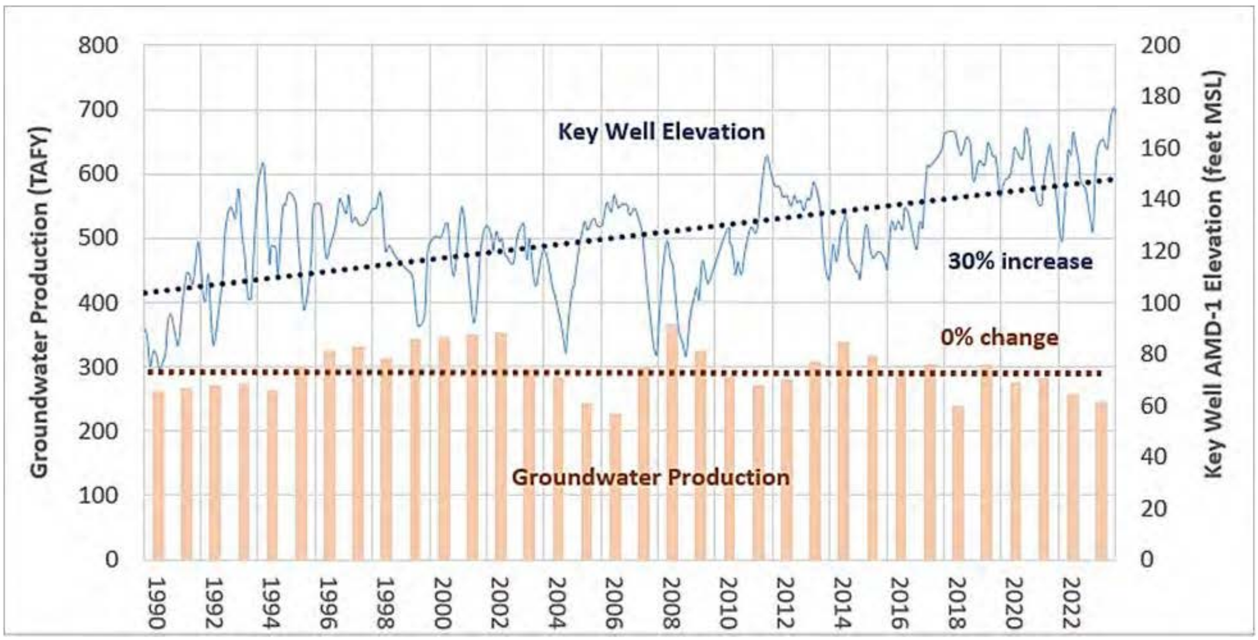


Figure 2-15. Historical Groundwater Production and Basin Overdraft for the Orange County Basin

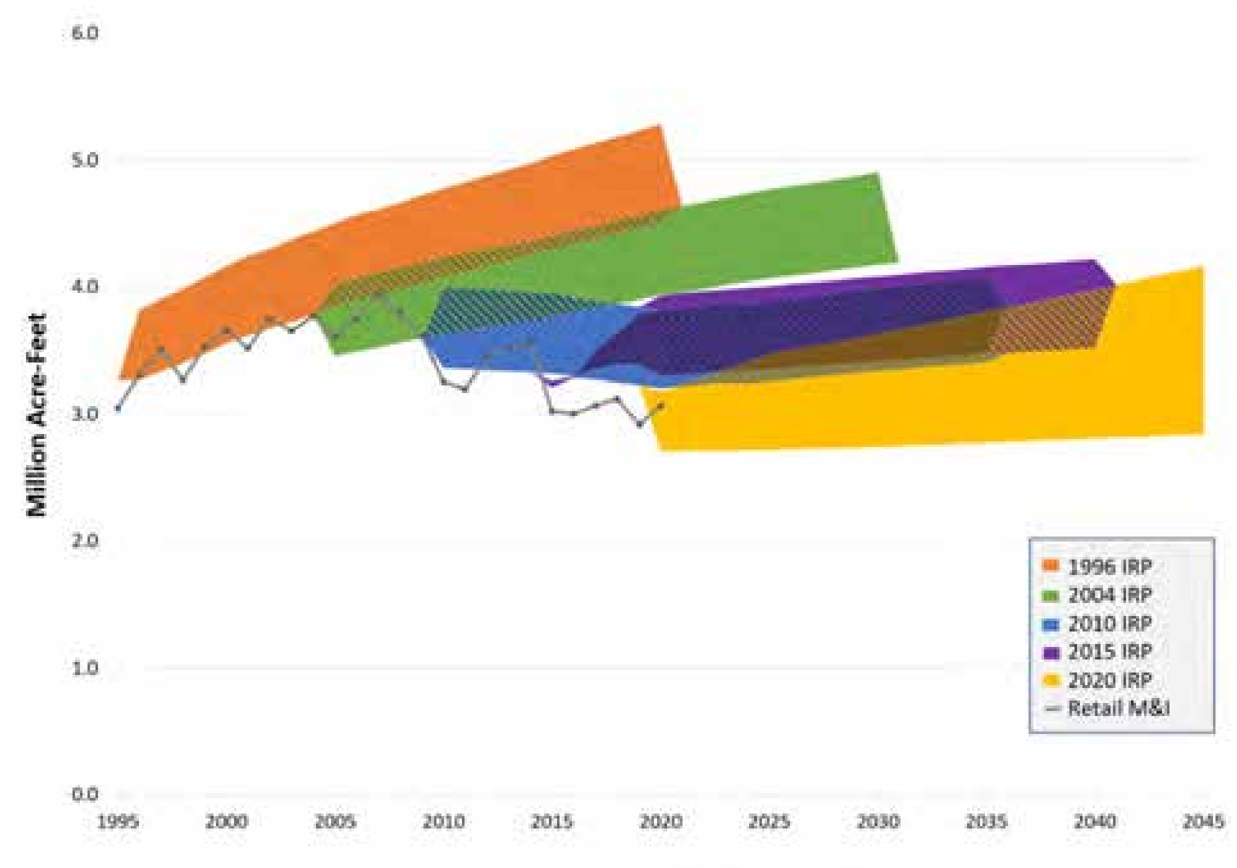
The Orange County Basin contains an extensive system of recharge facilities. Facilities include nearly 500 production wells, 800 monitoring wells, more than 1,000 acres of recharge ponds in the Montebello Forebay area, two seawater intrusion barriers, a mid-basin injection well field, three desalters, the GWRS, the Prado wetlands, and Prado Dam. OCWD operates and maintains many of these facilities.

OCWD actively manages the Santa Ana River to recharge the Orange County Basin. OCWD partners with the U.S. Army Corps of Engineers (USACE) to store storm flows behind Pardo Dam. These flows are gradually released to allow OCWD to divert the flow to a series of recharge basins. OCWD also uses imported water from Metropolitan and recycled water from OCWD's advanced purification facility, the GWRS, to recharge the basin. In April 2023, OCWD completed the GWRS final expansion to increase the facility's capacity to 130 MGD.

2.2. Current and Projected Water Demands

2.2.1. Population

In 1990, the population of Metropolitan's service area was approximately 15.0 million people. By 2020, it had reached an estimated 19 million, representing almost half of the state's population. Figure 2-16 shows the projected growth in retail municipal and industrial (M&I) demand. The figure shows how Metropolitan has recalibrated the baseline for each IRP update. In addition, each IRP update incorporated new knowledge on uncertainties in the forecasts. The 2020 IRP in the yellow shaded area of the chart offers a wider range of retail demand forecasts than previous IRPs. The 2020 IRP encompasses a range of assumptions comprising four distinct scenarios. It also takes a step forward from prior IRPs by examining a broader range of outcomes for these uncertainties rather than just one set of assumptions, as in past IRPs.



Source: Metropolitan 2022a, Figure 1-3.

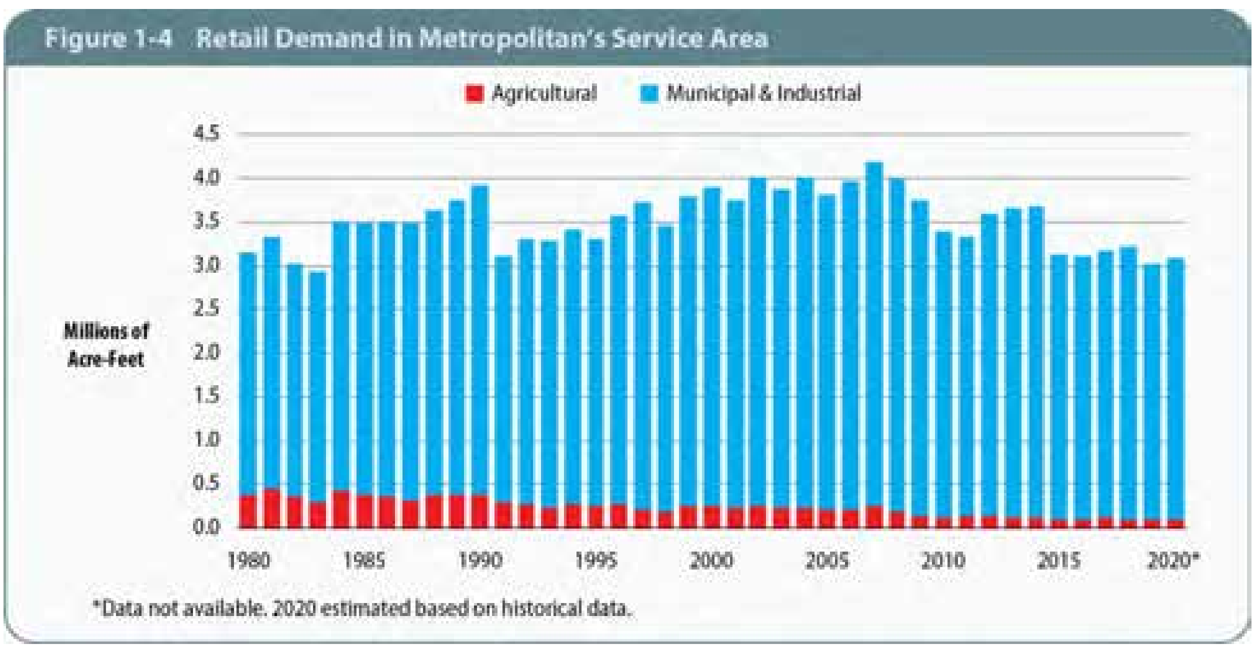
Figure 2-16. Retail M&I Demand Forecast

2.2.2. Current Demand

Figure 2-17 presents historical retail water demands in Metropolitan's service area. Since 1980, retail water demands varied from 2.9 MAF in 1983 to nearly 4.2 MAF in 2007. In 2020, about 96 percent of retail demands were used for M&I purposes, and 4 percent for agricultural purposes.

2.2.3. Projected Demands and Supply Imbalances

During wet years in which imported supplies are available in quantities over and above what is needed for regional demands and groundwater recharge, surplus water supplies are stored in Metropolitan storage programs. Conversely, in dry years, imported supplies are below what is needed for regional demands and groundwater recharge, and water supplies must be withdrawn from Metropolitan storage programs to meet those demands. If conditions are severe enough that water supply is insufficient from both imported sources and Metropolitan storage programs, and recharge water cannot be delivered to the local agency groundwater basins, then those basins may reach levels that result in the reduction of groundwater pumping available to meet regional demands.



Source: Metropolitan 2021a, Figure 1-4.

Figure 2-17. Historical Retail Demand

These challenging supply conditions are also likely to coincide with years of lower natural groundwater replenishment from precipitation, further affecting local agency groundwater basin levels.

The 2020 UWMP presents Metropolitan's water reliability assessments from 2025 through 2045. Total demands are the sum of retail demand for M&I and agricultural, seawater barrier demand, and replenishment demand. Total demands represent the total amount of water needed by the member agencies. Water savings from conservation reduces total retail demand. Local supplies represent water produced or imported independently by the member agencies and other local water agencies within Metropolitan's service area. Table 2-5 shows the demand for a normal year.

Table 2-5. Metropolitan Regional Water Demands: Normal Water Year (acre-feet)

		2025	2030	2035	2040	2045
A.	**Total** Demands [1]	**4,925,000**	**5,032,000**	**5,156,000**	**5,261,000**	**5,374,000**
	Retail Municipal and Industrial	4,403,000	4,514,000	4,632,000	4,743,000	4,854,000
	Retail Agricultural	144,000	134,000	130,000	123,000	123,000
	Seawater Barrier	61,000	61,000	61,000	61,000	61,000
	Storage Replenishment	316,000	323,000	332,000	334,000	335,000
B.	**Total Conservation** [2]	**1,162,000**	**1,211,000**	**1,263,000**	**1,325,000**	**1,389,000**
	Existing Active (through 2020) [3]	93,000	55,000	35,000	25,000	17,000
	Code-Based	560,000	623,000	665,000	701,000	731,000
	Price Effect [3]	259,000	283,000	313,000	349,000	391,000
	Pre-1990 Conservation	250,000	250,000	250,000	250,000	250,000
C.	**Total Local and Other Imported Supplies**	**2,613,000**	**2,712,000**	**2,809,000**	**2,836,000**	**2,860,000**
	Groundwater	1,255,000	1,273,000	1,296,000	1,311,000	1,325,000
	Surface Water	80,000	82,000	82,000	82,000	82,000
	Los Angeles Aqueduct [4]	257,000	257,000	258,000	258,000	258,000
	Seawater Desalination	51,000	51,000	51,000	51,000	51,000
	Groundwater Recovery	143,000	157,000	158,000	158,000	159,000
	Recycling [5]	550,000	613,000	687,000	698,000	706,000
	Other Imported Supplies [6]	278,000	278,000	278,000	278,000	278,000
D.	**Total Metropolitan Demands**	**1,149,000**	**1,110,000**	**1,084,000**	**1,100,000**	**1,125,000**
	Consumptive Use	1,020,000	981,000	954,000	971,000	996,000
	Seawater Barrier	4,000	4,000	4,000	4,000	4,000
	Replenishment	125,000	125,000	125,000	125,000	125,000

Notes:
All units are acre-feet unless specified, rounded to the nearest thousand.
Totals may not sum due to rounding.
1. Growth projections are based on SCAG 2020–2045 Regional Transportation Plan / Sustainable Communities Strategy and SANDBAG San Diego Forward: The 2019 Federal Regional Transportation Plan.
2. Does not include future active conservation savings. 1990 is base year.
3. Includes un-metered water use savings.
4. Los Angeles Aqueduct Project uses 1922–2017 hydrology.
5. Excludes Santa Ana River base flow, which is used for recharge of Orange County Groundwater Basin and reflected in the groundwater production numbers.
6. Exchange with SDCWA.
SANDBAG = San Diego Association of Governments
SCAG = Southern California Association of Governments
SDCWA = San Diego County Water Authority

The 2020 IRP Regional Needs Assessment (Metropolitan 2022a) applied Scenarios A, B, C, and D (see Section 2.1.3, Projected Future Supplies) to evaluate the potential for supply imbalances. The objectives for the PWSC Program are largely based on the shortage assessment from Scenario D. The shortage/surplus feasibility assessment for 2045 is provided for Scenario D on Figure 2-18.

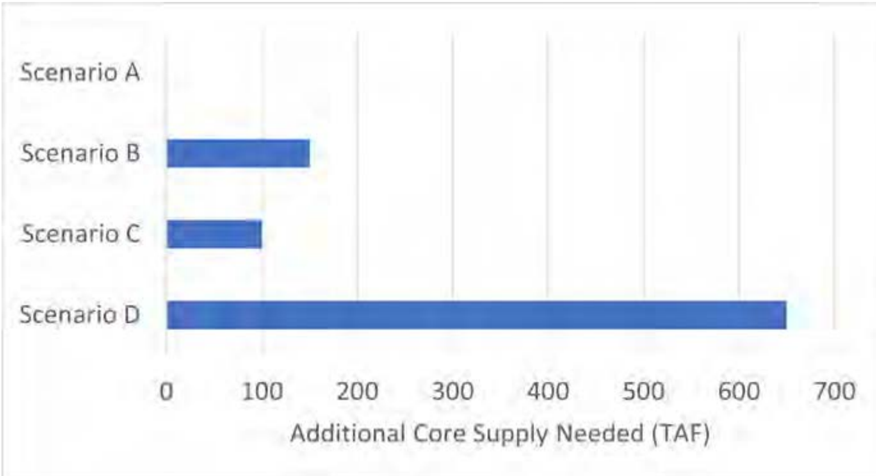


Figure 2-18. Shortage/Surplus Under Scenario D in 2045

Shortages are observed under all four scenarios with the largest shortage observed under Scenario D (high demand with reduced imports), which has a net shortage frequency of 66 percent and a recommended new core supply of 650,000 AF. The frequency of shortage is 5 percent under Scenarios B and C and increases to 66 percent under Scenario D.

2.3. Water Quality Concerns for Current and Projected Water Supply

Metropolitan's planning efforts for groundwater storage, recycled water, and other water management strategies are highly dependent on meeting specific water quality targets for imported water. Each source has specific quality issues. To date, Metropolitan has not identified any water quality risks that cannot be mitigated. However, based on current knowledge, a water quality issue that could potentially affect water management strategies and supply reliability in the future might be increases in the salinity of water resources.

Under severe drought conditions, decreased flows have altered Bay-Delta flow patterns, and there have been some observable changes in water quality such as increased salinity due to increased seawater intrusion. However, even under drought conditions, SWP salinity is significantly lower than Colorado River water salinity, and Metropolitan relies on blending imported water sources to mitigate for the higher salinity Colorado River water. During recent periods of drought, Metropolitan's SWP allocation has been reduced and blending operations were affected. Overall, Metropolitan anticipates no significant reductions in water supply availability from imported sources due to water quality concerns, such as salinity, over the next 5 years. Nevertheless, enhancing local water supplies provides an opportunity to improve water quality and reduce salinity throughout the region.

The following sections provide an overview of water quality issues. A more detailed summary is available in *the 2020 Urban Water Management Plan* (Metropolitan 2021a).

2.3.1. Colorado River

High salinity levels remain a significant issue associated with Colorado River supplies. In addition, Metropolitan has been engaged in efforts to protect its Colorado River supplies from threats of uranium, perchlorate, and chromium 6. Metropolitan has also been active in efforts to protect these supplies from potential increases in nutrient loading due to agriculture and urbanization and has been tracking the occurrence of constituents of emerging concern (CECs), such as N-nitrosodimethylamine (NDMA) and pharmaceuticals and personal care products (PPCPs). Metropolitan anticipates the use of Colorado River water will result in a continued need to blend (mix) it with SWP supplies to meet Metropolitan's Board-adopted salinity standards.

2.3.2. State Water Project

The key water quality issue for the SWP is disinfection byproduct precursors, particularly total organic carbon (TOC) and bromide. Metropolitan has needed to upgrade its water treatment plants to deal adequately with disinfection byproducts. Disinfection byproducts result from TOC and bromide in the source water reacting with disinfectants at the water treatment plant. Metropolitan has overcome these treatment restrictions through the use of ozone disinfection at its treatment plants. Ozone facilities have been completed at five of Metropolitan's treatment plants, including the Weymouth Water Treatment Plant. Arsenic is also of concern in some groundwater storage programs. Groundwater inflows into the California Aqueduct are managed to comply with regulations and protect downstream water quality while meeting supply targets. In addition, nutrient levels are significantly higher in the SWP system than in the Colorado River, leading to the potential for algal-related concerns that can affect water management strategies.

Metropolitan is engaged in efforts to protect the quality of SWP water from potential increases in nutrient loading from wastewater treatment plants.

2.3.3. Local Agency Supplies and Groundwater Storage

Drinking water standards for contaminants, such as arsenic, nutrients, chromium-6, and other emerging constituents, may affect the use of groundwater storage and potentially add treatment costs. These contaminants are not expected to affect the availability of Metropolitan supplies, but they may affect the availability of local agency supplies. This situation could affect the level of demand for Metropolitan supplies if local agencies abandon supplies in lieu of treatment options.

2.3.4. Issues of Potential Concern

Salinity: The State Water Resources Control Board's (SWRCB) Division of Drinking Water (DDW) established a secondary drinking water standard for salinity, commonly expressed as total dissolved solids (TDS), with a recommended Secondary Maximum Contaminant Level (SMCL) of 500 milligrams per liter (mg/L) and upper limit SMCL of 1,000 mg/L.

Higher salinity levels in Colorado River water would increase the proportion of SWP supplies required to meet Metropolitan's board-adopted imported water salinity objectives. These salinity impacts affect various sectors, including residential, agricultural, commercial, industrial, utility, groundwater, and recycled water. Metropolitan adopted an imported water salinity goal because higher salinity could increase costs and reduce operating flexibility.

Within Metropolitan's service area, local water sources account for approximately half of the salt loading and imported water accounts for the remainder. All sources must be managed to sustain water quality and supply reliability goals. Wastewater flows always experience significantly higher salinity concentrations than the potable water supply. Typically, each cycle of urban water use adds 250 to 400 mg/L of TDS to the wastewater.

Increased TDS in groundwater basins occurs either when basins near the ocean are overdrafted, leading to seawater intrusion, or when agricultural and urban return flows add salt to the basins. Much of the water used for agricultural or urban irrigation infiltrates into the aquifer, so where irrigation water is high in TDS or where the water transports salts from overlying soil, the infiltrating water increases the salinity of the aquifer. In addition, wastewater discharges in inland regions may lead to salt buildup from fertilizer and dairy waste. Although most groundwater basins in the region still produce water of acceptable quality, this resource must be managed carefully to minimize further degradation.

Perchlorate: Perchlorate compounds quickly dissolve and become highly mobile in groundwater. Unlike many other groundwater contaminants, perchlorate neither readily interacts with the soil matrix nor degrades in the environment. Conventional drinking water treatment (as used at Metropolitan's water treatment plants) is not effective for perchlorate removal.

DDW established a primary drinking water standard for perchlorate in 2007 with a Maximum Contaminant Level (MCL) of 6 micrograms per liter (μg/L). In February 2015, the California Office of Environmental Health Hazard Assessment (OEHHA) lowered the public health goal (PHG) for perchlorate from 6 μg/L to 1 μg/L. In response to the new PHG, DDW will review the perchlorate MCL. There is currently no federal drinking water standard for perchlorate, but the U.S. Environmental Protection Agency (USEPA) is in the process of developing a national primary drinking water regulation.

Perchlorate has been found in groundwater basins in Metropolitan's service area, largely from local sources. Per the SWRCB water quality database, reported monitoring results from

2011 to 2014 indicate that 10 Metropolitan member agencies have detected perchlorate in their service areas at levels greater than 4 μg/L.

Total Organic Carbon and Bromide: Disinfection byproducts (DBPs) form when source water containing high levels of TOC and bromide is treated with disinfectants such as chlorine or ozone.

Water agencies began complying with new regulations to protect against the risk of DBP exposure in January 2002. This rule, known as the Stage 1 Disinfectants and Disinfection Byproducts (D/DBP) Rule, required water systems to comply with new MCLs and a treatment technique to improve control of DBPs. USEPA then promulgated the Stage 2 D/DBP Rule in January 2006, which required systems to comply at terminus locations in the distribution system to be more representative of maximum residence time and to protect the public. Metropolitan has been in compliance with the Stage 2 D/DBP Rule since it became effective. Existing levels of TOC and bromide in Bay-Delta water supplies present challenges for water utilities to maintain safe drinking water supplies and comply with regulations. Levels of these constituents in SWP water have increased several-fold due to agricultural drainage and seawater intrusion as water moves through the Bay-Delta.

Nutrients: Elevated levels of nutrients (phosphorus and nitrogen compounds, including nitrates) can stimulate nuisance algal and aquatic weed growth, which affects water system operations and consumer acceptability, including the production of noxious taste, odor compounds, and algal toxins. Studies have shown phosphorus to be the limiting nutrient in both SWP and Colorado River supplies. Therefore, any increase in phosphorus loading has the potential to stimulate algal growth. SWP supplies have significantly higher nutrient levels than Colorado River supplies. Wastewater discharges, agricultural drainage, and nutrient-rich soils in the Bay-Delta are primary sources of nutrient loading to the SWP.

Taste and Odor: Metropolitan reservoirs receiving SWP water have experienced several taste and odor episodes in recent years. For example, between 2010 and 2014, Metropolitan reservoirs experienced 11 taste and odor events requiring treatment. Although current nutrient loading is of concern and anticipated to have cost implications, the comprehensive monitoring program and response actions should be able to manage algal-related issues to avoid impact on the availability of water supplies.

Cyanotoxins: The issue of cyanotoxins has become a growing concern as a result of increasing occurrences both nationally and internationally. In June 2015, USEPA issued health advisories for two cyanobacterial toxins: microcystins and cylindrospermopsin. The health advisories serve as recommended precautionary levels and are not enforceable federal water quality standards. Cyanotoxins are included on the current Contaminant Candidate List (CCL4), which identifies contaminants considered for regulation under the Safe Drinking Water Act. Metropolitan is complying with Unregulated Contaminant

Monitoring Rule monitoring and reporting requirements. Although phosphorus levels are much lower in the Colorado River than in the SWP, this nutrient is still of concern.

Arsenic: In April 2004, OEHHA set a public health goal for arsenic of 0.004 μg/L, based on lung and urinary bladder cancer risk. The MCL for arsenic in domestic water supplies was lowered to 10 μg/L, with an effective date of January 2006 in the federal regulations and an effective date of November 2008 in the California regulations. Southern California drinking water sources that contain concentrations of arsenic over 10 μg/L include San Bernardino (25 sources), Los Angeles (27 sources), Riverside (12 sources), San Diego (2 sources), Orange (2 sources), and Ventura (2 sources).

The arsenic drinking water standard impacts both groundwater and surface water supplies. Historically, Metropolitan's water supplies have had low levels of this contaminant and did not require treatment changes or capital investment to comply with the standard. However, some of Metropolitan's water supplies from groundwater storage programs are at levels near the MCL. These groundwater storage projects are called on to supplement flow only during low SWP allocation years.

Uranium: Metropolitan has been monitoring for uranium in the CRA and at its treatment plants since 1986. Uranium levels measured at Metropolitan's intake have ranged from 1 to 6 picocuries per liter, well below the California MCL. Conventional drinking water treatment, as employed at Metropolitan's water treatment plants, can remove low levels of uranium.

Chromium-6: Effective July 1, 2014, California's Office of Administrative Law approved a primary drinking water standard of 10 μg/L for chromium-6. USEPA regulates chromium-6 as part of the total chromium drinking water standard of 100 μg/L and is currently evaluating whether a new federal drinking water standard for chromium-6 is warranted based on new health effects information.

For several years, the Cities of Glendale, Burbank, and Los Angeles have been voluntarily limiting the chromium-6 levels in their drinking water to 5 μg/L, which is significantly lower than the State of California MCL of 10 μg/L.

1,2,3-Trichloropropane: 1,2,3-trichloropropane (TCP) is a chlorinated hydrocarbon with high chemical stability. It is a man-made chemical found at industrial or hazardous waste sites. It has been used as a cleaning and degreasing solvent and also is associated with pesticide products.

At its July 18, 2017, public meeting, the SWRCB adopted an MCL of 5 parts per trillion (ppt) for 1,2,3-TCP and related requirements, including establishing a detection limit for purposes of reporting (DLR), identifying the best available technology for treatment, and setting public notification and consumer confidence report language.

There have been no detections of this chemical in Metropolitan's system. However, 1,2,3-TCP has been detected above the new MCL in groundwater wells of three of Metropolitan's groundwater storage program partners through monitoring performed by these agencies. Levels detected in groundwater wells of the Arvin-Edison Water Storage District are the highest and impact the ability of Metropolitan to put water and take return water under that program. Metropolitan has temporarily suspended operation of this program until the water quality concerns can be further evaluated and managed. The levels of 1,2,3-TCP detected in Metropolitan's other groundwater storage programs are much lower and impact fewer groundwater wells. Metropolitan is evaluating the effects of 1,2,3-TCP on the return capability of those programs.

Emerging Contaminants: NDMA is part of a family of organic chemicals called nitrosamines. NDMA is a chloramine disinfection byproduct, and it is the most abundantly detected nitrosamine in drinking water systems. Metropolitan utilizes chloramines as a secondary disinfectant at its treatment plants. Wastewater treatment plant discharges can contribute organic matter into source waters, which react with chloramines to form NDMA at drinking water treatment plants. Certain coagulation aid polymers used in water treatment (e.g., polydiallyldimethylammonium chloride [polyDADMAC]) can also contribute to NDMA formation. Some NDMA control measures are being used to avoid adverse impacts on Southern California drinking water supplies. Metropolitan is involved in several projects to understand the impact of different treatment processes on NDMA and its precursors at drinking water treatment plants and in distribution systems.

PPCPs are a growing concern to the water industry. Numerous studies have reported the occurrence of these emerging contaminants in treated wastewater, surface water—and sometimes—in finished drinking water in the United States and around the world. The use of ozone in treatment processes may have a beneficial effect on PPCP removal in drinking water. The sources of PPCPs in the aquatic environment include treated wastewater and industrial discharge, agricultural runoff, and leaching of municipal landfills. There are no regulatory requirements for PPCPs in drinking water. USEPA included 14 PPCPs on Contaminant Candidate List 3 (CCL3) and 10 PPCPs on the current CCL4, nine of which are carried over from the CCL3; however, currently there are no standardized analytical methods for these compounds. USEPA's strategy for addressing PPCPs involves strengthening analytical methods, conducting source studies, improving public understanding of PPCPs in water, building partnerships and promoting stewardship opportunities, and taking regulatory action when appropriate.

In 2018, Senate Bill No. 1422 added Section 116376 to the Health and Safety Code, which required the SWRCB to adopt a definition of microplastics in drinking water on or before July 1, 2020. Section 116376 also required the SWRCB on or before July 1, 2021, to:

(1) adopt a standard methodology to be used in the testing of drinking water for microplastics

(2) adopt requirements for 4 years of testing and reporting of microplastics in drinking water, including public disclosure of those results

(3) if appropriate, consider issuing a Notification Level (NL) or other guidance to help consumer interpretations of the results of the testing required

(4) accredit qualified laboratories in California to analyze microplastics

No other states have defined microplastics. On June 16, 2020, the SWRCB adopted a definition and stated that the SWRCB will re-visit the microplastic definition as knowledge in the field progresses. The definition reads:

> "Microplastics in Drinking Water" are defined as solid polymeric materials to which chemical additives or other substances may have been added that are particles that have at least three dimensions that are greater than 1 nanometer (nm) and less than 5,000 micrometers (μm). Polymers that are derived in nature that have not been chemically modified (other than by hydrolysis) are excluded."

Metropolitan is participating in a study with the Southern California Coastal Water Research Project to develop analytical methods for microplastics.

Drinking water containing perfluorooctanoic acid (PFOA), perfluorooctanesulfonic acid (PFOS), and the larger family of per- and polyfluoroalkyl substances (PFAS) has become an increasing concern due to the persistence of these chemicals in the environment and their tendency to accumulate in groundwater. In August 2019, the SWRCB's DDW updated its guidelines for local water agencies to follow in detecting and reporting the presence of these chemicals in drinking water. The guidelines lower the NLs from 14 ppt to 5.1 ppt for PFOA, and from 13 ppt to 6.5 ppt for PFOS. NLs are non-regulatory, precautionary health-based measures for concentrations of chemicals in drinking water that warrant notification and further monitoring and assessment. The SWRCB also set new response levels (RLs) of 10 ppt for PFOA and 40 ppt for PFOS based on a running four-quarter average. A response level is set higher than a NL and represents a chemical concentration level at which DDW recommends a water system consider taking a water source out of service or providing treatment. In March 2021, DDW issued a NL of 0.5 part per billion (ppb) and an RL of 5 ppb for perfluorobutane sulfonic acid (PFBS), another PFAS chemical. The NL for PFBS is 100 times higher than the NLs for PFOA and PFOS. Metropolitan sources have not been affected by PFBS, but Metropolitan has not yet evaluated potential PFBS impacts on its member agencies' sources. DDW has also asked OEHHA to recommend NLs for six other PFAS compounds consistently detected in California drinking water sources. These are perfluorohexane sulfonic acid (PFHxS), perfluorohexanoic acid (PFHxA), perfluoroheptanoic acid (PFHpA), perfluorononanoic acid (PFNA), perfluorodecanoic acid (PFDA), and 4,8-dioxia-3H-perflourononanoic acid (ADONA). Legislation which took effect on January 1, 2020 (California Assembly Bill 756), requires that water systems that receive a monitoring order from the SWRCB and detect levels of PFAS that exceed their respective RLs must either take the drinking water source out of use, or provide specified public notification if they continue to supply water above the RL.

On the federal level, USEPA announced on January 19, 2021, that it is considering whether to designate PFOA and PFOS as hazardous substances under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and/or hazardous waste under the Resource Conservation and Recovery Act (RCRA). On February 22, 2021, USEPA announced its proposed revisions to the Unregulated Contaminant Monitoring Rule (UCMR 5) for public water systems, which includes monitoring for 29 PFAS in drinking water. The proposal would require pre-sampling preparations in 2022, sample collection from 2023 to 2025, and reporting of final results through 2026. On March 3, 2021, USEPA published its final regulatory determination to regulate PFOA and PFOS in drinking water. USEPA has 24 months to propose maximum contaminant level goals (MCLGs) and MCLs for PFOA and PFOS. After that deadline, USEPA has 18 months to publish final MCLGs and MCLs for PFOA and PFOS.

Metropolitan has not detected PFOA or PFOS in its raw water. In 2019, Metropolitan detected low levels of PFHxA in its supply, which is not acutely toxic or carcinogenic and is not currently regulated in California or at the federal level. No other PFASs have been detected in Metropolitan's imported or treated supplies. However, some of its member agencies have experienced detections in their groundwater wells.

Another chemical, 1,4-dioxane, has been used as a stabilizer for solvents. In response to the occurrence data and potential adverse health effects, an NL of 1 µg/L was established. The RL for 1,4-dioxane is 35 µg/L. The SWRCB set an NL of 1 µg/L for 1,4-dioxane in drinking water in November 2010. In August 2010, USEPA revised its 1,4-dioxane risk evaluation, lowering the recommended levels in drinking water to 0.35 µg/L. After USEPA's reevaluation of risk, the SWRCB revised the NL to 1 µg/L in November 2010, considering the analytical limitations at the time. On January 22, 2019, the SWRCB asked OEHHA to establish a PHG for 1,4-dioxane. OEHHA's PHG will be used by the SWRCB to set an MCL for 1,4-dioxane in drinking water.

2.4. Summary

The likelihood of future shortages in water supply for Metropolitan is estimated at 66 percent under Scenario D from the 2020 IRP (Metropolitan 2022a). This scenario indicates that an additional 650 thousand acre-feet (TAF) of core supply are needed. Furthermore, providing this additional water as local supply would reduce the risk of a protracted outage in the delivery of imported water supplies in the event of an earthquake that severely damages the SWP and/or CRA infrastructure.

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3. Water Recycling Opportunities

Water Recycling Opportunities (WTR 11-01).

Address the opportunities for water recycling in the study area and identify the sources of water that could be reclaimed or desalinated, including the following information.

(a) Description of all uses for recycled water, or categories of potential uses, including, but not limited to, environmental restoration, fish and wildlife, groundwater recharge, municipal, domestic, industrial, agricultural, power generation, and recreation. Identify any associated water quality, and associated treatment requirements.

(b) Description of the water market available to utilize recycled water, including:

- *(i) Identification of existing and potential users, expected use, peak use, on-site conversion costs, if necessary, desire to use recycled water, including letters of intent if available.*
- *(ii) Description of any consultation with potential recycled water customers. Letters of intent must be included, if applicable.*
- *(iii) Description of the market assessment procedures used.*

(c) Discussion of considerations (for example: physical, converting systems for reused water, or public acceptance) which will prevent implementing a water recycling project. Identify methods or community incentives to stimulate recycled water demand, and methods to eliminate obstacles which will inhibit the use of recycled water, including pricing.

(d) Identification of all the water and wastewater agencies that have jurisdiction in the potential service area or over the sources of recycled water.

(e) Description of potential sources of water to be recycled, including impaired surface and ground waters.

(f) Description and location of the source water facilities, including capacities, existing flows, treatment processes, design criteria, plans for future facilities, and quantities of impaired water available to meet new recycled water demands.

(g) Description of any current water recycling taking place in the study area, including a list of recycled water uses, type and amount of reuse, and a map of existing pipelines and use sites.

(h)Description of current and projected wastewater and disposal options other than the proposed water recycling project, and plans for new wastewater facilities, including projected costs, if any.

(i) Summary of any water recycling technology currently in use in the study area, and opportunities for development of improved technologies.

This section covers opportunities for water recycling in the study area and the sources of water that have potential to be recycled. This evaluation includes:

- A description of potential uses for recycled water
- Identification of existing and potential users; expected uses; peak uses; on-site conversion costs, if necessary; and desire to use recycled water, including letters of intent
- Discussion of obstacles that could prevent implementing a water recycling project
- Identification of water and wastewater agencies with jurisdiction in the study area
- Description of potential sources for recycled water
    - Description of source water facilities
    - Description of existing recycling facilities with capacities and uses
    - Description of wastewater and disposal options
- Description of technologies currently in use

3.1. Recycled Water Use

This section describes opportunities for the reuse of recycled water and the regulations governing reuse.

3.1.1. Types of Water Reuse

Recycled water use can be categorized as non-potable reuse and potable reuse. Potable reuse includes both IPR (via groundwater replenishment or reservoir water augmentation) and DPR. The definitions of each category and some of the approved uses associated with them are listed in Table 3-1. Water in Metropolitan's service area is currently used for non-potable and IPR purposes.

Table 3-1. Recycled Water Treatment and Uses

Treatment	Definition	Uses
Disinfected secondary	Recycled water that has undergone biological secondary treatment and disinfection	• Landscape irrigation of cemeteries, freeway landscaping, ornamental nursery stock, nonedible irrigation • Mixing concrete • Nonstructural firefighting • Soil compaction • Dust control • Cleaning roads, sidewalks, and work areas • Industrial processes where water will not come into contact with workers
Disinfected tertiary	Recycled water that has undergone biological secondary treatment, tertiary filtration, and disinfection	• All disinfected secondary allowed uses • Landscape irrigation of food crops, parks and playgrounds, school yards, residential landscaping, golf courses • Non-restricted recreational impoundments • Cooling water • Structural firefighting • Commercial laundries • Industrial processes where water may come into contact with workers • Toilets and urinal flushing • Decorative fountains • Artificial snow making • Commercial car washes • Groundwater recharge (surface application)

Source: WRD 2023.

Non-Potable Reuse. Non-potable reuse is subject to two different treatment categories: disinfected secondary treatment and disinfected tertiary treatment. See Title 22 California Code of Regulations (CCR) Article 3 for a complete list of approved uses.

Indirect Potable Reuse. IPR refers to the use of recycled water as potable water. After treatment, the water is discharged to an environmental buffer such as groundwater aquifers, lakes, or rivers. The environmental buffer or barrier is required before the water can be conveyed to a drinking water treatment plant. IPR requires additional removal of pathogens, inorganic chemicals, radionucleotide chemicals, organic chemicals, disinfection byproducts, lead, copper, secondary drinking water contaminants, and CECs beyond what is required for non-potable reuse. This treatment must include reverse osmosis (RO) and advanced oxidation.

Direct Potable Reuse. DPR refers to the direct augmentation of a water supply with advanced water purification without an intervening environmental or storage buffer. California has adopted DPR regulations on December 19, 2023.

3.1.2. California Recycled Water Regulations

Recycled water regulations are overseen by the SWRCB through the DDW and the individual Regional Water Quality Control Boards (RWQCBs). DDW has established uniform statewide Water Recycling Criteria for various uses for recycled water that are set forth in 22 CCR

§§ 60301 to 60355. The use of recycled water is also regulated through the California Water Code (CWC) and the California Health and Safety Code.

Non-Potable Reuse Regulations. A summary of the key requirements for non-potable recycled water reuse projects is provided in Table 3-2.

Table 3-2. Rules and Regulations for Non-Potable Recycled Water Reuse Projects

Section	Section Name
Uniform Statewide Recycling Criteria (California Code of Regulations, Title 22, Division 4, Ch 3)	
§ 60301.220	Disinfected secondary-2.2 recycled water
§ 60301.225	Disinfected secondary-23 recycled water
§ 60301.230	Disinfected Tertiary Recycled Water
§ 60301.320	Filtered Wastewater
§ 60304	Uses of recycled water for irrigation Including: Parks and Playgrounds
§ 60305	Use of recycled water for impoundments
§ 60306	Use of recycled water for cooling
§ 60307	Use of recycled water for other purposes
State Water Resources Control Board	
Recycled Water Policy – Chapter 3	Annual Reporting Requirements
Recycled Water Policy – Chapter 6	Salt and Nutrient Management Plan
Recycled Water Policy – Chapter 7	Permitting and antidegradation analysis for non-potable recycled water projects Incidental Runoff of recycled water for irrigation
Water Reclamation Requirements for Recycled Water Use (General Order)	
Statewide Toxicity Provisions	
California Regional Water Quality Control Board	
	Salt and Nutrient Plans
	Basin Plan
California Health and Safety Code	
§ 116815	Cross-Connection Control by Water Users
California Water Code	
§ 13520	Water Reclamation Law

Notes:
Basin Plan = Water Quality Control Plan

Indirect Potable Reuse Regulations. A summary of the key requirements for groundwater replenishment and surface water augmentation is provided in Table 3-3.

Table 3-3. Rules and Regulations Applicable to Indirect Potable Reuse Projects

Section	Section Name
Uniform Statewide Recycling Criteria – Title 22, Division 4, Ch. 3 Article 5.1 – Indirect Potable Reuse: Groundwater Replenishment Surface Application	
§ 60320.100	General Requirements
§ 60320.102	Public Hearing
§ 60320.106	Wastewater Source Control
§ 60320.108	Pathogenic Microorganism Control
§ 60320.110	Nitrogen Compounds Control
§ 60320.112	Regulated Contaminants and Physical Characteristics Control
§ 60320.114	Diluent Water Requirements
§ 60320.116	Recycled Municipal Wastewater Contribution (RWC) Requirements
§ 60320.118	Total Organic Carbon (TOC) and Soil-Aquifer Treatment (SAT) Process Requirements
§ 60320.120	Additional Chemical and Contaminant Monitoring
§ 60320.124	Response Retention Time
§ 60320.126	Monitoring Well Requirements
§ 60320.128	Reporting
Uniform Statewide Recycling Criteria – Title 22, Division 4, Ch. 3 Article 5.2 – Indirect Potable Reuse: Groundwater Replenishment Subsurface Application	
§ 60320.200	General Requirements
§ 60320.201	Advanced Treatment Criteria
§ 60320.202	Public Hearing
§ 60320.206	Wastewater Source Control
§ 60320.208	Pathogenic Microorganisms Control
§ 60320.210	Nitrogen Compounds Control
§ 60320.212	Regulated Contaminants and Physical Characteristics Control
§ 60320.214	Diluent Water Requirements
§ 60320.216	Recycled Municipal Wastewater Contribution (RWC) Requirements
§ 60320.218	Total Organic Carbon Requirements
§ 60320.220	Additional Chemical and Contaminant Monitoring
§ 60320.224	Response Retention Time
§ 60320.226	Monitoring Well Requirements
§ 60320.228	Reporting
Uniform Statewide Recycling Criteria – Title 22, Division 4, Ch. 3 Article 5.3 – Indirect Potable Reuse: Surface Water Augmentation	
§ 60320.301	General Requirements
§ 60320.302	Advanced Treatment Criteria
§ 60320.306	Wastewater Source Control
§ 60320.308	Pathogenic Microorganism Control
§ 60320.312	Regulated Contaminants and Physical Characteristics Control
§ 60320.320	Additional Chemical and Contaminant Monitoring
§ 60320.326	Augmented Reservoir Monitoring
§ 60320.328	Reporting

Section	Section Name
Uniform Statewide Recycling Criteria – Title 22, Division 4, Ch. 17 Article 9 – Indirect Potable Reuse: Surface Water Augmentation	
§ 64668.10	General Requirements and Definitions
§ 64668.20	Public Hearing
§ 64668.30	SWSAP Augmented Reservoir Requirements
Cross-Connection Control Regulations - CCR Title 17, Division 1, Subchapter 1 Group 4. Drinking Water Suppliers Article 1. General	
§ 7584	Responsibility and Scope of Program
§ 7585	Evaluation of Hazard
State Water Resources Control Board	
Recycled Water Policy – Chapter 3	Annual Reporting Requirements
Recycled Water Policy – Chapter 6	Salt and Nutrient Management Plan
Recycled Water Policy – Chapter 8	Permitting and antidegradation analysis for groundwater recharge projects
Recycled Water Policy – Attachment A	Monitoring Requirements for Constituents of Emerging Concern (CECs)
Regional Water Quality Control Board	
	Salt and Nutrient Plans
	Basin Plans
California Water Code	
§ 13523	Water Reclamation Law

Notes:
Basin Plan = Water Quality Control Plan

Direct Potable Reuse Regulations. The DDW is currently finalizing the regulations for DPR through raw water augmentation (RWA) (to allow the introduction of advanced recycled water into a raw water conveyance system upstream of a drinking water treatment plant) and treated water augmentation (the placement of advanced treated recycled water into a public drinking water distribution system). The regulations for DPR were adopted on December 19, 2023, and the final DPR regulations are to be included in new Article 10 to Chapter 17 of Division 4 of Title 22 of the CCR.

3.2. Recycled Water Market Assessment and Availability

This section describes the market assessment procedures, identifies existing recycled water users, and describes communication with potential recycled water users.

3.2.1. Market Assessment Procedures

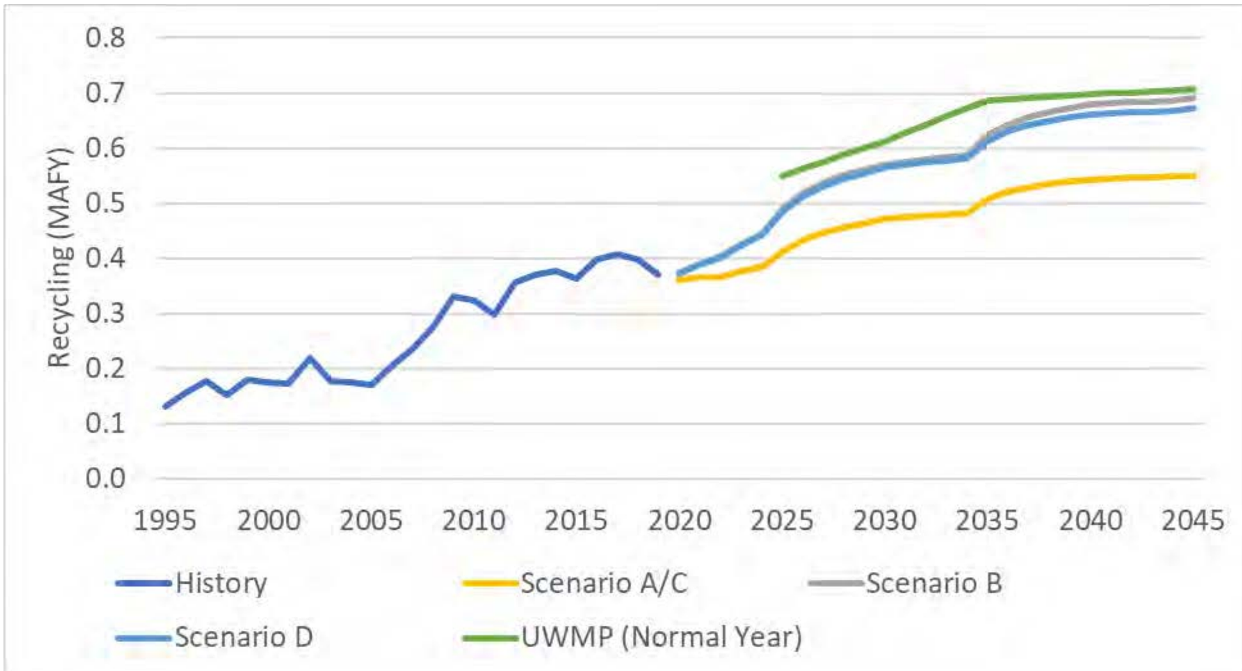
Metropolitan employs a comprehensive set of procedures to estimate water demands from groundwater, surface water, and recycled water, as required by the Urban Water Management Planning Act. Three critical planning analyses are conducted to evaluate supply reliability: (1) The Water Service Reliability Assessment compares available water supply sources with projected water use over a 20-year period. This evaluation accounts for typical year, single dry year, and 5-year drought scenarios. The typical year scenario draws from the historical data spanning 1917 to 2022, a single dry year references 1977 as the benchmark, and a prolonged 5-year drought is based on the years 1988 to 1992. These conditions serve as reference points for supply reliability assessments. (2) The Drought Risk Assessment (DRA) focuses on assessing the risk of drought over a 5-year period starting from the year after the assessment. (3) The Water Shortage Contingency Plan Outlines Metropolitan's strategies for addressing water shortages.

A summary of the typical water year demand projections is provided in Table 3-4, and the recycled water forecast is shown on Figure 3-1.Figure 3-1. Recycled Water Forecast

Table 3-4. Metropolitan Regional Water Demands (acre-feet)

	2025	2030	2035	2040	2045
Total Demands [1]	**4,925,000**	**5,032,000**	**5,156,000**	**5,261,000**	**5,374,000**
Retail Municipal and Industrial	4,403,000	4,514,000	4,632,000	4,743,000	4,854,000
Retail Agricultural	144,000	134,000	130,000	123,000	123,000
Seawater Barrier	61,000	61,000	61,000	61,000	61,000
Storage Replenishment	316,000	323,000	332,000	334,000	335,000
Total Conservation	**1,162,000**	**1,211,000**	**1,263,000**	**1,325,000**	**1,389,000**
Existing Active (through 2020) [2]	93,000	55,000	35,000	25,000	17,000
Code-Based	560,000	623,000	665,000	701,000	731,000
Price-Effect [3]	259,000	283,000	313,000	349,000	391,000
Pre-1990 Conservation	250,000	250,000	250,000	250,000	250,000
Total Local and Other Imported Supplies	**2,613,000**	**2,712,000**	**2,809,000**	**2,836,000**	**2,860,000**
Groundwater	1,255,000	1,273,000	1,296,000	1,311,000	1,326,000
Surface Water	80,000	82,000	82,000	82,000	82,000
Los Angeles Aqueduct [4]	257,000	257,000	258,000	258,000	258,000
Seawater Desalination	51,000	51,000	51,000	51,000	51,000
Groundwater Recovery	143,000	157,000	158,000	158,000	159,000
Recycling [5]	550,000	613,000	687,000	698,000	706,000
Other Imported Supplier [6]	278,000	278,000	278,000	278,000	278,000
Net Metropolitan Demands [7]	**1,149,000**	**1,110,000**	**1,084,000**	**1,100,000**	**1,125,000**
Consumptive Use	1,020,000	981,000	954,000	971,000	996,000
Seawater Barrier	4,000	4,000	4,000	4,000	4,000
Replenishment	125,000	125,000	125,000	125,000	125,000

Source: Metropolitan 2021a, page 2-12, Table 2-1.
Notes:
All units are acre-feet, unless specified, rounded to the nearest thousand. Totals may not sum due to rounding.
1. Growth projections are based on SCAG 2020 and SANDAG 2019.
2. Does not include future active conservation savings. 1990 is the base year.
3. Includes un-metered water use savings.
4. Los Angeles Aqueduct Projection uses 1922–2017 hydrology.
5. Excludes Santa Ana River base flow, which is used for recharge of Orange County groundwater basin and is reflected in the groundwater production numbers.
6. Exchange with San Diego County Water Authority (SDCWA).
7. Net Metropolitan Demands = Total Demands – Total Conservation – Total Local and Other Imported Supplies.



UWMP = Urban Water Management Plan

Figure 3-1. Recycled Water Forecast

In specifically evaluating the feasibility of indirect potable reuse for recycled water, the market assessment procedures are multifaceted, as described below:

- **Demand analysis** determines the projected need for recycled water in each groundwater basin. It considers existing replenishment demand provided by imported water, potential conversion of consumptive demand currently served by imported water to groundwater, and any additional replenishment supplies required for overdraft control or projected future demand.
- **Operational assessment** evaluates practical issues such as recharge capacity and extraction capacity. It ensures that the operational aspects of recycled water, including the ability to recharge and extract it, align with the program's goals.
- **Groundwater modeling** is used to assess how the recharge and extraction of purified water may affect water levels and travel times within the groundwater basins. This modeling helps identify potential impacts on wells and ensures that the project does not adversely affect groundwater use.
- **Facility needs identification** is essential for delivering and distributing purified water effectively. This assessment determines whether the existing infrastructure is adequate or if new facilities are needed to support the program's objectives.

These assessment procedures are important to ensure the effective integration of recycled water into the region's water resources. They provide a strong foundation for making informed decisions regarding the utilization of purified water and help to ensure its sustainable and efficient deployment in the local water market.

3.2.2. Recycled Water Market

Table 3-5 lists current and potential future users of recycled water in the Metropolitan service area by Water Reclamation Plant (WRP).

Because the Warren Facility does not currently have recycled water users, it presents a significant opportunity for new recycled water production.

Currently, the majority of the inland plants discharge secondary, and tertiary treated, disinfected effluent into local streams and rivers. Downstream of these facilities, water recycling is implemented and maximized before the water flows into the ocean. The water bodies where this occurs are:

- Los Angeles River
- Rio Hondo
- San Gabriel Rivers
- San Jose Creek
- Santa Clara River
- Coyote Creek

Metropolitan plans to deliver 66 MGD (or 68,000 AFY) for groundwater replenishment. The allocation for constant output from the treatment plants assigns replenishment flows across four groundwater basins:

- West Coast Groundwater Basin: Average of 26 MGD (26,800 AFY based on 92 percent online factor)
- Central Groundwater Basin: Average of 9 MGD (9,300 AFY based on 92 percent online factor)
- Main San Gabriel Basin: Average of 55 MGD (56,700 AFY based on 92 percent online factor)
- Orange County Groundwater Basin 0 to 20 MGD (0 to 20,000 AFY if necessary)

This allocation plan provides flexibility in case certain basins are temporarily unable to take their full share of purified water. To achieve this goal, it is crucial that the Main San Gabriel Basin has the capacity to increase its flow to 77 MGD, offering adaptability across the system. A map of the locations of these four groundwater basins is provided on Figure 3-2.

Figure 3-2. Map of the Central Basins

3.2.3. Consultation with Potential Recycled Water Users

Metropolitan staff maintain regular communication with member agencies and the groundwater management agencies potentially benefited by PWSC. These discussions offer valuable opportunities to explore how the new water resource could be integrated into the region's water storage framework, with consideration of the unique operational requirements of each basin.

Meetings with member agencies, groundwater management agencies, and groundwater pumpers encompass conceptual deliberations regarding potential arrangements for water delivery and use. Metropolitan is also engaging groundwater management agencies to conduct groundwater modeling specifically designed to assess the potential of PWSC to recharge the target basins.

The discussions with potential recycled water customers, including member agencies and groundwater management agencies, provide essential input on feasibility, Grace F. Napolitano Pure Water Southern California Innovation Center (Innovation Center) designs, groundwater basin assessments, and approaches to implementation. The agencies that have provided a letter of intent are the following:

- Los Angeles County Sanitation Districts
- Los Angeles Department of Water and Power (LADWP)
- San Gabriel Basin agencies

Table 3-5. WRPs in Metropolitan Service Area

WRP Owner	Water Reclamation Plant (WRP) Name	Highest Treatment Train*	Influent Flow (MGD)	Current/ Future Recycled Water Users
Los Angeles County Sanitation Districts	A.K. Warren Water Resource Facility	Primary-Secondary	260	**West Basin Municipal Water District** **Metropolitan Pure Water Southern California** **Los Angeles Department of Water & Power**
Los Angeles Sanitation and Environment	Hyperion WRP *	Primary-Secondary-Tertiary	251	City of Los Angeles Edward C. Little Water Recycling Facility
Orange County Sanitation District	OCSD Reclamation Plant No. 1	Primary-Secondary	192	Sends secondary treated wastewater to GAP and GWRS facilities that feed: • Mile Square Park • Golf Courses in Fountain Valley and Costa Mesa Country Club • Chroma • Systems carpet dyeing • Kaiser Permanente • Caltrans
City of San Diego	Point Loma WWTP *	Primary-Secondary-Tertiary	175	Point Loma Ocean Outfall
Orange County Sanitation District	OCSD Reclamation Plant No. 2 *	Primary-Secondary	150	Santa Ana River Pacific Ocean
Los Angeles County Sanitation Districts	San Jose Creek WRP	Primary-Secondary-Tertiary	50	California Country Club City of Industry Central Basin Municipal Water District (Rio Hondo System) Puente Hills Landfill Rose Hills Memorial Park Rowland Water District San Gabriel Valley Water Company Upper San Gabriel Valley Municipal Water District (Phase I Extension) Upper San Gabriel Valley Municipal Water District (Phase II-B Extension) Water Replenishment District of Southern California **Montebello Forebay Groundwater Recharge Program** **La Puente Valley County Water District Master Plan** **Pump Station for the Montebello Hills Residential Development** **Rose Hills Memorial Park Expansion** Landscape Irrigation Toilet/urinal flushing Cooling towers Dust control Discharge to San Gabriel River and San Jose Creek
City of Los Angeles Sanitation District	Donald C. Tillman WRP	Primary-Secondary-Tertiary	46.1	Balboa, Woodley, and Encino Golf Courses Balboa Sports Center Franklin Field Lake Recreation Area Model Airplane Center Archery Range Wildlife parks Donald C. Tillman Advanced Water Purification Facility

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WRP Owner	Water Reclamation Plant (WRP) Name	Highest Treatment Train*	Influent Flow (MGD)	Current/ Future Recycled Water Users
Encina Wastewater Authority	Encina Water Pollution Control Facility *	Primary-Secondary-Tertiary	43.3	City of Carlsbad On-site uses (seal flush, polymer dilution, makeup water, wash down, irrigation) Caltrans Carlsbad WRF Forest R. Gafner WRF
City of Riverside	Riverside Regional WQCP	Primary-Secondary-Tertiary	40	Landscape irrigation users
City of San Diego	North City WRP	Primary-Secondary-Tertiary	34	Agriculture Landscaping Industrial manufacturing
Eastern Municipal Water District	Perris Valley Regional WRF	Primary-Secondary-Tertiary	30	Landscaping and Irrigation
Inland Empire Utilities Agency	IEUA Water Recycling Plant 1	Primary-Secondary-Tertiary	28	Fontana Chino Rancho Cucamonga Montclair Ontario Upland
International Boundary and Water Commission (IBWC)	South Bay International WTP *	Primary-Secondary-Tertiary	25	—
Eastern Municipal Water District	Temecula Valley Regional WRP	Primary-Secondary-Tertiary	22.4	Santa Margarita
Ventura Regional Sanitation District	Oxnard WWTP *	Primary-Secondary	21.8	Oxnard AWPF
Los Angeles County Sanitation Districts	Los Coyotes WRP	Primary-Secondary-Tertiary	21.7	Central Basin Municipal Water District (Century System, CBMWD) City of Bellflower City of Cerritos City of Lakewood Forest Lawn, Cypress **City of Lakewood Master Plan** **GWMA Recycled Water Pipelines Project (Gateway Cities Extension)** **Customer Conversions for Disadvantaged Communities Project** **World Energy (Alt-Air), Paramount** Landscape Irrigation Dust control Toilet/urinal flushing Concrete mixing Cooling towers Industrial Use Discharge to San Gabriel River
Los Angeles County Sanitation Districts	Valencia WRP *	Primary-Secondary-Tertiary	21.6	Santa Clarita Valley Water Agency **Newhall Ranch Development** Landscape Irrigation Discharge to Santa Clara River
Eastern Municipal Water District	Moreno Valley Regional WRF	Primary-Secondary-Tertiary	20.8	75 parks, 27 school sites, seven golf courses, and public landscaping

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WRP Owner	Water Reclamation Plant (WRP) Name	Highest Treatment Train*	Influent Flow (MGD)	Current/ Future Recycled Water Users
Los Angeles County Sanitation Districts	Lancaster WRP *	Primary-Secondary-NDN-Tertiary	18	Apollo Community Regional Park City of Lancaster - Division Street Corridor Eastern Agricultural Site Development and Storage Project Piute Ponds **Antelope Valley Regional Recycled Water Distribution Project** **Palmdale Recycled Water Authority** **Palmdale Regional Groundwater Recharge and Recovery Project** Landscape Irrigation Municipal and Industrial Uses Apollo Lakes Regional Park Irrigation of Fodder Crops
South Orange County Wastewater Authority Irvine Ranch Water District	Michelson Water Recycling Plant	Primary-Secondary-Tertiary	18	Irvine Ranch Water District
City of Los Angeles Sanitation District	Los Angeles-Glendale WRP	Primary-Secondary-Tertiary	17.2	Los Angeles River
San Bernardino Municipal Water Department	San Bernardino WRP	Primary-Secondary	16	—
City of Los Angeles Sanitation District	Terminal Island WRP *	Primary-Secondary-Tertiary	15	Los Angeles Department of Water & Power Harbor Generating Station
Los Angeles County Sanitation Districts	Pomona WRP	Primary-Secondary-Tertiary	15	Pomona Water Department Spadra Landfill Site Cal Poly Center for Regenerative Studies Walnut Valley Water District Water Replenishment District of Southern California **Walnut Valley Water District** **Water Replenishment District of Southern California** **City of Pomona Master Plan** Landscape Irrigation Agricultural irrigation Landscape impoundment Fire protection Concrete mixing Dust control Groundwater Recharge (San Jose Creek into San Gabriel River) Discharge to San Jose Creek
Los Angeles County Sanitation Districts	Whittier Narrows WRP *	Primary-Secondary-Tertiary	15	Landscape Irrigation Car washing Groundwater Recharge: Discharge to Rio Hondo and San Gabriel River USGVMWD (Phase II-A Extension) WRD SGVWC – South El Monte Extension **City of Arcadia (USGVMWD Phase III Extension)** **SGVWC expansion**
Eastern Municipal Water District	San Jacinto Valley WRF	Primary-Secondary-Tertiary	14.9	Ponds Irrigation
Western Municipal Water District of Riverside County	Western Riverside Co WWTP	Primary-Secondary-Tertiary	14	Industrial users

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WRP Owner	Water Reclamation Plant (WRP) Name	Highest Treatment Train*	Influent Flow (MGD)	Current/ Future Recycled Water Users
Los Angeles County Sanitation Districts	Long Beach WRP	Primary-Secondary-Tertiary	13.9	City of Long Beach Alamitos Seawater Intrusion Barrier **Long Beach Utilities Department Master Plan** **City of Signal Hill** Coyote Creek Landscape Irrigation Re-pressurization of Oil-zone Toilet/urinal flushing Sewer flushing Discharged to Coyote Creek Groundwater Recharge/Seawater Intrusion Barrier
City of Escondido	Hale Avenue Resource Recovery Facility	Primary-Secondary-Tertiary	12.7	Membrane Filtration/Reverse Osmosis (MFRO) Facility
Los Angeles County Sanitation Districts	Palmdale WRP *	Primary-Secondary-Tertiary	12	City of Los Angeles World Airports Lease City of Palmdale **Palmdale Recycled Water Authority** **Palmdale Regional Groundwater Recharge and Recovery Project** Landscape Irrigation
South Orange County Wastewater Authority Moulton Niguel Water District	Regional Treatment Plant *	Primary-Secondary-Tertiary	12	Environmental/habitat restoration users
City of Corona	Corona WWTP #1	Primary-Secondary-Tertiary	11.5	Industry users Landscape irrigation users
City of Rialto	Rialto Municipal WWTP	Primary-Secondary-Tertiary	11.5	—
Inland Empire Utilities Agency	IEUA Water Recycling Plant 4	Primary-Secondary-Tertiary	10	Rancho Cucamonga Fontana San Bernardino County
City of Simi Valley	Simi Valley WQCP	Primary-Secondary-Tertiary	9.5	Landscape irrigation users Construction/dust control users
City of Burbank	Burbank WRP	Primary-Secondary-Tertiary	9	Chandler Bikeway Costco Empire Center Park Robert Gross Park AMC Theaters Burbank High School Bob Hope Airport Castaway Restaurant Starlight Bowl Stough Park
City of Thousand Oaks	Hill Canyon Treatment Plant	Primary-Secondary-Tertiary	9	Agricultural users
Inland Empire Utilities Agency	IEUA Water Recycling Plant 5	Primary-Secondary-Tertiary	9	Chino Chino Hills Ontario
Camp Pendleton Marine Corps Base	Camp Pendleton STP #12	Primary-Secondary	8.6	Irrigation Landscaping for the golf course, parks, grazing pastures at the base stables
City of Oceanside	San Luis Rey WWTP	Primary-Secondary-Tertiary	8.5	Golf courses Pure Water Oceanside (Drinking water facility)
Yucaipa Water District	Henry N. Wocholz Water Recycling Facility	Primary-Secondary-Tertiary	8	—

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WRP Owner	Water Reclamation Plant (WRP) Name	Highest Treatment Train*	Influent Flow (MGD)	Current/ Future Recycled Water Users
Las Virgenes Municipal Water District	Tapia WRF	Primary-Secondary-Tertiary	7.8	LVMWD and Triunfo Sanitation District Joint Venture Calleguas Municipal Water District Calabasas Landfill Westlake Village Lake Lindero Golf Courses Valley Oaks Cemetery Parks, playgrounds, freeways, and residential greenbelts
City of Ventura	Ventura WWTP *	Primary-Secondary-Tertiary	7.8	—
South Coast Water District	Aliso Creek WRF *	Tertiary	7.5	Aliso Creek
City of San Diego	South Bay WRP	Primary-Secondary-Tertiary	7.4	Pacific Ocean outfall Otay Water District International Treatment Plant On-site processes Ralph W. Chapman WRF
Inland Empire Utilities Agency	Carbon Canyon Water Recycling Facility	Primary-Secondary-Tertiary	7	Chino Chino Hills Montclair Upland
Santa Rosa Regional Resources Authority	Santa Rosa WRF	Primary-Secondary-Tertiary	7	Landscape irrigation and agriculture users Discharge to Santa Clara River
South Orange County Wastewater Authority	Coastal Treatment Plant *	Primary-Secondary-Tertiary	6.7	Moulton Niguel Water District South Coast Water District El Niguel Golf Course Mission Viejo Country Club
Los Angeles County Sanitation Districts	Saugus WRP *	Primary-Secondary-Tertiary	6.5	**Santa Clarita Valley Water Agency** **Newhall Ranch Development**
South Orange County Wastewater Authority Moulton Niguel Water District	J.B. Latham WWP	Primary-Secondary	6.5	San Juan Creek
City of Beaumont	Beaumont WWTP #1	Primary-Secondary-Tertiary	6	Landscape irrigation users
City of Colton	Colton WWTP	Primary-Secondary	5.6	City of Grand Terrace Unincorporated County areas
City of Oceanside	La Salina WWTP *	Primary-Secondary	5.5	Irrigation at Oceanside Municipal Golf Course
South Orange County Wastewater Authority Santa Margarita Water District	Chiquita WRP	Primary-Secondary-Tertiary	5.5	Ladera Ranch Talega Valley San Juan Creek
San Elijo Joint Powers Authority	San Elijo Water Reclamation Facility (San Elijo WPCF)	Primary-Secondary	5.25	San Dieguito Water District Santa Fe Irrigation District Olivenhain Municipal Water District City of Del Mar
Encina Wastewater Authority Vallecitos Water District	Meadowlark WRF	Primary-Secondary-Tertiary	5	City of Carlsbad Olivenhain Municipal Water District

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WRP Owner	Water Reclamation Plant (WRP) Name	Highest Treatment Train*	Influent Flow (MGD)	Current/ Future Recycled Water Users
Ventura County Waterworks District No.1	Moorpark Water Reclamation Facility	Primary-Secondary-Tertiary	5	MoorPark Country Club Rustic Canyong Golf Moorpark WRF City of Moorpark Ventura County PWA VCWW Recycled Water Reservoir Site Other landscape and irrigation users (lemon farms)
Camp Pendleton Marine Corps Base	North Regional Tertiary Treatment Plant (Camp Pendleton STP #9)	Primary-Secondary-Tertiary	4	Irrigation Landscaping for the golf course, parks, grazing pastures at the base stables
Elsinore Valley Municipal Water District	Lake Elsinore Regional WWRF	Primary-Secondary-Tertiary	4	Ponds Creek Outfall
City of San Clemente	San Clemente WRP	Primary-Secondary-Tertiary	3.71	San Juan Creek
Camrosa Water District	Camarillo WWTP	Primary-Secondary-Tertiary	3.4	Landscape irrigation Agricultural users
South Orange County Wastewater Authority Irvine Ranch Water District	Los Alisos WRP	Primary-Secondary-Tertiary	3.3	Irvine Ranch Water District San Diego Region Santa Ana Region
South Orange County Wastewater Authority Santa Margarita Water District	Oso Creek Water Reclamation Plant	Primary-Secondary-Tertiary	3.3	Santa Margarita Water District (SMWD) Parks, slopes, schools, recreation areas, greenbelts and freeway landscaping, and construction grading
El Toro Water District	El Toro Water District Water Recycling Plant	Primary-Secondary-Tertiary	3.1	El Toro Water District
City of Corona	Corona WWTP #2	Primary-Secondary-Tertiary	3	Ponds
Western Municipal Water District of Riverside County	Western Water Recycling Facility (March WWTP)	Primary-Secondary	3	Riverside National Cemetery General Archie Old Golf Course Groves, parks, nurseries, landscape irrigation users
Eastern Municipal Water District	Sun City Regional WRF	Primary-Secondary	3	Used as a lift station - 3 MGD
Fallbrook Public Utility District	Fallbrook Plant #1 WRF	Primary-Secondary-Tertiary	2.7	Pacific Ocean outfall
Big Bear Area Regional Wastewater Agency (BBARWA)	Big Bear Area Regional Wastewater Agency WWTP	Primary-Secondary	2.2	Agricultural users Groundwater recharge
Olivenhain Municipal Water District	4S Ranch Water Reclamation Facility	Primary-Secondary-Tertiary	2	Irrigation at schools, parks, golf courses Woods Valley Ranch Golf Course Valley Center Hydrologic Area
Padre Dam Municipal Water District	Ray Stoyer Water Recycling Facility (former name Padre Dam WRF) *	Primary-Secondary-Tertiary	2	Sycamore Creek Distribution System Santee lakes East County Advanced WRF
South Orange County Wastewater Authority Moulton Niguel Water District	3A Water Reclamation Plant	Primary-Secondary-Tertiary	1.7	San Juan Creek
Temescal Valley Water District	Lee Lake Water District WWTF (Temescal Valley WD WWRF) *	Primary-Secondary	1.58	Landscape irrigation users
Elsinore Valley Municipal Water District	Railroad Canyon WWRF	Primary-Secondary-Tertiary	1.3	Landscape irrigation users
Camrosa Water District	Camrosa WRF	Primary-Secondary-Tertiary	1.3	Agricultural and landscape irrigation users

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WRP Owner	Water Reclamation Plant (WRP) Name	Highest Treatment Train*	Influent Flow (MGD)	Current/ Future Recycled Water Users
Trabuco Canyon Water District	Robinson Ranch WRF	Tertiary	1.1	Robinson Ranch residential developments Dove Canyon Robinson Ranch Trabuco Highlands
City of Corona	Corona WWTP #3	Primary-Secondary-Tertiary	1	Industry users Landscape irrigation users
City of San Diego	San Pasqual WRP	Primary-Secondary-Tertiary	1	City of San Diego pump station
Running Springs Water District	Running Springs WWTP	Primary-Secondary-Tertiary	1	Irrigation
California Department of Corrections and Rehabilitation	California Institution for Men WWTP (Chino Institution for Men WWTP)	Primary-Secondary	0.9	Agricultural irrigation (alfalfa, corn, etc.)
Elsinore Valley Municipal Water District	Horsethief Canyon WWTP *	Primary-Secondary-Tertiary	0.8	Landscape irrigation users
Ramona Municipal Water District	San Vicente WWTP *	Primary-Secondary-Tertiary	0.8	San Vicente Golf Course Irrigation Avocado Grove Irrigation
Rancho Santa Fe Community Service District	Santa Fe Valley WRF *	Primary-Secondary-Tertiary	0.485	–
Rancho Santa Fe Community Service District	Rancho Santa Fe WRF	Primary-Secondary-Tertiary	0.45	Rancho Santa Fe Golf Course
Valley Center Municipal Water District	Lower Moosa Canyon WRF *	Primary-Secondary-Tertiary	0.44	–
Whispering Palms Community Services District	Whispering Palms WRF *	Primary-Secondary	0.26	Rancho Paseana
County of Los Angeles Department of Public Works	Malibu Mesa WRF *	Primary-Secondary-Tertiary	0.2	–
Los Angeles County Sanitation Districts	La Cañada WRP *	Primary-Secondary-Tertiary	0.2	Irrigation of Fodder Crops Landscape Irrigation (Golf Course)
South Coast Water District Moulten Niguel Water District Aliso Water Management Agency	Aliso Creek Advanced Wastewater Treatment Plant *	Tertiary	0.8	Aliso Water Management Agency South Coast Water District Ben Brown Golf Course AVCO development Niguel Shores Laguna Meadows Caltrans Sea Canyon Park Dana Hills High School
Rincon Del Diablo Municipal Water District	Harmony Grove Village WRF *	Primary-Secondary-Tertiary	0.2	–
Fairbanks Ranch Community Services District	Fairbanks Ranch WPCF *	Primary-Secondary	0.145	–
Rincon Del Diablo Municipal Water District	Harmony Grove Village South WRF *	Primary-Secondary-Tertiary	0.097	–
Los Angeles County Department of Public Works	Lake Hughes Community Wastewater Treatment Facility *	Primary-Secondary	0.093	On-site irrigation
County of Los Angeles Department of Public Works	Trancas WPCP *	Primary-Secondary-Tertiary	0.075	Leachfield Disposal System
Valley Center Municipal Water District	Skyline Ranch WRF *	Primary-Secondary-Tertiary	0.035	Irrigation (Golf Course) Skyline Ranch Country Club
Valley Center Municipal Water District	Woods Valley Ranch WRF *	Primary-Secondary-Tertiary	0.0045	Irrigation at Wood Valley Golf Course
Camp Pendleton Marine Corps Base	Camp Pendleton STP #1	Primary-Secondary	–	Irrigation Landscaping for the golf course, parks, grazing pastures at the base stables
Camp Pendleton Marine Corps Base	Camp Pendleton STP #2	Primary-Secondary	–	Irrigation Landscaping for the golf course, parks, grazing pastures at the base stables
Camp Pendleton Marine Corps Base	Camp Pendleton STP #3	Primary-Secondary	–	Irrigation Landscaping for the golf course, parks, grazing pastures at the base stables

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Notes for Table 3-5

* = Not included in the 2002 Southern California Comprehensive Water Reclamation and Reuse Study plant location maps (Reclamation 2002).
Bolded = Future recycled water uses according to the *33rd Annual Status Report on Recycled Water Use, 2021–2022* (Sanitation Districts no date [est. 2023]).
— = not applicable
Caltrans = California Department of Transportation
GAP = Green Acres Project
GWMA = Gateway Water Management Authority
GWRS = Groundwater Replenishment System
IBWC = International Boundary and Water Commission
IEUA = Inland Empire Utilities Agency
OCSD = Orange County Sanitation District
SGVWC = San Gabriel Valley Water Company
USGVMWD = Upper San Gabriel Valley Municipal Water District
WRD = Water Replenishment District
WQCP = Water Quality Control Plant
WRF = Water Resource Facility
WRP = Water Reclamation Plant
WWTP = wastewater treatment plant

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- Upper San Gabriel Valley Municipal Water District
- Three Valleys Municipal Water District
- Main San Gabriel Water Basin Watermaster
- Central Basin Municipal Water District
- West Coast Basin agencies
- West Basin Municipal Water District
- Water Replenishment District of Southern California
- City of Torrance
- City of Long Beach
- Los Angeles County Flood Control District
- San Gabriel Valley Municipal Water District
- Southern Nevada Water Authority (SNWA)
- Arizona Department of Water Resources and Central Arizona Water Conservation District

The letters of intent from each agency are provided in Appendix A.

3.3. Obstacles Limiting Implementation and Opportunities to Stimulate Demand

Water reuse programs encounter several challenges that hinder their growth and slow down their implementation.

- Permitting: A lengthy and variable permitting process that varies from region to region within the state can lead to regulatory uncertainties and delays and significantly impede project development. Furthermore, regulatory constraints such as treatment requirements, blend water specifications, and the Water Quality Control Plan (Basin Plan) objectives may impose limitations on the amount of recycled water that can be feasibly recharged into groundwater basins, and such limitations can affect a project's economic viability.

- Cost: The overall cost of recycled water development, which encompasses capital investment and ongoing operation and maintenance, remains a considerable concern for several agencies, especially those requiring extensive distribution systems and advanced treatment facilities.

- Operational Challenges: Fluctuations in wastewater flows, the need for seasonal storage, concentrate disposal, and regulatory compliance can impact the efficiency and effectiveness of recycled water projects.

To address these obstacles and stimulate demand for recycled water, several strategies and community incentives can be considered.

- Focusing on investing in public education and outreach efforts to raise awareness about the safety and the benefits of recycled water and ultimately to improve public perception and acceptance
- Advocating for a streamlined and consistent permitting process to reduce delays and uncertainties in project development
- Employing standardized messaging
- Identifying and accessing various funding sources, such as grants, loans, and low-interest financing, to help alleviate the financial burden associated with recycled water projects
- Collaborating with other water and wastewater agencies to reduce cost and share resources to make projects more feasible
- Investing in research and development of new technologies to develop more cost-effective treatment methods and improve water quality, thereby addressing some operational challenges

Financial incentives for end-users to transition from potable water systems to recycled water, along with incentives for project development, can stimulate demand and promote broader adoption. Regional collaboration through shared data (e.g., Geographic Information System (GIS) data) can identify opportunities for surplus and need in multijurisdictional areas. Supporting legislation and regulations that align with public health protection and state goals can facilitate project development. Also, exploring innovative financing mechanisms and considering different ownership models, such as partnerships or public-private collaborations, can help surmount funding challenges and advance the case for water recycling.

Examples of approaches used elsewhere include the purple pipe system implemented by the Las Virgenes Municipal Water District. Recycled water is often sold at a lower cost than potable water. For example, the West Basin Municipal Water District provides recycled water for irrigation and industrial uses by selling the recycled water at a lower cost than potable water.

In summary, addressing the challenges related to permitting, regulations, public perception, costs, and operational issues while simultaneously promoting public education, innovative financing, partnerships, and standardized messaging can collectively stimulate recycled water demand and mitigate challenges, including pricing concerns, to enhance the successful implementation of water reuse projects.

3.4. Water and Wastewater Agencies within the Study Area

This section identifies water and wastewater agencies with jurisdiction over potential recycled water in the Metropolitan service area, describes potential sources of water for recycling, summarizes the quantities of recycled water available, and discusses existing wastewater recycling opportunities.

3.4.1. Agencies with Jurisdiction

Metropolitan comprises 26 voluntary member agencies, encompassing 14 cities, 11 municipal water districts, 4 groundwater basins, and 1 county water authority across 5,200 square miles. Metropolitan operates as a water wholesaler and has no direct retail customers. Instead, it supplies both treated and untreated water directly to its member agencies, which then distribute the water resources to the residents of 152 cities and 89 unincorporated communities. Figure 3-3 shows the locations of the wastewater treatment facilities within the Metropolitan Water District of Southern California. Table 3-6 lists the member municipal water districts (11), cities (14), and county water authority (1) that belong to Metropolitan. Metropolitan is divided into four regions: The Los Angeles Basin, Orange County, San Diego, and the Inland Empire (Table 3-7). Within each region, a Project Advisory Committee has been established to provide guidance and feedback as PWSC progresses.

Table 3-6. Metropolitan Water District of Southern California Member Municipal Water Districts, Cities, and County Water Authorities

Municipal Water Districts (11)	Member Cities (14)	County Water Authorities (1)
Calleguas *	Anaheim *	San Diego *
Central Basin *	Beverly Hills	—
Foothill *	Burbank *	—
Inland Empire *	Compton	—
Eastern *	Fullerton	—
Las Virgenes *	Glendale *	—
Orange County *	Long Beach *	—
Three Valleys	Los Angeles *	—
Upper San Gabriel Valley *	Pasadena *	—
West Basin *	San Fernando	—
Western *	San Marino	—
—	Santa Ana	—
—	Santa Monica *	—
—	Torrance *	—

Source: Metropolitan 2016, UWMP Table 1-1 Page 1-7.
Notes:
* Denotes member agencies with jurisdiction over recycled water.
— = not applicable

Table 3-7. Cities (152) and Unincorporated Communities (89) That Receive Water Resources from Metropolitan Member Agencies

Metropolitan Member Agencies			
Calleguas MWD	**Eastern MWD**	**MWD of Orange Co. (cont'd)**	**West Basin MWD (cont'd)**
Camarillo	Good Hope	San Juan Capistrano	Lomita
Camarillo Heights	Hemet	Seal Beach	Malibu
Fairview	Homeland	Stanton	Manhattan Beach
Lake Sherwood Valley	Juniper Flats	Tustin	Marina del Rey
Las Posas	Lakeview	Tustin Foothills	Palos Verdes Estates
Moorpark	Mead Valley	Villa Park	Rancho Palos Verdes
NAWS Point Mugu	Menifee	Westminster	Redondo Beach
NCBC Port Hueneme	Moreno Valley	Yorba Linda	Rolling Hills
Oak Park	Murrieta		Rolling Hills Estates
Oxnard	Murrieta Hot Springs	**Three Valleys MWD**	Ross-Sexton
Port Hueneme	Nuevo	Azusa	Topanga Canyon
Santa Rosa Valley	North Canyon Lake	Charter Oak	West Adams
Simi Valley	Perris	Claremont	West Hollywood
Somis	Quail Valley	Covina	
Thousand Oaks	Romoland	Covina Knolls	**Western MWD of Riverside County**
	San Jacinto	Diamond Bar	
Central Basin MWD	Sun City	Glendora	Bedford Heights
Artesia	Temecula	Industry	Canyon Lakes
Bell	Valle Vista	La Verne	Corona
Bellflower	Winchester	Pomona	Eagle Valley
Bell Gardens		Rowland Heights	El Sobrante
Cerritos	**Las Virgenes MWD**	San Dimas	Jurupa
Commerce	Agoura	So, San Jose Hills	Lake Elsinore
Cudahy	Agoura Hills	Walnut	Lake Mathews
Downey	Calabasas	West Covina	March AFB
East Los Angeles	Chatsworth		Murrieta
Florence	Hidden Hills	**Upper San Gabriel Valley MWD**	Norco
Hawaiian Gardens	Lake Manor	Arcadia	Riverside
Huntington Park	Malibu Lake	Avocado Heights	Rubidoux
La Habra Heights	Monte Nida	Baldwin Park	Temecula
Lakewood	Westlake Village	Bradbury	Temescal Canyon
La Mirada	West Hills	Citrus	Woodcrest
Lynwood		Covina	
Maywood	**MWD of Orange County**	Duarte	**San Diego CWA**
Montebello	Aliso Viejo	El Monte	Alpine
Norwalk	Brea	Glendora	Bonita

Metropolitan Member Agencies			
Paramount	Buena Park	Hacienda Heights	Bonsall
Pico Rivera	Capistrano Beach	Industry	Camp Pendleton
Santa Fe Springs	Corona Del Mar	Irwindale	Carlsbad
Signal Hill	Costa Mesa	La Puente	Casa De Oro
South Gate	Coto de Caza	Mayflower Village	Chula Vista
South Whittier	Cypress	Monrovia	Del Mar
Vernon	Dana Point	Rosemead	El Cajon
Whittier	Fountain Valley	San Gabriel	Encinitas
	Garden Grove	South El Monte	Escondido
Foothill MWD	Huntington Beach	South Pasadena	Fallbrook
Altadena	Irvine	South San Gabriel	Lakeside
La Cañada Flintridge	Laguna Beach	Temple City	La Mesa
La Crescenta	Laguna Hills	Valinda	Lemon Grove
Montrose	Laguna Niguel	West Covina	Mouth Helix
	Laguna Woods	West Puente Valley	National City
Inland Empire	La Habra		Oceanside
China	Lake Forest	**West Basin MWD**	Pauma Valley
Chino Hills	La Palma	Alondra Park	Poway
Fontana	Leisure World	Carson	Rainbow
Montclair	Los Alamitos	Culver City	Ramona
Ontario	Mission Viejo	El Segundo	Rancho Santa Fe
Rancho Cucamonga	Monarch Beach	Gardena	San Diego
Upland	Newport Beach	Hawthorne	San Marcos
	Orange	Hermosa Beach	Santee
	Placentia	Inglewood	Solana Beach
	Rancho Santa Margarita	Ladera Heights	Spring Valley
	San Clemente	Lawndale	Valley Center
	South Laguna	Lennox	Vista

Source: Metropolitan 2016, UWMP Table 1-3 Page 1-9.
AFB = Air Force Base
CWA = County Water Authority
MWD = Metropolitan Water District
NAWS = Naval Air Weapons Station
NCBC = Naval Construction Battalion Center

3.5. Potential Sources of Recycled Water, Facilities, and Current Water Reclamation

As part of the UWMP preparation, a database of the wastewater facilities, operating agency, location, elevation, treatment extent, capacity, anticipated production, method of effluent disposal and effluent water qualities were generated. The database is composed of 89 plants identified within Metropolitan's service area. A summary of the combined capacity from the 89 plants is summarized in Table 3-8.

Table 3-8. Existing and Projected Total Effluent Capacity
(Wastewater Treatment Plants Within Metropolitan's Service Area)

Treatment Level	2002 Capacity (MGD) [1]	2040 Capacity (MGD) [1]
Primary	1,770	3,139
Secondary	1,169	2,708
Tertiary	434	1,464
Advanced	104	229

Source: Metropolitan 2021a, UWMP Table 3-8.

Notes:

1. The data were compiled as part of the Southern California Comprehensive Water Reclamation and Reuse Study in 2002 (Reclamation 2002). As of the date of the 2020 UWMP, this reuse study has not been updated to reflect new information.

MGD = million gallons per day

Potential sources of recycled water are effluent from all WRPs in the Metropolitan service area (Table 3-5). Within Metropolitan's jurisdiction, there are approximately 1,770 MGD of primary treated wastewater and 1,169 MGD of secondary treated wastewater, as shown in Table 3-8. By 2040, these capacities are expected to increase to 3,139 MGD and 2,708 MGD, respectively. Tertiary and advanced treatment processes could be used to provide further treatment to these flows to increase the recycled water production. See Figure 3-3 for the locations of the wastewater treatment facilities in the Metropolitan service area.

Figure 3-3. Map of the Wastewater Treatment Facilities in the Metropolitan Service Area

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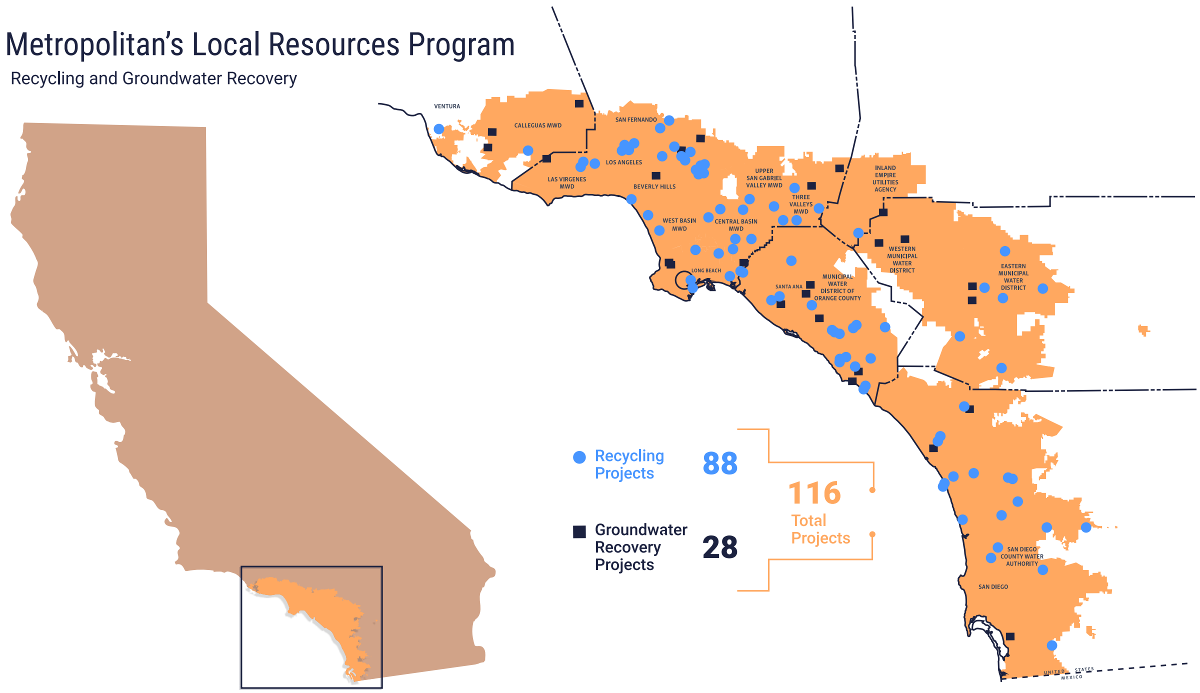
3.5.1. Current Water Recycling

Since 1982, Metropolitan has invested in local regional water supply reliability projects through the LRP. The LRP accelerates the development of local projects by incentivizing agencies within Metropolitan's service area to construct recycled water, groundwater recovery and seawater desalination projects. Today, LRP projects support nearly half the recycled water and groundwater recovery production in the district's service area. Per the January 2018 Local Resource Project Summary Report, the Metropolitan service area includes 85 recycled water projects that range in uses. Figure 3-4 shows the location of the projects by area.



Source: Metropolitan 2021c, Figure A.

Figure 3-4. Recycled Water and Groundwater Recovery Projects

Within the Metropolitan service area, there is a significant volume of wastewater treatment, recycled water production, and recycled water use taking place. Specifically, within the Sanitation Districts, the total effluent produced, which includes the Warren Facility, amounts to 348 MGD (389,854 AFY) (Table 3-9). In addition, the Sanitation Districts generates a substantial amount of recycled water, totaling 149 MGD (166,635 AFY), and 103 MGD (115,058 AFY) are used for various purposes within the districts. Table 3-10 shows the quantity of water used for various recycled water uses.

Table 3-9. Effluent and Recycled Water Production by System in the Sanitation Districts

System	Total Effluent Produced (AFY)	Total Recycled Water Produced (AFY)	Recycled Water Used (AFY)
Joint Outfall System	389,854	121,051	94,383
Santa Clarita	—	20,600	426
Antelope Valley	—	24,984	20,249
Total	**389,854**	**166,635**	**115,058**

Source: Sanitation Districts no date (est. 2023), page xii.
Notes:
— = not applicable
AFY = acre feet per year

Table 3-10. Types and Quantities of Recycled Water Use

Recycled Water Use	Quantity Used (AFY)	% of Total Reuse
Groundwater replenishment	70,094	60.9%
Landscape irrigation	20,508	17.8%
Agriculture	16,453	14.3%
Industrial	3,746	3.3%
Environmental	4,266	3.7%

Source: Sanitation Districts no date (est. 2023), page xii.
Notes:
AFY = acre-feet per year

As of 2020, recycled water produced within Metropolitan's service area is predominantly used for groundwater replenishment, landscape irrigation, and industrial processes and applications in the region. Inland treatment plants in Riverside and San Bernardino Counties irrigate feed and fodder crops with recycled water.

3.5.2. Current and Projected Wastewaters and Disposal Options

Metropolitan's goal is to convert wastewater into recycled water rather than discharging it into the Pacific Ocean. The design capacity and recycled water production for the Sanitation Districts' facilities, a central focus of this initiative, are summarized in Table 3-11. With potable reuse implementation, RO in the advanced water treatment process would produce RO concentrate, which must be discharged to the ocean via existing outfall systems. Under PWSC, the Warren Facility would transition to producing recycled water from a portion of the treated wastewater flow that was previously discharged into the ocean.

Table 3-11. Recycled Water Production Facilities Receiving Source Water from WRPs within Metropolitan Service Area

Influent Source	WRP Owner	WRP Name	Highest Treatment Train*	Influent Flow (MGD)	Current/ Future Recycled Water Users
Orange County Sanitation District Reclamation Plant No.1	Orange County Water District	Groundwater Replenishment System	Tertiary	130	Groundwater recharge Anaheim Canyon Power Plant Anaheim Regional Transportation Intermodal Center Anaheim Adventure Park
Los Angeles City Sanitation Hyperion WRF	West Basin Municipal Water District	Edward C. Little Water Recycling Facility (Title 22 Treatment Plant)	Secondary-Tertiary-AWPF	61.3	West Coast Basin Seawater Barrier Dominguez Gap Barrier Industry and agriculture users Chevron Nitrification Plant Torrance Refinery Juanita Millender-McDonald Carson Regional WRP (Carson Regional WRP)
Colton WWTP	San Bernardino Municipal Water Department	Rapid Infiltration and Extraction WRP	AWPF	33	—
Donald C. Tillman WRP	Los Angeles Department of Water and Power	Donald C. Tillman Advanced Water Purification Facility	AWPF	19	Groundwater Recharge
San Jose Creek Water Reclamation East & West Plants	Water Replenishment District	Albert Robles Center for Water Recycling and Environmental Learning *	AWPF	14.8	City of Pico Rivera Montebello Forebay Groundwater Recharge
Terminal Island WRP	City of Los Angeles Sanitation District	Terminal Island WRP AWPF *	AWPF	12	Los Angeles Department of Water & Power Harbor Generating Station Dominguez Gap Barrier Machado Lake Harbor area industrial users Los Angeles Harbor irrigation
WBMWD Edward C. Little WRF	West Basin Municipal Water District	West Coast Seawater Intrusion Barrier Facility	AWPF	12	Saltwater Barrier
Ray Stoyer Water Recycling Facility (former name Padre Dam WRF)	East County Join Powers Authority	East County AWPF *	AWPF	11.5	East San Diego County
Long Beach WRP Los Coyotes WRP	Water Replenishment District	Leo J. Vander Lans Water *	AWPF	8	Long Beach Water Department Alamitos Seawater Intrusion Barrier Groundwater Recharge/ Seawater Intrusion Barrier
Camp Pendleton Sewer Treatment Plants #1, #2, #3	Camp Pendleton Marine Corps Base	Southern Region Tertiary Treatment Plant (Camp Pendleton Sewer Treatment Plant #13) *	Tertiary	7.5	Camp Pendleton Irrigate the Naval Hospital, Golf Course and Parade Grounds
WBMWD Edward C. Little WRF	West Basin Municipal Water District	Juanita Millender-McDonald Carson Regional WRP (Carson Regional WRP)	AWPF	7.15	Industrial users
EWA Encina Water Pollution Control Facility	Carlsbad Municipal Water District	Carlsbad WRF	Tertiary-AWPF	7	Carlsbad Municipal Water District La Costa Golf Course, Park Hyatt Resort and Golf Course The Crossings @ Carlsbad Golf Course Legoland California Grand Pacific Palisades Hotel Karl Strauss Brewery
Oxnard WWTP	Ventura Regional Sanitation District	Oxnard AWPF *	AWPF	6.25	Seawater intrusion barrier Agricultural and landscape irrigation users
WBMWD Edward C. Little WRF	West Basin Municipal Water District	Chevron Nitrification Plant	Secondary	5	Chevron El Segundo Refinery
San Bernardino WRP	San Bernardino Municipal Water Department	San Bernardino Tertiary Treatment System	Tertiary	5	Irrigation Use (Parks, Golf Courses)
WBMWD Edward C. Little WRF	West Basin Municipal Water District	Torrance Refinery Water Recycling Plant *	AWPF	4.9	Torrance Refinery
Hale Ave. Resources Recovery Facility	City of Escondido	Membrane Filtration/Reverse Osmosis (MFRO) Facility*	AWPF	2	Agricultural Reuse

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Influent Source	WRP Owner	WRP Name	Highest Treatment Train*	Influent Flow (MGD)	Current/ Future Recycled Water Users
South Bay WRP	Otay Water District	Ralph W. Chapman WRF	Tertiary	1.1	Irrigation
Municipal Wastewater	City of Santa Monica	Santa Monica SWIP	AWPF	1	Santa Monica Groundwater Basin
EWA Encina Water Pollution Control Facility	Leucadia Wastewater District	Forest R. Gafner WRF	Tertiary	1	La Costa Golf Course
Municipal Wastewater	City of Santa Monica	Santa Monica SWIP	AWPF	1	Santa Monica Groundwater Basin
3A Water Reclamation Plant	Santa Margarita Water District	Lake Mission Viejo Advanced Purified Water Treatment Facility *	AWPF	0.72	Lake Mission Viejo

Notes:
* = Not included in the plant location maps in Reclamation 2002.
— = not applicable
AWPF = Advanced Water Purification Facility
EWA = Encina Wastewater Authority
MGD = million gallons per day
SWIP = Sustainable Water Infrastructure Project
WBMWD = West Basin Municipal Water District
WRF = Water Resource Facility
WRP = Water Reclamation Plant
WWTP = Wastewater Treatment Plant

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3.5.3. Opportunity for Recycled Water Production at the Warren Facility

As mentioned previously, the Warren Facility presents an excellent option for recycled water production for PWSC. Currently, the facility produces an average of 235 MGD of secondary effluent; with additional treatment, this effluent could serve as a significant source of recycled water. The Warren Facility is one of the largest water resource facilities (WRFs) in Metropolitan's service area that has not initiated recycled water production. Therefore, enabling water recycling at this facility would signify a crucial milestone in securing water sustainability for the future in the region.

3.6. Technologies Currently in Use

Existing Recycled Water Treatment Processes. Recycled water treatment processes consist of different physio-chemical processes to achieve the necessary pathogen log reduction credits and chemical removal for the type of reuse desired. Table 3-12 lists different recycled water uses with their minimum respective treatment technology types.

Table 3-12. Overview of Treatment Technologies Utilized for Various Recycled Water Uses

Use	Treatment Technology
Discharge to river	Gravity filters Disinfection
Agriculture irrigation–Fodder crops	Filtration: Cloth-media filters Gravity filters Disinfection
Landscape irrigation	Filtration: Dual-media pressure filters Gravity filters Cloth-media filters Disinfection
Industrial applications	Gravity filters Disinfection
Indirect potable reuse–Groundwater recharge via surface spreading (when diluent water is present)	Gravity filters UV disinfection
Indirect potable reuse–Groundwater recharge/saltwater barrier via surface spreading or injection wells	Microfiltration/MBR RO UV/AOP

Notes:
MBR = membrane bioreactor
RO = reverse osmosis
UV = ultraviolet
UV/AOP = ultraviolet / advanced oxidation process

Secondary Treatment Innovation Opportunities. Some of the WRPs in the Metropolitan service area use conventional activated sludge or high-purity oxygen secondary treatment processes. Effluent from high-purity oxygen treatment with shorter solids retention time typically has higher levels of biofoulants, which can accelerate fouling in the downstream membranes. If potable reuse is to be implemented, an additional microfiltration unit process would be required downstream of the secondary clarifiers to minimize fouling on RO membranes.

Alternatively, membrane bioreactors (MBRs) can be used to address both issues described above (microfiltration can only address the fouling issue). The intensive MBR research efforts and challenge testing undertaken by the PWSC team using the primary and secondary effluent from the Warren Facility have played a crucial role in confirming the viability of the MBR process for PWSC, demonstrating the reliability of MBR as a pathogen barrier to California DDW and supporting the path forward in granting future pathogen log reduction values (LRVs) for MBRs.

4. Description of Alternatives

Description of Alternatives (WTR 11-01)

The following information is required:

(a) Description of the non-Federal funding condition. The reasonably foreseeable future actions that the non-Federal project sponsor would take if Federal funding were not provided for the proposed water reclamation, recycling or desalination project, including estimated costs.

(b) Statement of the specific objectives all alternatives, including the water reclamation, recycling or desalination project, are designed to address.

(c) Description of the proposed water reclamation, recycling or desalination project including detailed project cost estimate; annual operation, maintenance, and replacement cost estimate; and life cycle costs shall be provided with sufficient detail to permit a more in-depth evaluation of the project, including non-construction costs. In this regard, the cost estimates shall clearly identify expenditures for major structures and facilities, as well as other types of construction and non-construction expenses and shall be based on calculated quantities and unit prices.

(d) The estimated costs shall also be presented in terms of dollars per million gallons (MG), and/or dollars per acre-foot of capacity, to facilitate comparison of alternatives described in Paragraph 4.B.(5) below. References, design data, and assumptions must be identified. The level of detail shall be as required for feasibility studies in RM D&S, Cost Estimating (FAC 09-01).

(e) Description of waste-stream discharge treatment and disposal water quality requirements, if applicable, for the proposed water reclamation, recycling or desalination project.

(f) Description of one or more alternative technologies that could be used in the proposed water reclamation, recycling or desalination project under consideration. Where a project only consists of reclaimed, recycled or desalinated water distribution, alternative plans for distribution or implementation will be provided. These alternatives must be approved by the state(s) or tribal authorities in which the project will be located.

Description of Alternatives (WTR TMR-128)

WTR 11-01 Paragraph 3.B.(4) requires a description of the proposed project and a comparison to alternatives that would satisfy the same water demand as the proposed project. Feasibility studies for Large-Scale Water Recycling projects must also include the following additional requirements:

(a) A description of a reasonable range of viable alternatives that would satisfy the same water demand as the proposed project, including other water supply sources and/or project types that are practicable, feasible, and meet the planning objectives.

(b) A description of the baseline condition without the proposed project or any of the alternatives.

(c) Alternative plans must clearly identify and evaluate the trade-offs among stakeholders and resources. The viability of an alternative will be determined through an evaluation of its acceptability, efficiency, effectiveness, and completeness. Alternative plans will be formulated based on most likely future conditions expected with and without implementation of a plan.

(d) Consideration of the impact of climate change in the trade-off analysis and the comparison of alternatives.

(e) In lieu of the cost information required in WTR 11-01 Paragraphs 3.B.(4) (c) and (d), Large-Scale Water Recycling Projects will be required to provide the cost information described in Paragraph 3.B.(2), below.

> *(2) Economic Analysis. For projects considered under the Large-Scale Water Recycling Program, the non-Federal project sponsor must submit the following information for the economic analysis as part of the feasibility study report in lieu of the information described in WTR 11-01 Paragraph 3.B.(5).*

(a) Description of the conditions that exist in the area and provide projections of the future with, and without, the project. Emphasis in the analysis must be given to the contributions that the plan could make toward meeting the future water demand in an efficient and economically sound manner.

(b) Identification of all project-related costs for the selected water reclamation or recycling project and the alternatives identified. Costs must be provided for all planning, design, and construction activities as well as operations and maintenance costs. Cost estimates must be presented in terms of pay items, quantities, unit prices, contract costs, non-contract costs, and escalation. Cost estimates for the final analyzed alternatives shall be at a sufficient design level to conduct the comparisons required in subsection (d). Cost estimates shall include: (i) Pay Items – Abbreviated descriptions of work for which payments or charges to accounts are made. Pay items represent a logical and practical breakdown of the proposed work into separate and distinct classes of work.

> *(ii) Quantities – The quantities for pay items shall be presented by a number and a unit of measure such as pounds, cubic yard, or another unit that most appropriately represents the measurement for the particular pay item.*
>
> *(iii) Unit Prices – Current unit prices shall be used in all estimates and identified.*
>
> *(iv) Contract Cost – The contract cost represents the estimated cost of the contract at time of bid or award and will include allowances for design contingencies and for procurement strategies, but not construction contingencies.*
>
> *(v) Non-Contract Cost – Costs associated with work or services provided in support of the project, these may include project management, investigations and data collection, construction management, environmental compliance, and archeological considerations.*

(vi) *Escalation – For projects that are to be developed over an extended period of time, or at some distant time in the future, estimates may account for escalation that may occur.*

This section states the project objectives and then describes the alternatives for meeting those objectives. A description of the baseline condition is provided in the No-Action Alternative. The description includes both capital and long-term costs for operation, maintenance, and replacement. After the description of the baseline condition, the alternatives are evaluated for their effectiveness, efficiency, completeness, and acceptability.

4.1. Reasonably Foreseeable Future Actions

The reasonably foreseeable future without the project is consistent with the evaluation of projected water supply and demand in Chapter 2 of this Feasibility Study. Metropolitan would continue to rely on a combination of imported water and local water supplies (including existing recycled water and groundwater resources). In addition, the Warren Facility would continue to discharge to the ocean, and any future restrictions on ocean discharge may necessitate additional capital improvements for compliance.

As discussed in Chapter 2, imported water supplies and allocations from the SWP and the CRA have been highly variable (Figure 2-6) and heavily impacted by drought. Local supplies, including groundwater and existing recycled water, are more resilient to drought and climate change, though groundwater levels have been declining in local basins (Figure 2-8). Additional actions to improve local supply are underway, as described in Section 2.1.3. The 2020 IRP has evaluated a framework of supply and demand scenarios to assess the effects of climate change, regulatory requirements, and the economy. As shown in Sections 2.1.3 and 2.2.3, future shortages are anticipated under all scenarios.

4.2. Project Objectives

The initial step in the development of alternatives was the establishment of the overall objectives for PWSC. Alternatives were developed to achieve the following objectives:

- Provide a new high-quality local water source that is reliable, cost-effective, and climate-change resilient to help meet regional water demands, with expedited or phased deliveries of such supplies where feasible.
- Diversify Metropolitan's water supply portfolio, increase regional operational flexibility, and provide opportunities for improved coordination and future integration with other water supply and distribution systems.
- Contribute to the water supply and water quality of local groundwater basins.

- Provide improved wastewater treatment to maximize beneficial reuse of wastewater that would otherwise be discharged into the ocean while complying with water quality requirements for ocean discharge.
- Further statewide goals of increasing use of recycled water as a sustainable, environmentally sound water source for indirect and direct potable reuse.
- Reduce reliance on imported water supplies and provide greater resilience of local water supplies.
- Increase the locally available water supply to protect against seismic events and service disruptions.

4.3. Non-Federal Funding Condition

Metropolitan is committed to improving the resilience of local water supply to meet the regional demand in accordance with the IRP findings (Metropolitan 2022a). It will be necessary to advance a project with or without federal funding. The absence of federal funding would likely delay the project and increase the likelihood of water shortages if severe drought conditions occur. Delays would include postponing the start of major facility design until after the approval of the EIR. This postponement would result in a delay of about 2 years or more. The later construction start date would also increase the cost of construction.

4.4. Development of Alternatives

WTR 11-01 Paragraph 3.B.(4) requires a description of the proposed project and a comparison to alternatives that would satisfy the same water demand as the proposed project. Potential alternatives include other water supply sources and/or project types that are practicable, feasible, and meet the planning objectives.

The alternatives considered must include a description of the baseline condition without the proposed project or any of the alternatives (i.e., the No-Action Alternative).

The evaluation of alternative plans must analyze the trade-offs among stakeholders and resources. The viability of an alternative will be determined through an evaluation of its acceptability, efficiency, effectiveness, and completeness. Alternative plans are developed and evaluated based on the most likely future conditions expected with and without implementation of a plan. The evaluation includes consideration of the impact of climate change in the trade-off analysis and the comparison of alternatives.

Identification of all project-related costs is required for the selected water recycling project and the alternatives identified. Costs must be provided for all planning, design, and construction activities as well as operation and maintenance costs. Cost estimates must be presented in terms of pay items, quantities, unit prices, contract costs, non-contract costs, and escalation. PWSC is currently in the planning stage and the estimates provided in this report are continuing to evolve. Estimating details for individual project components were assembled into a comprehensive estimate in 2023. The cost continues to be updated and refined as design activities advance, and pending project stage updated cost estimates can be provided to Reclamation as they are finalized.

Two action alternatives in addition to the No-Action Alternative are developed below for detailed evaluation. This evaluation focused on large infrastructure alternatives capable of meeting the scale of the problems and needs discussed in Chapter 2 of this report.

4.5. No-Action Alternative

The No-Action Alternative characterizes the without-project condition and provides a baseline for the analysis of alternatives. Under this alternative, imported water supplies would continue in accordance with existing agreements. Local supplies would be operated consistent with current practices and some upgrades in conveyance would be performed, as described in Section 2.1.3, Project Future Supplies.

Local supplies such as groundwater face significant uncertainties and stress under the No-Action Alternative. Groundwater basin yields are the result of local rainfall, replenishment with imported supplies, and locally recycled water. The replenishment provided by imported supplies has decreased in recent years due in part to the effects of extended drought on allocations from the SWP and CRA. Natural replenishment has decreased due to years of drought. Groundwater elevations in the Main San Gabriel and Central Basins have declined in recent years. Under the No-Action Alternative, these conditions would be expected to persist or worsen. The No-Action Alternative provides a baseline condition for comparison with the action alternatives. The No-Action conditions are consistent with the those presented in Chapter 2, Problems and Needs.

Under the No-Action Alternative, operations at the Warren Facility would continue consistent with existing and future regulatory requirements. Treated wastewater from this Sanitation Districts facility would be discharged to the ocean without beneficial use. Upgrades to the Warren Facility would be needed to comply with additional requirements for wastewater discharge via the ocean outfall.

4.6. Alternative 1: Pure Water Southern California

The primary goal of the overall PWSC Program is to provide a total of 150 MGD (155,000 AFY) for non-potable reuse application, groundwater basin recharge and direct augmentation of water supplies for two of Metropolitan's WTPs. The total annual recycled water benefit has been adjusted for an "online factor" of 92 percent to account for facility downtime for maintenance and other activities, which results in an actual product water quantity of 155,000 AFY of a new, climate resilient water supply for the region. This factor is implicit in all AFY benefits presented as it pertains to the actual anticipated production capacity, not the total facility capacity. The PWSC Program will be delivered over two phases. Alternative 1 (PWSC Phase 1) would deliver 115 MGD (118,590 AFY) and the future Phase 2 project would deliver an additional 35 MGD (37,122 AFY) of DPR water. Phase 1 of PWSC would produce a total recycled water benefit of approximately 118,590 AFY by delivering 66 MGD of IPR, 24 MGD of NPR, and 25 MGD of DPR water.

Planning studies identified the Warren Facility, which has an ultimate effluent capacity of 400 MGD, as the largest untapped source of recycled water in Metropolitan's service area. Currently, 100 percent of the wastewater flows from this facility are discharged to the Pacific Ocean. The facility has an average daily flow of approximately 230 to 240 MGD. The centralized treatment at the Warren Facility, along with its size, available space for siting new equipment, and proximity to the Pacific Ocean, provides an opportunity for Metropolitan and the Sanitation Districts to implement a large-scale recycled water project while leveraging economies of scale for an efficient, environmentally sound, and cost-effective operation that maximizes existing infrastructure.

PWSC would implement critical infrastructure adjacent to the Sanitation Districts' Warren Facility to establish the advanced treatment capacity and conveyance infrastructure, which would produce 115 MGD (118,590 AFY) of purified water (90 MGD) for NPR and IPR and 25 MGD of water for DPR on completion of construction. The purified water would then be conveyed via new backbone pipeline to the north to the City of Azusa (Figure 4-1) and to the east to the City of La Verne. The purified water (IPR) would be used to recharge the West Coast, Central, Main San Gabriel, and Orange County Groundwater Basins through spreading facilities and injection wells (i.e., through groundwater augmentation) and to augment water supplies at Metropolitan's Weymouth WTP in La Verne, California, and eventually the Diemer WTP in Yorba Linda, California, for DPR (raw water augmentation).

Figure 4-1: Pure Water Southern California Project Area

In addition to providing indirect and direct potable reuse, agencies such as the West Basin Municipal Water District and the LADWP would potentially be able to connect to the proposed conveyance facilities to serve non-potable users. A portion of the non-potable water would be used to support PWSC and Warren Facility operations and irrigation needs at Sanitation Districts' leased properties and nearby parks.

PWSC would provide enough water for half-a-million households per year, making it one of the largest recycled water projects in the world. PWSC would create direct and indirect benefits throughout Metropolitan's 5,200-square-mile service area and beyond.

Proposed facilities to implement PWSC (see Table 4-1) include modifications to the existing Warren Facility, a new AWPF adjacent to the Warren Facility, DPR treatment facilities, pipelines, pump stations, service connections, groundwater recharge facilities and improvements, and ancillary facilities as needed.

4.6.1. Treatment Facilities

The Warren Facility, in the City of Carson, is one of 11 wastewater treatment plants in the Sanitation Districts' system and is one of the largest wastewater treatment plants in the world, providing both primary and secondary treatment (Figure 4-2). The Warren Facility currently produces an average monthly flow ranging from 237 to 261 MGD (2015 through 2022 data) of non-nitrified secondary effluent (in compliance with its National Pollutant Discharge Elimination System [NPDES] permit limits and mass emission benchmark). Wastewater secondary effluent from the Warren Facility is currently being discharged into the ocean.

Treated effluent from the Warren Facility would be the source for all PWSC processes. Existing wastewater treatment processes at the Warren Facility include screening, grit removal, primary sedimentation, high-purity oxygen activated sludge, secondary clarification, and disinfection. All water treated at the plant receives secondary treatment.

Warren Facility Improvements: Some modifications at the Warren Facility are required for the implementation of the PWSC alternative, including constructing a new side-stream centrate treatment system and operating existing high purity oxygen–activated sludge reactors in nitrification/denitrification (NdN) mode (high purity oxygen Ludzack-Ettinger [HPOLE]), The modifications are intended to lower the ammonia and nitrogen concentrations of the influent to the proposed AWPF (RO system) to meet the water quality objectives for groundwater augmentation and DPR.

- Side-Stream Centrate Treatment System**:** Nitrogen management is a key factor to protect public health and the environment and to ensure a safe, reliable supply of recycled water for beneficial reuse. To meet the potable reuse standards, nitrogen management facilities are needed at the Warren Facility. A side-stream centrate treatment process would be constructed to lower the amount of nitrogen being recycled back into the

Warren Facility, meet the IPR and DPR water quality requirements, lower the chemical addition requirements for the AWPF, improve downstream operation of the AWPF processes, and reduce the nitrogen load discharged to the ocean.

- HPOLE: The HPOLE process can achieve nutrient and phosphorus removal. No major modifications to existing mechanical equipment or oxygen feed systems are required to implement HPOLE. The HPOLE process has the ability to reduce the organic and nitrogenous loading, resulting in lower carbon demands in any downstream tertiary treatment process, and allows these downstream processes to be smaller/have fewer units.

- Flow Equalization: Based on the current flow conditions, flow equalization would be provided at the Warren Facility to ensure constant feed to the AWPF. The AWPF would be sized based on the expected long-term wastewater flows to minimize the amount of equalization required. Wet weather peak flows at the Warren Facility generated by storms were not considered to be available for reuse under PWSC due to the unpredictable nature of their occurrence, large volume, and the lack of on-site storage.

Additional information on the Warren Facility and planned improvements to the facility can be found in Appendix B.1.

Table 4-1. Alternative 1 Project Facilities

Components
Warren Facility Modifications
• Side-stream centrate treatment facility
• Campus water recycling system
• Warren Facility connection to secondary effluent channel
Advanced Water Purification Facility
• AWPF site preparation and demolition
• AWPF pretreatment process (influent PS, and screening facilities, MBR)
• Flow equalization and PS
• Advanced water treatment processes (RO and UV/AOP)
• Required ancillary facilities (chemical facilities, ops/admin/electrical buildings, public outreach facilities, lab, warehouse, workshop, EV facilities, training facilities)
• Sitework, yard piping, site electrical, substation
• Pump station for purified water
• Additional ancillary facilities (demonstration garden, amphitheater/innovation center, tour galleries, battery storage, solar panels, parking, and workforce facilities)
Weymouth DPR Treatment Facility
• Treatment train—depends on pilot testing
Conveyance Facilities (Approximately 42 miles)
• Reach 1: Includes outlets to service connections 1 and 2
• Reach 2: Includes outlet to service connection 3
• Reach 3: No service connections
• Reach 4: No service connections
• Reach 5: Includes outlet to service connection 4
• Reach 6: No service connections
• Reach 7: No service connections
• Reach 8: Includes outlets for service connections 5 to 9
• Azusa pipeline improvements for Phase 1 DPR to Weymouth
Pump Stations
• Whittier Narrows PS (within reach 6)
• Santa Fe Spreading Grounds PS (within reach 8)
• Two DPR PSs to Azusa: San Gabriel Canyon Spreading Grounds PS and Big Dalton PS (along the existing DPR Azusa pipeline) with operational storage at Weymouth
Recharge Facilities
• Injection wells
• Spreading facilities improvements (tied to rock pit & other)
• Relocation of wells at Canyon Spreading Grounds
Other
• Southern California Edison off-site electrical supply facilities
• Land (rock pit or other percolation pond property)

Notes:
General Note: Phase 1 facilities.
AWPF = Advanced Water Purification Facility
Azusa pipeline = Devil Canyon–Azusa pipeline
DPR = direct potable reuse
EV = electric vehicle
MBR = membrane bioreactor
MWD = Metropolitan Water District of Southern California
PS = pump station
RO = reverse osmosis
UV/AOP = ultraviolet / advanced oxidation process

Source: Metropolitan 2019, Figure 4.1.

Figure 4-2. Warren Facility/Advanced Water Purification Facility

AWPF Site: The AWPF would be adjacent to the Warren Facility. The 52-acre site for the Warren Facility includes 16 acres of mostly vacant area, and an additional 36 acres of vacant land that was formerly used by the Fletcher Oil and Refinery Company.

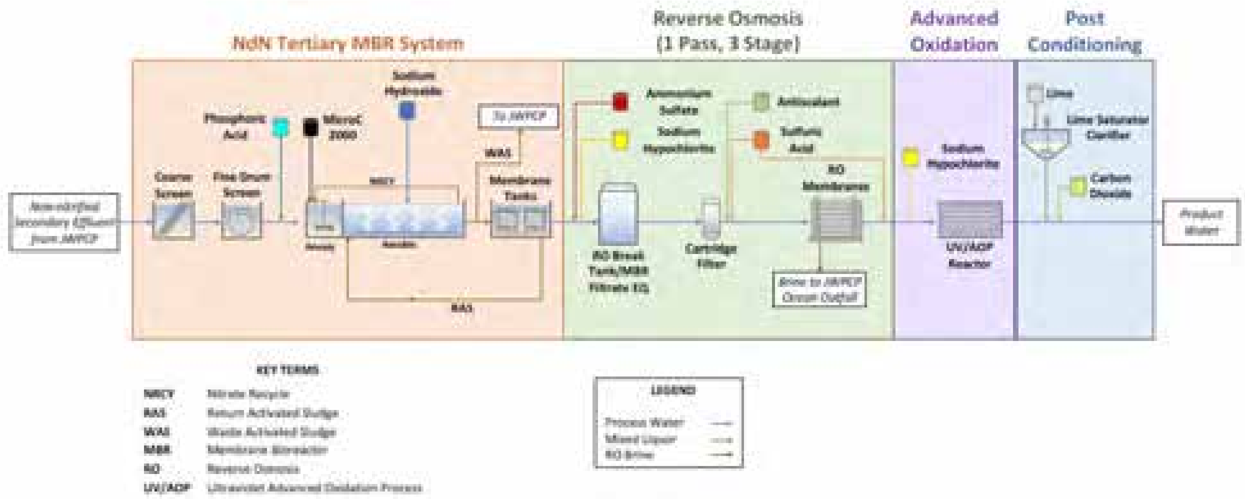
The AWPF is designed to meet requirements for both groundwater replenishment and for raw water augmentation. Treatment would consist of membrane filtration followed by RO and an advanced oxidation process (AOP). This treatment train has proven successful in facilities throughout the world, most notably at the largest potable reuse project in the world—the 130 MGD GWRS facility operated by the OCWD.

Because the Warren Facility produces non-nitrified effluent, the inclusion of an MBR nitrification process would help reduce organics and minimize membrane fouling, and the denitrification process, in combination with RO, would help achieve nitrate levels that meet the Water Quality Control Plan objectives for each specific groundwater basin.

Figure 4-3 provides the potential layout for the AWPF components (influent pump station, screening, chemical feed/storage facilities, product water stabilization/conditioning, MBR, flow equalization, RO, ultraviolet / advanced oxidation process (UV/AOP), and purified water pump station) adjacent to the Warren Facility. Based on Metropolitan's demonstration testing and use of MBR in potable reuse applications (i.e., Morro Bay AWPF) and initial positive feedback from the California DDW, this Feasibility Study assumes that MBR can successfully achieve sufficient pathogen log reduction credit during demonstration testing. The process flow schematic for the base case AWPF is presented on Figure 4-4.

Source: Metropolitan 2023b.

Figure 4-3. Site Layout for the Advanced Water Treatment Facility



Source: Stantec 2022a, Figure 2-1.

Figure 4-4. Flow Schematic for Base Case of AWPF

The AWPF processes are briefly described below.

- Fine Screening: Dedicated screening for the Flex MBR that is expandable to screen flows for future PWSC phases would be provided.
- Flex MBR: The bioreactor sizing reflects the advancement of the flex bioreactor concept that allows for improved operational flexibility and facilitates expansion between operating phases. All biological trains are to be designed to achieve nitrogen targets based on the use of single-pass RO downstream. The Flex MBR is configured to enable operation as tertiary nitrification only (N-only), tertiary NdN, or secondary biological nutrient removal (including nitrogen and phosphorus). Filtrate from the MBR would be fed directly to the RO unit.
- RO: The RO system would remove a significant portion of the dissolved solids, organics, and pathogens that remain after MBR treatment. The RO system is expected to achieve a 1.5 log reduction of viruses, *Cryptosporidium*, and *Giardia*. The RO process area includes the RO feed tank, RO cartridge filters, RO facility, and RO flush tank. This process train utilizes single-pass RO.
- UV/AOP: AOP involves generation of hydroxyl radicals to oxidize organic compounds at ambient temperature and pressure. Hydroxyl radicals are generated through photolysis of an oxidant by UV light, which helps degrade contaminants of concern. UV/AOP is also a highly efficient disinfection process that is capable of achieving at least a 6-log inactivation/ reduction of viruses, Cryptosporidium, and Giardia, which is the maximum log reduction/inactivation disinfection credit that the DDW would allow for any single unit process. Each UV/AOP system would include a UV reactor, a control panel, an oxidant

dosing system, an acid feed system for pH adjustment, and associated instrumentation for monitoring, control, and performance validation.

DPR Site: A portion of the purified water produced at the AWPF would be used as source water for raw water augmentation at Metropolitan's existing Weymouth WTP in La Verne and at the Diemer WTP in Yorba Linda. Purified water would be blended with raw water from the SWP or CRA and undergo additional treatment before entry into Metropolitan's treated drinking water distribution system. Per current regulations, this purified water would be considered DPR, and therefore this water would require additional treatment beyond the AWPF described above before reaching the Weymouth WTP. Metropolitan would perform pilot testing to evaluate alternative treatment technologies for use at the Weymouth WTP to confirm the additional treatment requirements for DPR. With the completion of these pilot tests, the recommended treatment technologies for a 25 MGD DPR facility would be designed and constructed near Weymouth WTP to augment the raw water supply for Weymouth WTP.

Figure 4-3 provides the potential layout for the AWPF components at the Warren Facility. Additional description of the AWPF features is provided in *Updated Opinion of Probable Cost for the NdN Tertiary MBR Based Advanced Water Treatment Facility* (Stantec 2022c), which is included as Appendix B.2 to this Feasibility Study.

Conveyance Facilities: The backbone pipeline would convey purified water over 40 miles from the Carson area to the San Gabriel Valley, primarily for groundwater replenishment and non-potable uses through various service connections with member agencies. The pure water backbone pipeline would be sized for the system's planned 150 MGD capacity under Phase 2. The effluent pipeline would be 84 inches in diameter as far north as the Whittier Narrows and then increase in diameter up to 108 inches in diameter from this location north to the end of the backbone system at the San Gabriel Canyon Spreading Grounds to accommodate a potential future connection and flows from LADWP's Operation NEXT recycled water project. New pump stations and recharge facility modifications would be required. In Phase 1, up to 25 MGD would also be conveyed farther east through the existing San Gabriel Valley Municipal Water District Devil Canyon–Azusa pipeline (Azusa pipeline) for raw water augmentation at Metropolitan's Weymouth WTP, in La Verne. The recommended backbone pipeline alignment with reaches is shown on Figure 4-1. Additional information regarding the conveyance facilities is provided in *Feasibility Level Design Report: Backbone Conveyance* (B&V 2020). A copy of this report is provided as Appendix B.3 to this Feasibility Study.

Three proposed pump stations would pump water along the backbone pipeline from the AWPF uphill to the San Gabriel Canyon Spreading Grounds. In addition to the pump station at the AWPF (reach 1), a second pump station would be located near Whittier Narrows (reach 5), with a third near the Santa Fe Spreading Grounds (reach 8).

The San Gabriel Valley Municipal Water District's existing Azusa pipeline could potentially be used to convey up to approximately 25 MGD of purified water to the Weymouth WTP in Phase 1. Two new pump stations (including the San Gabriel Canyon Pump Station and Big Dalton Pump Station) would be required along the Azusa pipeline to pump the water eastward toward the Weymouth WTP. Adding further capacity during Phase 2 could result in an additional DPR pipeline with one additional pump station in the future.

Metropolitan would provide metered service connections at various locations along the DPR pipelines to monitor DPR use.

4.6.2. Groundwater Recharge Facilities

The groundwater basin analysis considered four basins: Central, West Coast, Main San Gabriel, and Orange County. These basins were selected based on their proximity to the Warren Facility and their ability to accommodate recharge. Purified water from PWSC discharged into groundwater basins via spreading facilities and injection wells would be used for IPR purposes. Groundwater recharge via spreading facilities could occur at the San Gabriel Canyon Spreading Grounds, the Santa Fe Spreading Grounds, other recharge areas near the Santa Fe Dam, the Rio Hondo Coastal Spreading Grounds, the San Gabriel Coastal Spreading Grounds, and the Orange County Groundwater Basin Spreading Grounds. Groundwater recharge via injection wells could occur in the West Coast Groundwater Basin near the City of Carson, and the Central Groundwater Basin in the City of Long Beach.

Metropolitan would provide metered service connections at various locations along the backbone pipeline to enable agencies to obtain water for non-potable uses and groundwater recharge. Metered service connections would also be used on DPR pipelines to monitor DPR. A list of member agencies and each user's type of use is listed in Table 4-2. Smaller-diameter lateral pipelines to connect the meters to new or existing facilities and to provide non-potable water at and near the Warren Facility would be developed.

Table 4-2. Average Demand by Phase for Member Agencies

Demand	Type	Average Demand (MGD)	Phase
Harbor Area	Non-potable reuse	24	Phase 1
West Coast Basin	Groundwater replenishment	2	
Central Basin	Groundwater replenishment	9	
Main San Gabriel	Groundwater replenishment	55	
DPR	RWA	25	
DPR	RWA	35	Phase 2
Total	—	**150**	—

Notes:
— = not applicable
DPR = direct potable reuse
MGD = million gallons per day
RWA = raw water augmentation

PWSC would make improvements to existing spreading facilities, construct new spreading facilities, install new injection wells, relocate existing production wells, and install service connections to these facilities. These facilities would be operated and maintained by the municipal agencies, including releasing purified water into and maintaining spreading facilities; recharging purified water into groundwater basins; maintaining and operating injection and production wells; and inspecting, maintaining, and operating service connections and pipelines.

Assumptions and operational criteria for the demand analysis and groundwater modeling were developed through coordination with member agencies, basin managers, and the Los Angeles County Department of Public Works. Existing groundwater models for each basin were used to aid in evaluating the ability of individual basins to recharge the water and to identify possible impacts that the recharge may have.

The four main groundwater basins are shown on Figure 4-1.

A system-wide analysis determined the locations for groundwater recharge and the estimated recharge flow rates. Due to seasonal or operational issues, one or more of the groundwater basins may not be able to recharge the maximum amounts for short periods. Therefore, the facilities would be designed to accommodate a range of flow conditions and have the ability to move water to different groundwater basins when needed. Table 4-3 summarizes the results of the analysis.

Table 4-3. Summary of Groundwater Basin Analysis

Groundwater Basin	Is There Sufficient Demand?	Are There Operational Issues?	Does Modeling Suggest Replenishment Is Feasible?	What Facilities Would Be Required?
West Coast	Yes	Pumping capacity could be a limiting factor	Yes	Up to 1 new injection well
Central	Yes	None	Yes	Up to 3 new extraction wells (relocated) Up to 13 new injection wells
Main San Gabriel	Yes	None	Yes	Up to 10 extraction wells may need to be relocated
Orange County	Yes	Recharge capacity limited in winter. Pumping governed by financial incentives	Yes	Tracer study indicates that six wells should be relocated.

The RWQCBs regulate groundwater recharge projects with input from DDW under 22 CCR Division 4, Chapter 3. Final regulations for groundwater replenishment reuse projects using surface application (e.g., spreading) and subsurface application (i.e., recharge) went into effect in June 2014. These groundwater replenishment regulations address the protection of public health with respect to chemicals, microorganisms, and CECs. Groundwater replenishment projects must incorporate a multiple-barrier strategy that protects public health by incorporating safeguards to ensure that a failure at any given treatment step would not compromise public health and would ensure long-term protection of the groundwater aquifer as a source of drinking water supply.

The RWQCBs have also established water quality goals for basin recharge. Table 4-4 shows the governing water quality limits for key constituents and their corresponding basins. Groundwater replenishment regulations are shown in Table 4-5. Treatment would be required to achieve a 2.5-log credit for reduction of *Cryptosporidium* and *Giardia* with the MBR before groundwater recharge. Testing is underway at the Innovation Center to confirm the adequacy of treatment.

Table 4-4. Water Quality Goals for Basin Recharge

	West Coast [2]	Central [2]	Main San Gabriel [2]	Orange County [3]
Boron	—	—	0.5	—
Chloride	150	150	100	—
Sulfate	300	300	100	—
Total Dissolved Solids	750	750	450	580
Nitrate	10 [1]	10 [1]	10 [1]	3.4
Nitrite	1	1	1	—
Total coliform (per 100 mL)	—	—	—	1.1

Notes:
1. Nitrate + Nitrogen < 10 mg/L as N.
2. Source: LA RWQCB 2020, Chapter 4.
3. Source: Santa Ana RWQCB, Chapter 8.
— = not applicable
mL = milliliter(s)

Table 4-5. Key Requirements of the Groundwater Replenishment Regulations

Constituent / Parameter	Type of Recharge	
	Surface Application	Subsurface Application
Pathogenic Microorganism		
Filtration	≤ 2 NTU	≤ 2 NTU
Disinfection	450 CT mg-min/L with 90 min modal contact time or 5-log virus inactivation; and < 2.2 total coliform per 100 mL	450 CT mg-min/L with 90 min modal contact time or 5-log virus inactivation; and < 2.2 total coliform per 100 mL
Pathogen control	12-10-10 log reduction for enteric virus, cryptosporidium, and giardia reduction	12-10-10 log reduction for enteric virus, cryptosporidium, and giardia reduction
Response retention time	≥ 2 months (depending on estimating method used)	≥ 2 months (depending on estimating method used)
Regulated Constituents		
Drinking water standards	Meet all drinking water MCLs in recycled water (or recharge water, as applicable); quarterly for primary MCLs; annually for secondary MCLs	Meet all drinking water MCLs in recycled water (or recharge water, as applicable); quarterly for primary MCLs; annually for secondary MCLs
Nitrogen compounds	TN ≤ 10 mg/L in recycled or recharge water	TN ≤ 10 mg/L in recycled or recharge water
Unregulated Chemicals Control		
Total organic carbon	TOC ≤ 0.5 $\frac{mg}{l.}$ Compliance point is in recycled water or in recycled water after soil aquifer treatment not impacted by dilution (no blending)	TOC ≤ 0.5 $\frac{mg}{l.}$
Recycled Water Contribution		
RWC Definition	RWC = $\frac{Vol.of\ Recycled\ Water}{Vol.of\ Recycled\ Water+Diluent\ Water}$	
RWC_{max} Initial *	Up to 20% without RO/AOP Up to 100% with RO/AOP	Up to 100% (RO/AOP required for entire waste stream)
Increased RWC_{max}	≥ 20% subject to additional requirements	Up to 100% subject to additional requirements

Notes:
* RO/AOP represents treatment using RO and an AOP that meets requirements as outlined in the regulation.
CT = Contact Time
MCL = Maximum Contaminant Level
mg-min/L = minimum milligrams per liter
mL = milliliters
min = minute(s)
NTU = Nephelometric Turbidity Unit
RO/AOP = reverse osmosis / advanced oxidation process
RWC = Recycled Municipal Wastewater Contribution
TN = total nitrogen
TOC = total organic carbon

Each groundwater basin that would receive purified water has a different nitrate discharge limit. The most stringent requirement is the Orange County Groundwater Basin, with a nitrate limit of 3.4 mg/L N. Denitrification (MBR in combination with RO) would be required to treat non-nitrified Warren Facility secondary effluent to comply with the basin objective.

Based on recent pilot-scale testing of side-stream treatment of the centrate stream from the dewatering centrifuges at the Warren Facility, the total inorganic nitrogen levels in the secondary effluent can be reduced by at least 20 percent (from 41.7 mg/L-N to 33.4 mg/L-N based on 2011 to 2015 data). Side-stream treatment could be an effective approach to minimize the treatment cost by reducing the carbon and energy demand of the mainstream nitrogen removal facilities.

To protect agricultural beneficial uses, particularly for citrus crops, the State of California boron NL is 1 mg/L, and the Basin Plan limit is 0.5 mg/L for the Main San Gabriel Groundwater Basin. Further actions to address boron include monitoring wastewater quality and treatment efficacy, conducting source control investigations, and pursuing regulatory options to minimize or preclude the need for additional boron treatment. Although the Main Basin does have an adopted Salt and Nutrient Management Plan (SNMP) incorporated into the Basin Plan, it does not specifically evaluate boron concentrations and does not evaluate a recycled water recharge project that utilizes AWPF. Consequently, a supplemental boron antidegradation analysis would likely be useful for obtaining a RWQCB permit for PWSC to demonstrate compliance with basin antidegradation guidelines. PWSC is currently the only anticipated recycled water project in the region. It would likely be the only Main Basin recycled water reuse project, with the exception of existing minor direct use projects. Given the totality of proposed project benefits to the Main Basin and the relatively low assimilative capacity utilization, it is not anticipated that the boron assimilative capacity utilization would limit regulatory approval of the PWSC project (Stetson Engineers 2021).

4.6.3. DPR Uses

Phase 1 for PWSC would include up to 25 MGD of purified water for DPR through RWA at Metropolitan's Weymouth and Diemer WTPs for a total of 115 MGD in Phase 1. Purified water would be blended with raw water from the SWP or CRA and undergo additional treatment before entry into Metropolitan's treated drinking water distribution system. Per current regulations, this purified water would be considered DPR, and therefore this water would require additional treatment beyond the AWPF described above before reaching the WTPs. Metropolitan is evaluating alternative DPR treatment technologies for use at the Weymouth WTP to confirm the additional treatment requirements for DPR. With the completion of this testing, the recommended treatment technologies for a 25 MGD DPR facility would be designed and constructed near the Weymouth WTP to augment the raw water supply for that facility. In future phases, additional DPR treatment may be required at the AWPF.

In Phase 2, additional treatment would be needed to provide an additional 35 MGD of purified water from the AWPF that could be conveyed to the Weymouth and Diemer WTPs for RWA. The current DDW draft DPR regulations would require that the entire flow be treated with ozone/ biological activated carbon (BAC) as a pretreatment for the RO system unless an alternative process scheme is approved by DDW.

The Weymouth and Diemer WTPs are two of the three treatment plants that supply potable water to the Central Pool, and introduction of the purified water would augment a portion of Metropolitan's potable water distribution system, further enhancing water supply reliability and system flexibility for Metropolitan's service area. The amount of recycled water that can be used between the two WTPs would depend on the DPR regulations.

4.6.4. Non-Potable Uses

In addition to these applications, agencies such as the West Basin Municipal Water District and LADWP would be able to connect to the proposed conveyance facilities for non-potable use. Service connections for non-potable uses would include installation of smaller distribution pipelines and ancillary facilities from the backbone pipeline would be developed by PWSC partner agencies.

4.6.5. Costs

Table 4-6 provides the construction; operation, maintenance, and replacement (OM&R); and total costs for the PWSC alternative. Costs were developed using the latest cost estimate from Metropolitan (see Appendices C.0, C.1 and C.2) that correspond to an average unit cost of water of $4,630/AF (including financing costs) for a 30-year repayment period.

Table 4-6. Estimated Construction and Annual Costs for Alternative 1: PWSC

Item	Cost
Construction Cost (2023 $)	
Total construction cost (includes mobilization, bonds, and insurance)	$3,339,700,000
Noncontract costs (contingency, soft costs, community benefits)	$2,804,500,000
Environmental mitigation	$30,000,000
Grand total (including mitigation)	$6,174,200,000
Investment Cost (2023 $)	
Escalation to midpoint of construction (to 2028)	$291,800,000
Total Investment Cost	$6,466,000,000
Interest Repayment Cost	$3,166,200,000
Total Investment Cost (including Interest)	$9,632,200,000
Annual Cost (2023 $)	
Construction (with interest and amortization) [1]	$321,100,000
Operation, maintenance, and replacement	$228,000,000
Total Annual Cost [2]	$549,100,000
Construction (excluding interest and amortization) [1]	$215,500,000
Operation, maintenance, and replacement	$228,000,000
Total Annual Cost [2]	**$443,500,000**

Notes:
1. Annualized construction cost based on a 30-year repayment period.
2. Totals may not sum exactly due to rounding.
PWSC = Pure Water Southern California

Using the present values of the estimated costs described above, the base case equivalent uniform annual unit cost for the project is $3,236/AF for a 50-year operating period.

4.7. Alternative 2: Distributed Recycled Water Treatment Plants

Like Alternative 1, this alternative includes an AWPF and new regional conveyance facilities; however, the Warren Facility AWPF has been downsized and is supplemented with one additional distributed treatment facility. The primary benefit anticipated from the use of a distributed treatment plant is the potential for reduced distribution system pumping (water purified at the distributed plant would be pumped a shorter distance). Metropolitan studied this alternative (Stantec 2022b), including the identification and evaluation of candidate treatment sites and a comparative assessment of distributed and Warren Facility treatment (see Appendix B.4). Purified water flow from any alternative site would be piped directly to the backbone conveyance distribution system (see Section 10) and purified to water quality goals and standards consistent with that within the backbone system (this pipeline would have a smaller diameter).

Alternative 2 includes the following facilities and features in addition to those described for Alternative 1:

- Wastewater Interception/Diversion: Those physical improvements needed to intercept raw wastewater flows within the existing conveyance system, divert a portion of it from the existing conveyance network, and transport the diverted raw wastewater to the new distributed treatment plant site.
- Treatment: Procurement of a parcel of land with sufficient area and geometry to construct and operate the distributed treatment plant system. This land is required to provide full secondary treatment and advanced purification to achieve IPR standards.
- Purified Water Conveyance: Facilities to convey purified product water to the backbone of the water distribution system.
- RO Concentrate Conveyance: Facilities to convey RO concentrate to the Warren Facility. Solids residuals would also be disposed of or conveyed to the sewer in accordance with the Sanitation Districts' industrial wastewater discharge permit requirements.

The analysis was carried out for two candidate diversion locations within the Sanitation Districts' joint outfall system's collection network and three potential sites for treatment.

4.7.1. Candidate Distributed Treatment Locations

The two primary considerations in the selection of interception/diversion locations were their proximity to reuse applications (e.g., proximity to spreading grounds), and the amount of wastewater that can be diverted. To reduce purified water pumping costs, candidate sites for distributed treatment were limited to properties within a 5-mile distance from the backbone pipeline. In addition, the wastewater to be diverted to the distributed treatment site must be tributary to the Warren Facility so that it would not reduce flows to other Sanitation Districts' water reclamation plants and impact their ability to meet their existing recycled water obligations. Adherence to the Sanitation Districts' limitations related to the discharge of residual solids was also required, including:

- The mass of the solids in scalped sewage roughly equals the mass in discharge
- No impact to downstream sewers from solids
- No impact to the operation of downstream wastewater plants (including the Warren Facility) from discharge
- Only solids residual from treatment of sewage and residuals from on-site treatment of other wastewater in accordance with the industrial waste permit
- No grit or screenings should be disposed

These criteria, primarily the requirement to find excess flows tributary to the Warren Facility (see paragraph above), exclude many potential locations for intercepting and diverting raw sewage to distributed treatment sites.

The suitability of short-listed sites for a treatment plant was assessed using criteria such as elevation, distances (to the Warren Facility, the diversion location, and the backbone pipeline), physical area, level of site development, and current listed status. Records from the California Environmental Protection Agency and the California Geologic Energy Management Division were also used to track any hazardous waste, cleanup sites, toxic releases, presence of oil or water wells, and the previous status of the land (such as a previous landfill, recycling facility, or a Superfund site). This evaluation resulted in the selection of three sites for distributed treatment.

4.7.2. Additional Conveyance for Distributed Treatment

In addition to the treatment plant, the distributed treatment approach also requires three sets of conveyance facilities for each plant, as follows:

- Raw Wastewater: This facility would convey raw wastewater from the diversion point to the plant.
- Purified Water: This facility would convey purified potable recycled water from the plant to the backbone recycled water distribution pipeline.
- Residuals: This facility would convey RO concentrate, screenings, and sludge from the treatment plant to the Warren Facility.

4.7.3. Selected Distributed Treatment Configuration

Diversion North Site 2 Commerce East (Figure 4-5) was selected as the preferred location for Alternative 2 in this Feasibility Study, primarily due to its larger capacity. The alternative as studied would provide 107 MGD for Phase 1 (including water produced at the reduced size Warren Facility) with expansion in Phase 2 up to 139 MGD. The Diversion North Site 2 Commerce East system would have a capacity of 13 MGD.

The conveyance system for the distributed water treatment plant is shown on Figure 4-5.

Source: Stantec 2022b, Figure 5-3.

Figure 4-5. Site 2 Commerce East Conveyance System

The purified water backbone pipeline for the selected alternative under Alternative 2 was sized in accordance with the following criterion:

- Where the velocity reduction in the pipeline allowed for a reduction of the pipeline diameter to a standard size while still maintaining the design criterion of a velocity that is less than 6 feet per second, then the pipeline size was reduced.
- The pipeline size was also reduced for the segment of the backbone pipeline from the Warren Facility to the point of connection with distributed treatment product water (the downstream pipeline conveys the combined 150 MGD flow rate).

Alternative 2 is shown on Figure 4-6.

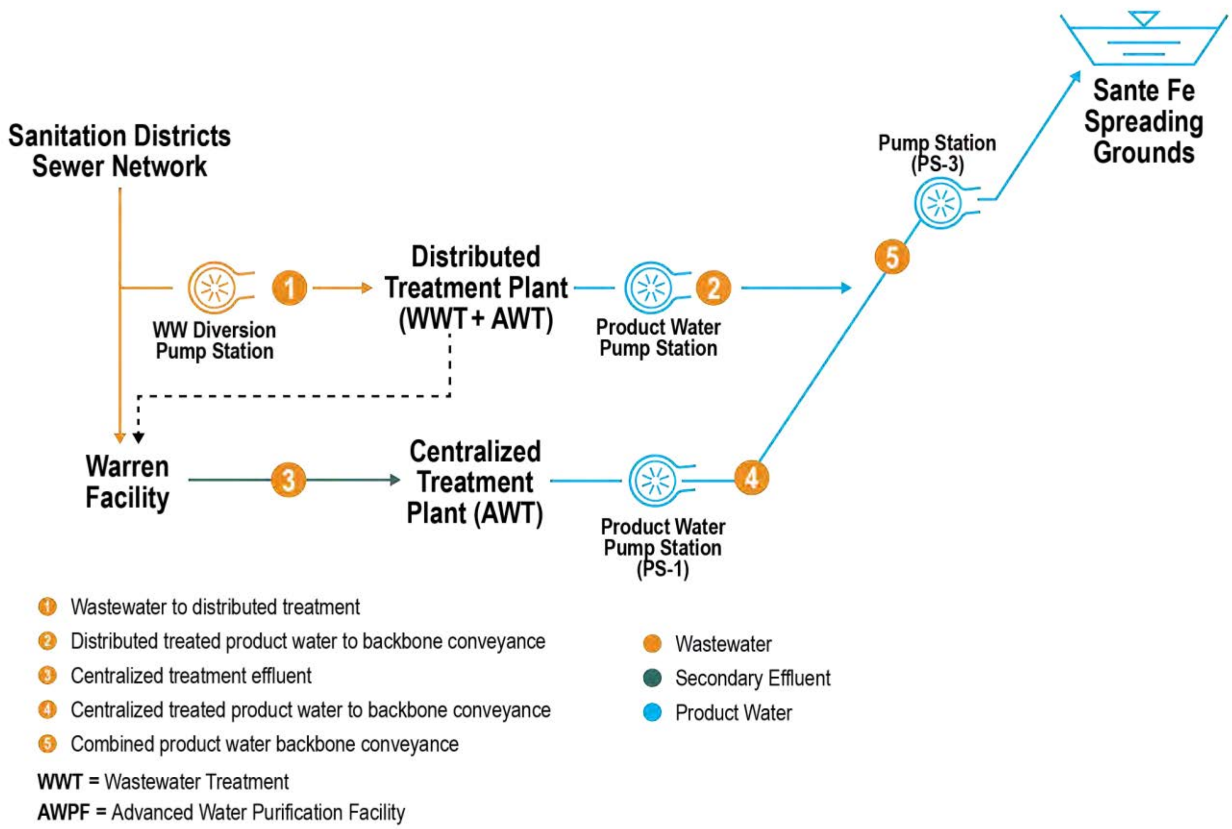


Figure 4-6. Alternative 2: Decentralized Recycled Water Treatment Plant

4.7.4. Modifications to the AWPF Resulting from Reduced Pumping and Conveyance

With the distributed AWPF treatment plant, treatment capacity can be reduced at the Warren Facility AWPF. A reduction in energy for the pumping from the centralized AWPF is based on the following factors:

- Reduced purified water flow rate from the Warren Facility AWPF
- Reduced friction losses in the backbone system from the Warren Facility AWPF to the point of connection with the purified water from the distributed AWPF

4.7.5. Recharge Facilities

The recharge facilities under Alternative 2 are identical to those in Alternative 1 (see Section 4.6.2, Groundwater Recharge Facilities).

4.7.6. Costs

Table 4-7 provides the construction, OM&R, and total costs for the Distributed Recycled Water Treatment Plant Alternative. Costs were developed using the cost estimate from *Assessment of Distributed Recycled Water Treatment Plants* (Stantec 2022b) (see Appendices C.0 and C.3). Alternative 2's estimated $600.8 million annual total cost (including financing costs) corresponds to an average unit cost of water of $5,615/AF for a 30-year repayment period.

Table 4-7. Estimated Construction and Annual Costs for Alternative 2: Distributed Recycled Water Treatment Plant

Item	Cost
Construction Cost (2023 $)	
Total Construction Cost (includes mobilization, bonds, and insurance)	$3,942,000,000
Noncontract Costs (contingency, soft costs, community benefits)	$3,153,000,000
Environmental Mitigation (assumed at %)	$36,000,000
Grand Total including mitigation	$7,131,000,000
Investment Cost (2023 $)	
Escalation to midpoint of construction (2028)	$337,000,000
Total Investment Cost	$7,467,000,000
Interest Repayment Cost	$3,656,800,000
Total Investment Cost (including Interest)	$11,124,800,000
Annual Cost (2023 $)	
Construction (with interest and amortization) [1]	$370,800,000
Operation, maintenance, and replacement	$230,000,000
Total Annual Cost [2]	$600,800,000
Construction (excluding interest and amortization) [1]	$248,900,000
Operation, maintenance, and replacement	$230,000,000
Total Annual Cost [2]	**$478,900,000**

Notes:
1. Annualized construction cost based on a 30-year repayment period.
2. Totals may not sum exactly due to rounding.

Using the present values of the estimated costs described above, the equivalent uniform annual unit cost estimate for Alternative 2 is $3,898/AF for a 50-year operating period.

4.8. Evaluation of Alternatives

The following sections evaluate the alternatives in terms of their effectiveness, efficiency, completeness, and acceptability consistent with the requirements of WTR TRMR-128.

4.8.1. Comparative Evaluation of Alternative Effectiveness

Effectiveness is the extent to which each alternative alleviates problems and needs (see Chapter 2, Problems and Needs) and accomplishes the planning objectives (Council on Environmental Quality 2013).

The No-Action Alternative would not provide benefits to member agencies or meet any of the project objectives. Alternatives 1 would provide regional benefits to all member agencies, not just those directly receiving the purified water. Alternative 1 would provide water directly to certain member agencies for non-potable uses and groundwater replenishment through IPR. These deliveries would replace portions of current and future imported deliveries and increase Metropolitan's storage capabilities, increasing reliability for all member agencies. In addition, because deliveries to Weymouth WTP and Diemer WTP via DPR would deliver Pure Water to most of Metropolitan's Los Angeles and Orange Counties service areas, there is also a direct benefit to numerous member agencies. Alternative 2 would deliver water to member agencies in a similar fashion. These benefits can be grouped into six categories:

- Reducing the risk of regional shortages
- Reducing the risk of outages due to earthquakes
- Reducing the risk of a loss of groundwater production capability
- Providing additional local supply development to reduce reliance on imported water
- Improving resilience to climate change and drought
- Adding the benefit of DPR with raw water augmentation

Reducing the risk of regional shortages: As described in Chapter 2, future shortages may occur up to 66 percent of the time under Scenario D of the 2020 IRP Regional Needs Assessment (Metropolitan 2022a). Metropolitan uses a threshold level of 1 MAF for regional storage to avoid impacts to regional reliability. Low storage levels during a drought or emergency would significantly impact Metropolitan's member agencies and the overall reliability for the region. Shortages due to drought are likely to coincide with lower groundwater replenishment from precipitation.

The No-Action Alternative would not reduce the risk of regional shortages. Alternative 1 would improve reliability for all member agencies. Reliability would be increased through:

- Lower risk of net shortages
- Increased operational flexibility

The regional reliability benefits for Metropolitan's member agencies can be seen by analyzing the impacts of the additional supply that PWSC would provide. Two standard probabilistic water resource simulation modeling analyses were used to show the need for and impact of additional supply development for the region. Figure 4-7 shows the additional core supply needed under each of the IRP planning scenarios. Under Scenario D, an additional 650 TAF of core supply is needed and Alternative 1 reduces the amount of additional core supply to 490 TAF.

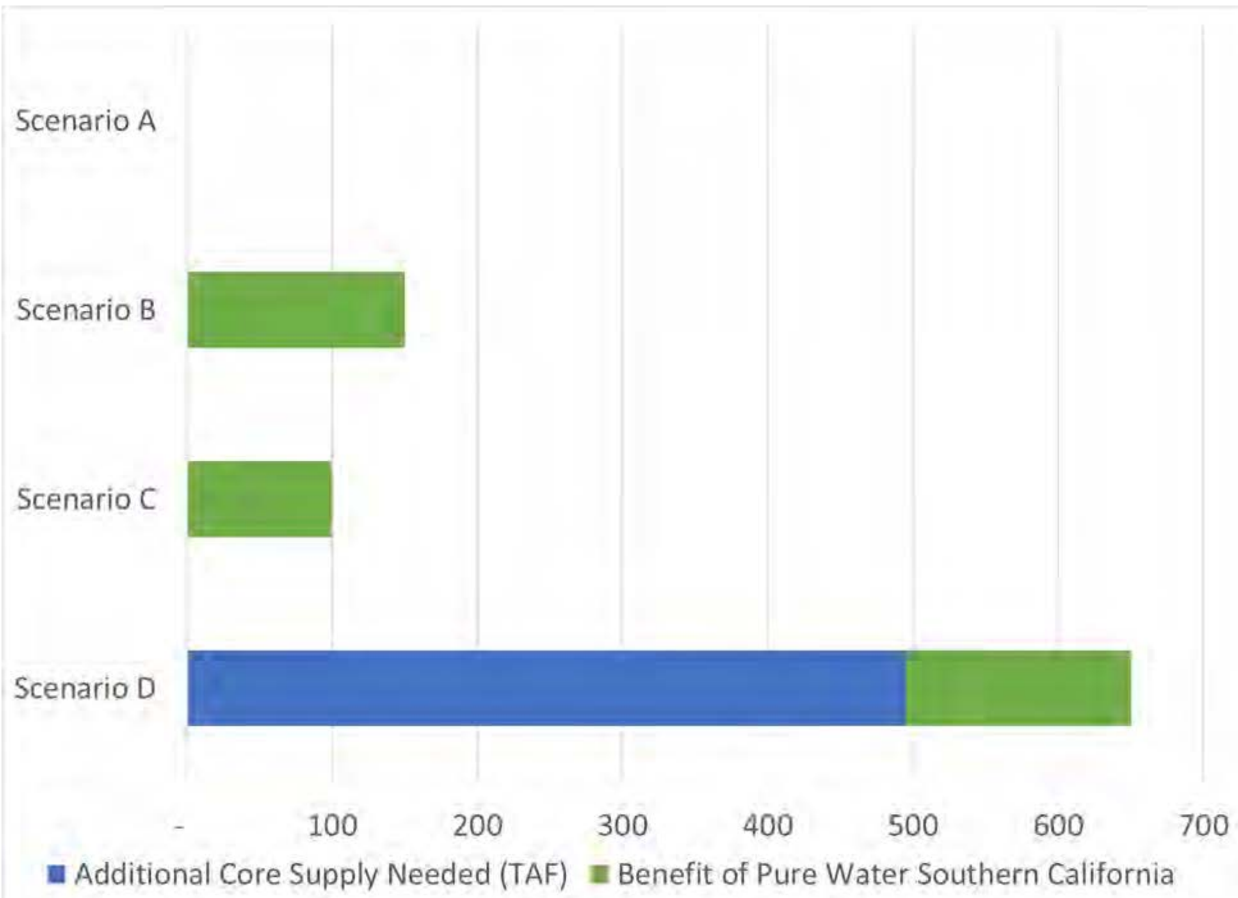


Figure 4-7. Range of Regional Water Balances

Alternative 1 provides slightly more protection than Alternative 2 against shortages due to its higher capacity (9 percent greater capacity). Although multiple distributed facilities sometimes increase reliability by introducing redundancy, the benefits of redundancy are limited in this case due to the location (facilities are near to each other and a grid failure may affect multiple facilities), size (the distributed treatment system is small relative to total production capacity), and the need for additional conveyance assets (pump stations, pipelines) that require operation, maintenance, and management.

Alternative 2 includes a 13 MGD distributed AWPF facility, with a 94 MGD AWPF Warren Facility; therefore, the benefit of redundancy is of limited significance due to the relative size of the 13 MGD facility. Furthermore, Alternative 1 produces 9 percent more water than Alternative 2 due to treatment system capacities.

Reducing the risk of outages due to earthquakes: Under the No-Action Alternative, the Metropolitan service area would remain vulnerable to a protracted outage due to an earthquake. The SWP is particularly vulnerable to a strong earthquake on the San Andreas Fault.

Alternative 1 would benefit the Metropolitan service area in the event of a catastrophic earthquake by maintaining supplies within the region. Alternative 2 provides a similar benefit. Alternatives 1 and 2 are both on the coastal side of the San Andreas fault and because they do not cross the fault, they are more reliable for this criterion. A strong earthquake (e.g., the M 7.8 Shake Out scenario) on the southern San Andreas Fault system could severely damage the SWP, the CRA, and the Los Angeles Aqueduct, all of which cross the San Andreas Fault. The extent of damage from this type of event could potentially cause protracted outages of the facilities and halt the flow of imported water. These outages could range from several months to extended periods of time on one or more of the aqueducts.

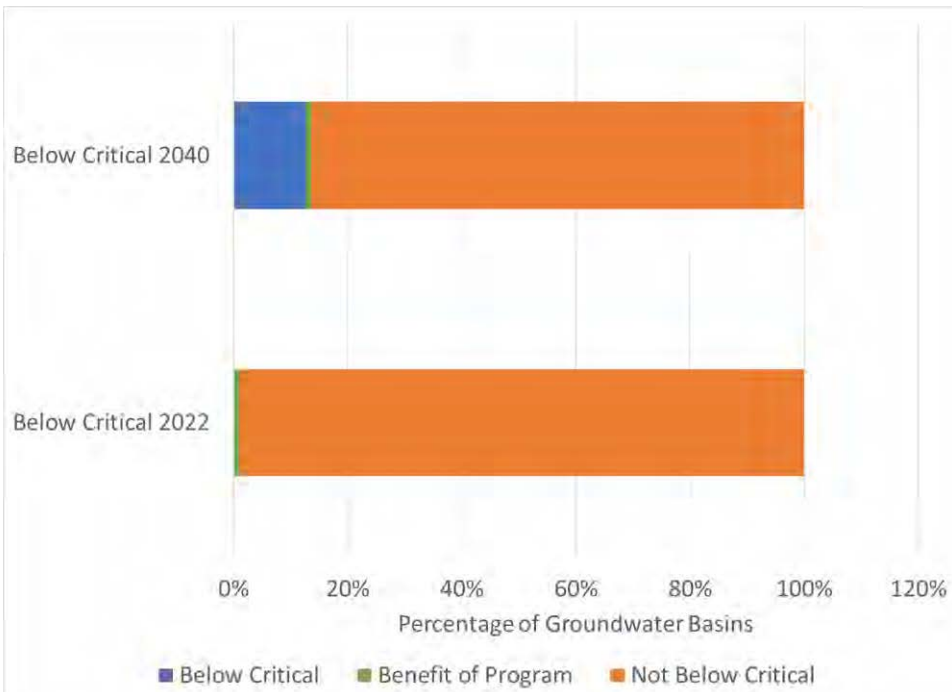
In the aftermath of such an event, the region would need to rely entirely on local supplies (DPR, surface storage, and groundwater production) while repairs are being made to the aqueducts. Purified water would be available to keep water flowing in the Weymouth and Diemer WTPs even if imported supplies were cut off by the earthquake event.

This study estimated that during a seismic outage, an adequate local supply would need to range from 1 to 1.2 MAF. Recycled water projects are assumed to be 100 percent available during a seismic outage; therefore, Alternative 1 could increase local supplies by up to 15 percent during a seismic emergency. The action alternatives could also improve the seismic resilience of the region by enhancing and maintaining the storage level in groundwater basins before a major seismic event and by providing a reliable local supply of high-quality water for groundwater replenishment and for raw water augmentation throughout the emergency.

Reducing the risk of loss of groundwater production capability: The No-Action Alternative would not reduce the risk of a loss of groundwater production capability.

Alternative 1 would help support groundwater aquifers in Los Angeles and Orange Counties by sustaining groundwater levels, maintaining groundwater as a significant local source of potable water, and reducing the pressure on Metropolitan’s service due to declining groundwater production. Alternative 2 would also support the groundwater aquifers, but with less water delivered for IPR.

Over the past 30 years, Metropolitan has delivered an average of 213,000 AFY of imported water for groundwater replenishment. Unfortunately, replenishment deliveries into the groundwater basins have not been sufficient to maintain the groundwater levels, because drought conditions have increased groundwater demand in the service area. As a result, groundwater storage has dropped by about 1.5 MAF since 2000. More than 72 percent of the groundwater basins in the service area are in decline. Figure 4-8 shows the current and projected critical level conditions of groundwater basins in Southern California, and Figure 4-9 shows the current status of the basins. By 2040, groundwater production under the No-Action Alternative could decline by as much as 116 TAF (about 10 percent of current groundwater levels). Figure 4-10 shows the recharge benefits resulting from the implementation of Alternative 1. Alternative 2 would provide a reduced level of recharge due to its having 9% less capacity than Alternative 1.



Source: Metropolitan 2023a.

Figure 4-8. Current and Projected Critical Level Conditions of Groundwater Basins in Southern California

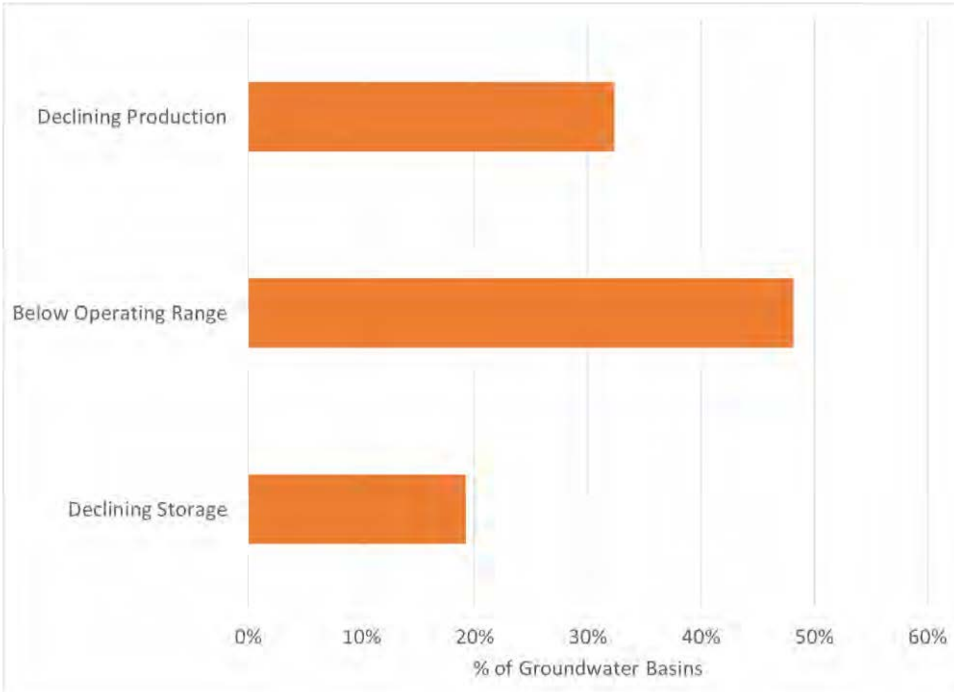
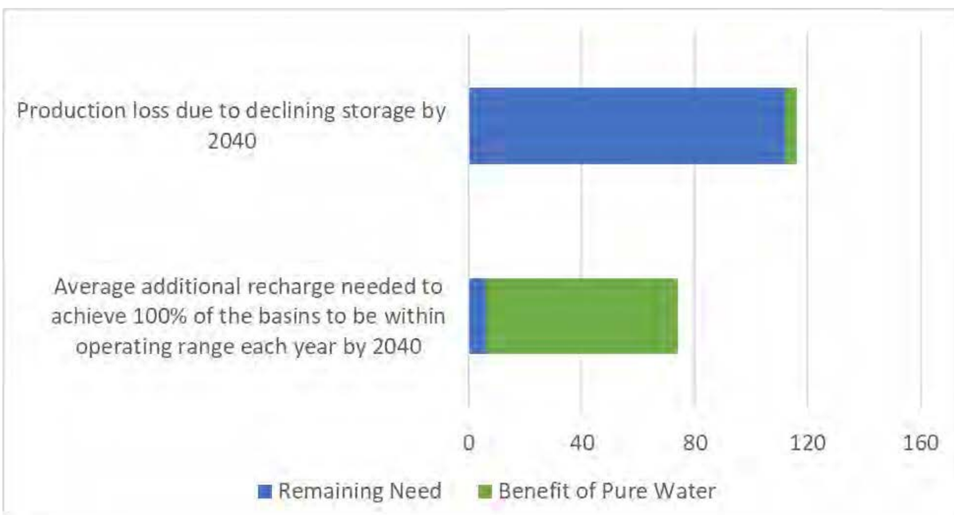


Figure 4-9. Current Status of Groundwater Basins



Source: Metropolitan 2023a, Figure 13.

Figure 4-10. Recharge Benefits from Alternative 1.

As shown on Figure 4-10, Pure Water Southern California would also reduce the need for additional recharge supplies from Metropolitan's integrated system. About 74 TAF would be needed each year to achieve the target of 100 percent of the groundwater basins in Southern California within their established operating ranges. Pure Water Southern California would help basins reach this goal and prevent future basins from reaching the critical level.

By 2040, groundwater production could decline by as much as 116 TAF (about 10 percent of current groundwater levels). As shown on Figure 4-10, CWSC would reduce the risk of groundwater agencies increasing their Metropolitan demand in the future by stabilizing groundwater basin levels in the service area. If this risk is not reduced, it would put pressure on Metropolitan's integrated system,

The changing climate has impacted the use of groundwater by reducing the amount of natural recharge and impacting the availability of imported replenishment water. These two circumstances combine to increase the risk that the groundwater basins could fall below the critical level, reducing storage and resulting in production loss. A purified water supply is drought resilient because its source is wastewater, and the climate doesn't influence wastewater influent flows. Because Pure Water Southern California flows wouldn't be reduced because of drought or climate change, PWSC would benefit all of the service area by maintaining local groundwater production and reducing the risk that groundwater agencies will increase their Metropolitan demand and their demand on the integrated system as the climate changes. For the basins to continue to provide benefits for regional reliability, they require reliable water deliveries for replenishment. Alternatives 1 can provide stable year-to-year deliveries of a new supply for groundwater replenishment; including up to 66 MGD of potential replenishment flows. Alternative 2 provides stable deliveries for replenishment, but has 9 percent lower flows.

Because of this replenishment, additional agencies in the West Coast Basin would begin to use groundwater instead of surface water, and storage in the Main San Gabriel Basin is projected to increase by over 50 feet, increasing basin and Metropolitan sustainability and ensuring a long-term supply of groundwater.

Providing additional local supply development to reduce reliance on imported water: Metropolitan faces many challenges in maintaining imported water supplies, including long-term drought in both the Northern California and Colorado River watersheds, climate change, regulatory and environmental restrictions, changing hydrological and biological conditions in the Bay-Delta, and unresolved issues with the development of long-term Delta conveyance of SWP supplies (Table 4-8). These challenges can result in variable water deliveries and impose severe restrictions on water deliveries. The No-Action Alternative would not reduce the current level of reliance on imported water.

Alternative 1 would become part of Metropolitan's integrated core supply in the same way that SWP and CRA are part of Metropolitan's service. Therefore, PWSC offers significant regional benefits for Metropolitan and the Southwest (Figure 4-11). Alternative 1 would provide reliable replenishment supplies that would reduce the need for imported water for the environment or could be placed in storage as a drought buffer. Alternative 2 provides a similar benefit, but Alternative 1 has a 9% greater capacity than Alternative 2.

Table 4-8. Summary of SWP and CRA Offset

Source of Offsets	Percent Reduction in Demand	Alternative 1 Total Offset (MGD)	Alternative 2 Total Offset (MGD)
CRA Offset	40%	60	55
SWP-Dependent Area Offsets	43%	65	59
SWP Offset (not in dependent area)	17%	25	23
Total	**100%**	**150**	**137**

Source: Metropolitan 2023a.
Notes:
CRA = Colorado River Aqueduct
MGD = million gallons per day
SWP = State Water Project

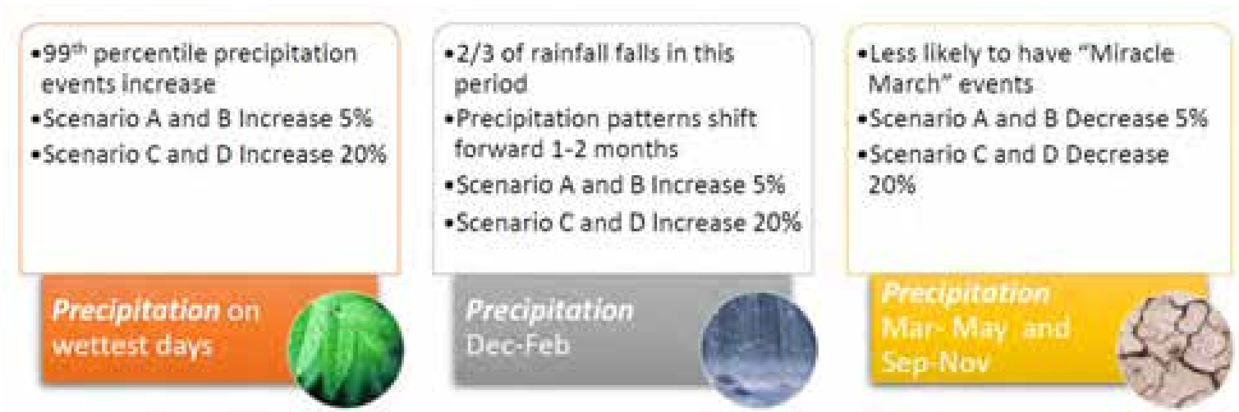
Figure 4-11. Benefits from Alternative 1 Across the Southwest

Recycling water in Southern California under Alternative 1 can advance water supply reliability locally and in distant communities such as Las Vegas, Phoenix, and Tucson through partnerships and exchanges (see Figure 4-11). Implementation of Alternative 1 would free up to 115 MGD of capacity in the existing conveyance and distribution systems. Implementation of Alternative 2 would free up 107 MGD of capacity.

Alternative 1 would also help Metropolitan reduce its reliance on imported water by alleviating pressure on Metropolitan's existing water supplies and facilities while also becoming a new source of potable water through DPR. Alternative 1 would be integrated into the existing regional system and become part of Metropolitan's network of facilities. Using purified water to supplement Metropolitan's existing supply of imported water would free up capacity in Metropolitan's existing facilities to meet demands by member agencies and allow more flexibility on directing the water to where it is needed the most. Alternative 2 would provide benefits in a similar manner.

Purified water from Alternative 1 would reduce reliance on SWP and CRA supplies. Table 4-8 shows the potential offset under the full PWSC Program. Alternative 2 would provide a similar, but lesser benefit.

Improving resilience to climate change and drought: Climate change forecasts prepared for the 2020 IRP include gradual and extreme climate change scenarios by 2100. Figure 4-12 illustrates the climate change assumptions for precipitation used in the 2020 IRP (see Chapter 2 for a description of Scenarios A, B, C, and D).



Source: Metropolitan 2023a, Figure 11. See Chapter 2 for a description of Scenarios A, B, C, and D.

Figure 4-12. Climate Change Assumptions by 2100

Based on the climate change assumptions presented on Figure 4-12, annual precipitation in the Metropolitan service area is forecasted to increase by 5 to 13 percent, but exhibit greater variability, including more frequent periods of drought, by the end of the century due to climate change. Other changes because of climate change include:

- Evapotranspiration will increase due to higher temperatures. The recently observed declines in runoff efficiency will continue for the SWP and the CRA.
- Stormwater recharge in Metropolitan's service area is predicted to decline by 3 to 8 percent by 2100, leading to total groundwater recharge declines of as much as 1.1 percent by the end of the century. Although recharge is expected to increase from December to February, it is expected to decrease up to 20 percent between March and May and September to November. This results in an overall decline in recharge. Long-term droughts may occur more often, increasing reliability issues.

These factors demonstrate how the No-Action Alternative becomes increasingly ineffective with climate change. Alternative 1 provides a drought-resilient approach to climate change because they are not dependent on rainfall runoff and are not at risk from changes in climate or hydrology. The new purified water supply is separate from the hydrologic cycle. Therefore, these alternatives can be delivered under all weather conditions and would produce water supplies outside of the critical habitat that could be adversely affected by climate change. Protections against drought and climate change introduce a water security benefit not available with other Metropolitan sources. Alternative 2 would provide a similar benefit.

Adding the benefit of DPR with raw water augmentation: The No-Action Alternative would not add DPR. Alternative 1 would also deliver water to Metropolitan's Weymouth and Diemer WTPs via raw water augmentation for DPR. This DPR approach would directly serve many member agencies, because treated water from the Weymouth and Diemer WTPs is delivered to most of Los Angeles and Orange Counties. Production of purified water within Metropolitan's service area would reduce the use of, and increase capacity in, the integrated conveyance system that delivers water into Metropolitan's service area. This additional supply could be used for exchanges with the SNWA, Arizona parties, or other partners. Alternative 2 would also provide DPR with raw water augmentation.

If—for any reason—the full amount of purified water cannot be delivered to the groundwater basins for IPR, it may also be possible to deliver this extra purified water for raw water augmentation instead, which would allow the AWPF to operate most efficiently in continuous production.

The benefits for Metropolitan and its member agencies resulting from raw water augmentation include the following:

- The number of raw water sources available to Metropolitan would increase.
- Drought resilience would increase, because purified water is largely independent of rainfall.
- Metropolitan would have the ability to serve purified water to additional member agencies.
- Metropolitan would gain the ability to transfer existing imported supplies from Northern California to SWP-only areas because supply to other areas would be supplemented with purified water.
- Metropolitan would experience improved water quality because the augmented water would have lower TDS concentrations relative to the TDS concentrations in Colorado River water.
- Metropolitan would experience improved water quality over that of imported water in terms of reduced constituents such as boron, chlorides, nitrates, and other water quality constituents.

4.8.2. Comparative Evaluation of Alternative Efficiency

Efficiency is the extent to which an alternative plan is the most cost-effective means of alleviating specified problems and realizing specified opportunities, consistent with protecting the nation's environment (Council on Environmental Quality 2013). Supporting economic analysis follows in Chapter 5.

The No-Action Alternative does not meet any of the project objectives and does not provide a cost-effective solution. All benefits are presented as the difference between with-project and without-project conditions. The negative impacts of the No-Action Alternative are presented as avoided costs in the economic analysis of the project (Chapter 5, Economic Analysis of Alternatives).

The use of a single, centralized facility for Alternative 1 reduces capital costs, operating and maintenance costs, and is anticipated to be permitted and constructed in less time.

The cost-efficiency of the distributed facilities in Alternative 2 is reduced by the need for additional infrastructure to permit, construct, operate, and maintain two AWPF facilities. Additional conveyance, including RO concentrate disposal lines, would also need to be permitted and constructed. Having multiple facilities also requires additional staff. The additional facilities that are introduced by multiple treatment plants include the need for either two laboratories or transportation of water samples from one site to the central laboratory, two treatment facilities and associated buildings, and distributed assets of wastewater pump stations and wastewater, purified water, and RO concentrate conveyance lines. The economic evaluation in Chapter 5 demonstrates the improved economic efficiency of Alternative 1 over Alternative 2. As a result, Alternative 2 would likely take longer to implement.

These additional assets and redundant facilities introduce increased resource requirements on the part of Metropolitan and/or the Sanitation Districts to operate and maintain, and to manage the associated staff and coordinate operations.

The cost-effectiveness for Alternatives 1 and 2 is shown in terms of dollars per acre-foot based on their equivalent uniform annual cost for a 50-year operating period. Table 4-9 shows that Alternative 1 is the most efficient of the action alternatives.

Table 4-9. Cost-Effectiveness of Alternatives ($/AF)

Alternative	Cost/AF
Alternative 1: PWSC (centralized treatment)	$3,236
Alternative 2: Distributed Recycling Plants	$3,898

Notes:
AF = acre-feet
PWSC = Pure Water Southern California

4.8.3. Comparative Evaluation of Alternative Completeness

Completeness is the extent to which an alternative provides and accounts for all features, investments, and/or other actions necessary to realize the planned effects, including any necessary actions by others (Council on Environmental Quality 2013).

The No-Action Alternative is incomplete and would require numerous actions to attempt to increase imports or local supplies in response to long-term water shortages. Alternative 1 would provide the 115 MGD target water supply and aquifer recharge anticipated under PWSC. Alternative 2 provides less water (107 MGD). Both alternatives would require additional investment by individual water agencies to construct laterals needed to incorporate water from PWSC into their local distribution systems. Both action alternatives would also require the individual water agencies to operate and maintain groundwater replenishment systems as well as the local distribution systems.

4.8.4. Comparative Evaluation of Alternative Acceptability

Acceptability is the viability and appropriateness of an alternative from the perspective of the nation's general public and consistency with existing federal laws, authorities, and public policies. It does not include local or regional preferences for particular solutions or political expediency (Council on Environmental Quality 2013).

Due to the severity of the effects of long-term drought, the No-Action Alternative is not considered to be an acceptable approach to the region's water supply challenges.

California's Water Quality Control Policy for Recycled Water (Recycled Water Policy) encourages the beneficial use of recycled water to meet the definition in CWC Section 13050(n) in a manner that complies with State of California and federal water quality laws and protects public health and the environment. The Recycled Water Policy provides direction to the RWQCBs, proponents of recycled water projects, and the public regarding the methodology and appropriate water quality control criteria for the SWRCB and the regional water boards to use when issuing permits for recycled water projects. Beneficial reuse of wastewater from the existing Warren Facility reduces the amount of effluent discharged to the ocean consistent with the Recycled Water Policy.

Alternative 2 would require additional real estate. A smaller footprint would result in smaller impacts under Alternative 1, thereby streamlining regulatory compliance and reducing construction impacts to the general public. By centralizing facilities at the Warren Facility, Alternative 1 avoids these impacts.

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5. Economic Analysis of Alternatives

Economic Analysis (WTR 11-01).

A water reclamation, recycling or desalination feasibility study report must include an economic analysis of the proposed water reclamation, recycling or desalination project relative to other water supply alternatives that could be implemented by the non-Federal project sponsor in lieu of a water reclamation, recycling or desalination project. This assessment needs to identify the degree to which the water reclamation, recycling or desalination project alternative is cost-effective, and the economic benefits that are to be realized after implementation. The study lead must submit the following information for the economic analysis in a water reclamation, recycling or desalination feasibility study report.

(a) The economic analysis included in the feasibility study report shall describe the conditions that exist in the area and provide projections of the future with, and without, the project. Emphasis in the analysis must be given to the contributions that the plan could make toward alleviation of economic problems and the meeting of future water demand.

(b) A cost comparison of alternatives that would satisfy the same demand as the proposed water reclamation, recycling or desalination project. Alternatives used for comparison must be likely and realistic, and developed with the same standards with respect to interest rates and period of analysis.

(c) Description of other water supply alternatives considered to accomplish the objectives to be addressed by the proposed water reclamation, recycling or desalination project, including benefits to be gained by each alternative, total project cost, life cycle cost, and corresponding cost of the project water produced expressed in dollars per MG, and/or dollars per acre-foot. An appraisal level cost estimates, or better, is acceptable for these alternatives.

(d) When a water reclamation, recycling or desalination project provides water supplies for municipal and industrial use, the benefits of the project can be measured in terms of the cost of the alternative most likely to be implemented in the absence of the project. This is assuming that the two alternatives would provide comparable levels of service. This comparison must be provided, if applicable.

(e) Some water reclamation, recycling or desalination project benefits will be difficult to quantify; for example, a drought tolerant water supply, reduced water importation, and other social or environmental benefits. These benefits shall be documented and described qualitatively as completely as possible. These qualitative benefits can be considered as part of the justification for a water reclamation, recycling or desalination project in conjunction with the comparison of project costs described above.

Economic Analysis (WTRMR-128)

For projects considered under the Large-Scale Water Recycling Program, the non-Federal project sponsor must submit the following information for the economic analysis as part of *the feasibility study report in lieu of the information described in WTR 11-01 Paragraph 3.B.(5).*

(a) Description of the conditions that exist in the area and provide projections of the future with, and without, the project. Emphasis in the analysis must be given to the contributions that the plan could make toward meeting the future water demand in an efficient and economically sound manner.

(b) Identification of all project-related costs for the selected water reclamation or recycling project and the alternatives identified. Costs must be provided for all planning, design, and construction activities as well as operations and maintenance costs. Cost estimates must be presented in terms of pay items, quantities, unit prices, contract costs, non-contract costs, and escalation. Cost estimates for the final analyzed alternatives shall be at a sufficient design level to conduct the comparisons required in subsection (d). Cost estimates shall include:

- *(i) Pay Items – Abbreviated descriptions of work for which payments or charges to accounts are made. Pay items represent a logical and practical breakdown of the proposed work into separate and distinct classes of work.*
- *(ii) Quantities – The quantities for pay items shall be presented by a number and a unit of measure such as pounds, cubic yard, or another unit that most appropriately represents the measurement for the particular pay item.*
- *(iii) Unit Prices – Current unit prices shall be used in all estimates and identified.*
- *(iv) Contract Cost – The contract cost represents the estimated cost of the contract at time of bid or award and will include allowances for design contingencies and for procurement strategies, but not construction contingencies.*
- *(v) Non-Contract Cost – Costs associated with work or services provided in support of the project, these may include project management, investigations and data collection, construction management, environmental compliance, and archeological considerations.*
- *(vi) Escalation – For projects that are to be developed over an extended period of time, or at some distant time in the future, estimates may account for escalation that may occur.*

(c) Identification, quantification, and monetization of benefits, both direct use benefits and indirect use benefits, for the selected project and the alternatives identified. Benefits may include, but are not limited to, benefits related to water supply, recreational benefits, ecosystem benefits, water quality, energy efficiency, public health and other social benefits, and/or avoided costs.

(d) A comparison of the benefits and costs associated with the selected water reclamation or recycling project and the alternatives identified. The results of this comparison should be discounted to the net present value. The alternative plan that reasonably maximizes net public benefits will be identified.

(i) *This comparison must result in a benefit cost ratio that is provided for the selected project and the alternatives.*

(ii) *Discussion about the extent to which the selected project maximizes benefits must be included.*

(e) *Some water reclamation, recycling or desalination project benefits will be difficult to quantify; for example, a drought tolerant water supply, reduced water importation, and other social or environmental benefits. These benefits shall be documented and described qualitatively as completely as possible. Any qualitative benefits will be considered as part of the justification for a water reclamation, recycling or desalination project in conjunction with the comparison of project costs described above.*

(f) *A summary, in one table of the net present value of monetized benefits and costs, and the listing and ranking of the benefits described qualitatively.*

This section provides an economic analysis of the alternatives. This analysis identifies the degree to which the alternatives are cost-effective and the economic benefits that would result after implementation. In accordance with the applicable LSWRP directives and standards (Reclamation 2022), the analysis provides: (1) a cost analysis of the alternatives; (2) a benefit analysis that provides identification, quantification, and monetization of both direct and indirect benefits from the alternatives; and (3) a cost-benefit comparison of the alternatives in net present value terms that identifies the alternative that maximizes net public benefits.

5.1. Cost Analysis

The performance of the alternatives would include water production quantities, delivery scheduling, geographic locations for origin/end use, and water quality. Similarly, each alternative's construction cost and future operation and maintenance expenses have been estimated separately and consistently to ensure that they provide a true and equitable representation of the total cost that would be incurred over the full study period (2023 to 2063).

5.1.1. Alternative 1: Pure Water Southern California

Table 4-6 in Section 4, Description of Alternatives, provides the annual construction cost; OM&R cost; and total cost for Alternative 1, which was developed using the latest cost estimate from Metropolitan.

More detailed backup for project-related costs for Alternative 1 is presented in Appendices C.0, C.1, and C.2, which provides cost information for all planning, design, and construction activities as well as OM&R. Cost estimates are provided in terms of pay items, quantities, unit prices, contract costs, non-contract costs, and escalation.

The undiscounted annual costs shown in Table 4-6 are based on a 30-year operating period. As a result, these are conservative estimates because (1) the total annual cost does not factor in the residual value of Alternative 1 or Alternative 2 facilities at the end of 2062 (given that most of their facilities have an expected useful life of 50 years or longer); and (2) Alternatives 1 and 2 are expected to operate for 20 or more years after 2063, especially with proper OM&R, which can extend the life of water infrastructure. As a result, Alternatives 1 and 2 would continue to generate its operational benefits after 2063, and their annual cost would decrease to its OM&R cost since the construction cost would have been fully repaid.

5.1.2. Alternative 2: Distributed Recycled Water Treatment Plants

Table 4-7 in Section 4, Description of Alternatives, provides the annual construction, OM&R, and total costs for Alternative 2. Costs were developed using the cost estimate from *Assessment of Distributed Recycled Water Treatment Plants* (Stantec 2022b) (see Appendices C.0 and C.3). The cost estimates for each of the project activities are reported in terms of pay items, quantities, unit prices, contract costs, non-contract costs, and escalation.

5.2. Monetized Benefits

Under the future No-Action conditions, it is projected that the water supply increases cannot be achieved through increased use of imported water and groundwater. Metropolitan would face major water supply shortages under the No-Action conditions. The region's future water shortages, which would be most severe during drought or other supply interruptions, would result in adverse physical changes and economic disruptions and losses. The following section briefly summarizes the quantified and monetized benefits (including avoided negative impacts) resulting from future development and operation of the action alternatives.

Unless specifically noted otherwise, all benefits are evaluated in comparison with the No-Action conditions. As a result, many of the benefits achieved by the action alternatives represent avoided adverse outcomes (such as water supply shortages during drought conditions) or savings from avoided costs that would otherwise be incurred under the No-Action conditions (e.g., increased energy use for groundwater pumping because of lower groundwater levels).

As discussed in Section 5.1, the alternatives have been designed and their costs for both construction and operations estimated to ensure that their future operation would achieve comparable levels of service, as required by WTR TRMR-128. Alternative 1 would produce an estimated 118.59 TAF of recycled water per year, and Alternative 2 would produce an estimated 107 TAF of recycled water per year. Accordingly, a pro rata adjustment decrease of 9.8 percent is applied to the Alternative 1 estimated benefits to represent the corresponding decreased benefits that would result from Alternative 2's lower annual water supply production.

5.2.1. Water Supply

With a service area extending 5,200 square miles over six counties, the current annual total retail demand within Metropolitan's service area is projected to range from 3.4 to 4.8 million AFY. At a production and delivery rate of approximately 118,590 AFY, Alternative 1 would provide 2.3 to 3.4 percent of the total retail demand, with expansion under Phase 2 to 3.2 to 4.6 percent of the total retail demand within the service area through 2045.

Alternative 2 would add 107,000 AFY (9.8 percent less than Alternative 1) of new local water supplies to the region's water system portfolio, which would reduce Metropolitan's reliance on imported water supplies for the recharge of the three regional groundwater basins and thereby enable a commensurate amount of future imported supply use for either storage or other uses within the region's water system or the wider state water system.

The supplemental supplies of water provided by the alternatives would represent net new water that would both increase Metropolitan's ability to meet water demand within the region and significantly improve Metropolitan's water supply reliability. The benefit of this new supplemental water supply would be most impactful and valuable in helping Metropolitan better meet potable demands during droughts and supply disruptions.

Currently, Metropolitan's water supply portfolio consists primarily of imported water and local supplies (groundwater basins, stormwater recharge, and smaller recycled water projects). If imported water is not available, the region has to rely on local supplies to meet demands. Without replenishment and careful management, local groundwater basins are not a sustainable long-term water source. Continued aquifer drawdown to meet the region's potable water demands would eventually be limited by drawdown requirements and could result in the loss of the functionality of those basins as a source of water; such a loss would have a larger and permanently negative regional impact. It is infeasible to offset these water supply losses with increased imported water supplies. Thus, a new reliable local supply is critical.

Alternative 1: Pure Water Southern California. The project's M&I water supply benefits are measured based on the alternative cost of supply. This approach is consistent with Reclamation's WTR 11-01 economic analysis guidance (Reclamation 2007). As such, this benefit exceeds (and incorporates) the agency's avoided costs for increased groundwater use and purchases of increased SWP/CRA imported water supplies. As a result, Alternative 1's water supply benefits have an estimated water use benefit value of $530.8 million per year.

Alternative 2: Distributed Recycled Water Treatment Plants Alternative. As shown in Table 4-7, using a pro rata adjustment, the average annual undiscounted cost of water for the distributed Recycled Water Treatment Plants Alternative is estimated to total $478.9 million per year.

5.2.2. Water Shortage Avoidance

The estimated perceived monetary loss to residents and the economic effects from reduced residential deliveries and water shortages can be estimated using a linear demand function method with retailer-specific domestic water rates. These estimates are based on standard methods using available data for median incomes, utility water rates, and published estimates of demand elasticity. The current unit value of economic losses for Los Angeles varies by water retailer between $500 to $4,270/AF (Porse et al. 2018). When the anticipated price and demand increases over the next 20 years are also considered, these annualized benefits are projected to correspond to annualized projected avoided water shortage benefits ranging from $1,300/AF to $9,437/AF for a 20-year period based on assumed price and demand increases (Porse et al. 2018).

This water supply reliability benefit represents the marginal value of the supplied water during periods of water scarcity and shortages. For this analysis, a benefit value of $1,279/AF (equivalent to Metropolitan's cost for increased imported water supplies) is used as a conservative benefit value at the low end of the range estimated for the current cost of economic losses for Los Angeles water users. Based on this unit benefit value assumption, the total water use economic losses during an annual water shortage that PWSC would offset are estimated to total $151.57 million.

The monetized benefit of the water shortage benefit (i.e., the avoided cost) offset by PWSC can partially be based on the avoided current cost to Metropolitan of purchasing additional imported water supplies necessary to provide an equivalent level of water deliveries. To represent the full value of the action alternatives' benefits, these imported water acquisition quantities and costs would need to recognize the increased marginal cost (scarcity cost) of water purchases during drought periods with reduced water availability and/or increased water demand.

Currently, Metropolitan experiences drought conditions and supply scarcity approximately once every five years, which corresponds to a 20 percent incidence factor. Based on this incidence factor, the annualized benefit from Alternative 1 for water shortage reduction would be $30.3 million per year. However, as discussed in Chapter 2, Problems and Needs, the future incidence rate of water shortage is projected to increase to 66 percent under Scenario D, and the resulting adjusted annualized benefit for water shortage reduction under Alternative 1 would be $101 million per year. Based on its lower annual water deliveries, the annualized benefit for water shortage reduction for Alternative 2 is estimated to total $91.1 million per year.

5.2.3. Water Supply Reliability

If local groundwater supplies were not available due to depleted groundwater tables and imported supplies were available (e.g., by purchase, transfers, or agreements), Metropolitan would need to purchase additional SWP and CRA water to meet shortage demands. The estimated cost to purchase (actual transactions would be subject to availability) supplemental supplies would be expected to be equal to or greater than Metropolitan's current average unit cost for imported water purchases (and delivery) of $1,279/AF. As discussed above regarding the water shortage avoidance benefits, this value can also represent a conservative proxy value for the willingness to pay and economic losses of Metropolitan's water users.

For a conservative representation of the analysis, a benefit value of $1,279/AF (which is also equivalent to Metropolitan's cost for increased imported water supplies) is used as a conservative benefit value at the low end of the range estimated for the current cost of economic losses for Los Angeles water users. Based on this unit benefit value assumption, the total water reliability benefit for Alternative 1 is estimated to total $151.6 million per year. Based on its lower annual water deliveries, the total water reliability benefit for Alternative 2 is estimated to total $136.9 million per year.

By replacing potable water consumption that otherwise would occur, highly purified water would free up a portion of the region's potable water supply for other uses. This additional potable water could be used as insurance against the water-use reductions arising from droughts and other supply interruptions, increasing water-supply reliability for Metropolitan's water customers.

The extent to which highly purified water would fully improve the reliability of Metropolitan's water supplies depends in part on how the displaced potable water supplies resulting from each strategy would be distributed to households subjected to water-use restrictions in the Metropolitan service area. As shown previously in Figure 4-7, spread evenly across all households currently receiving water from the agency, the additional recycled water supplies would fully offset water-use reductions under Scenarios B and C, and result in a 25 percent decrease in projected shortages under future Scenario D conditions. If the additional recycled water supplies are allocated among a subset of Metropolitan water users, the economic benefits of the avoided water-use reductions would be even greater.

The water shortage and water reliability benefits are interrelated and may overlap. Therefore, to avoid any double-counting of their combined benefits, the water reliability benefits are attributed below in the benefit summation for the benefit-cost analysis, but the water shortage avoidance benefits are not included.

5.2.4. Water Quality

Under Alternatives 1 and 2, groundwater augmentation with highly purified water (that is of better quality than imported water and current groundwater supplies) would reduce concentrations of TDS, chlorides, and nitrates in the long term due to the continuous recharge of the local groundwater basins. Recharging or spreading highly purified water would help to dilute the existing basin water quality and reduce loading from other sources.

The potential water quality benefits can be quantified based on the volume of water that requires treatment and the mass of salt or contaminants that would need to be removed in the future with and without project conditions.

The monetized benefit is calculated based on the avoided unit cost of groundwater treatment ($300/AFY) for nitrate reduction. As a result, if Alternative 1's total 118,590 AFY in water supply were instead solely obtained from its existing groundwater system, Metropolitan would be expected to incur $35.6 million per year in additional groundwater treatment costs.

5.2.5. Avoided Groundwater Costs

Due to drought conditions, groundwater demand has increased, groundwater replenishment has decreased, and groundwater storage has dropped 1.2 MAF since 2005. Replenishment deliveries to the basins have not been sufficient to maintain groundwater basins levels, with 32 percent of the basins in the service area in declining production, 19 percent in declining storage, and 48 percent below operating range in 2023. Several factors contribute to this condition, including diminished water supply availability due to drought, regulatory restrictions, and replenishment purchase patterns. Comparatively, in 2022 72 percent of the same basins were in decline, demonstrating the importance of groundwater replenishment in basin sustainability. Increased groundwater development and/or use is not a feasible alternative source for Alternative 1 or 2 supplies.

Without continued replenishment of the groundwater basins, groundwater storage is expected to continue to decline due to increased demands, thereby further straining the stretched basins. Alternative 1 would provide for stable year-to-year deliveries of up to 68,080 AFY of new supply for groundwater replenishment to reduce strain on local groundwater basins.

Increased Pumping Costs from Groundwater Depletion. Alternatives 1 and 2 would support regional groundwater basin levels by recharging these basins with highly purified water. The augmentation of the basins with purified water on a consistent basis would maintain local groundwater levels. During droughts and supply interruptions, benefits would include groundwater pumping cost savings due to the lesser energy consumption needed to pump water from a higher groundwater levels rather than from greater depths that would occur under the future No-Action conditions without groundwater replenishment. Because of the PWSC groundwater replenishment, storage in the groundwater basins served by PWSC would have higher water levels (Table 5-1). For example, in Main San Gabriel Basin water levels at the Baldwin Park key well (well 3030F) are projected to increase by about 37 feet, 107 feet above projected water level under historical conditions, as shown on Figure 5-1 and in Table 5-1.

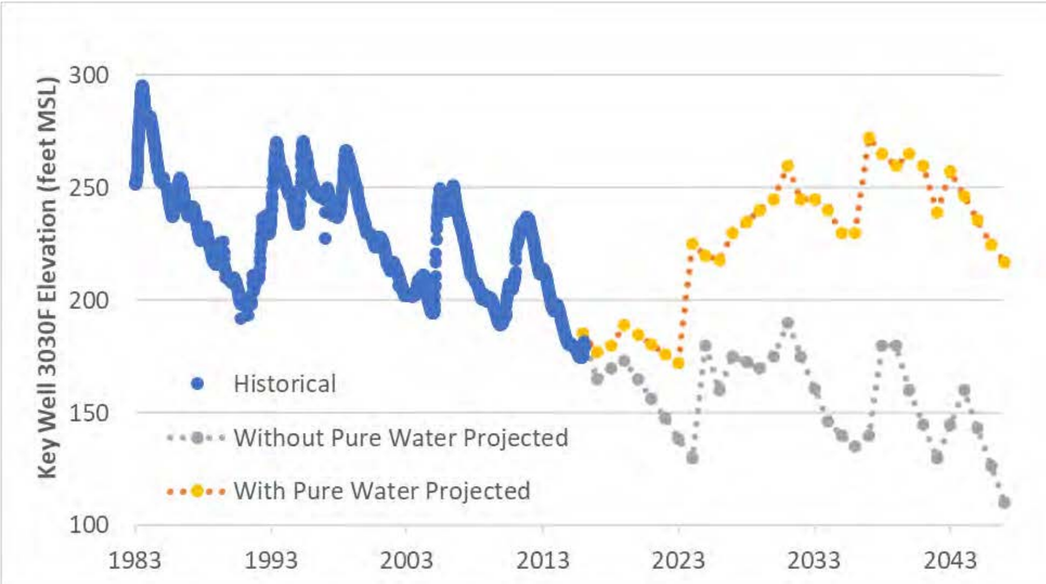


Figure 5-1. Groundwater Elevations in Key Wells for Main San Gabriel Basin

Table 5-1. Historical Groundwater Elevations in Groundwater Basins

Area	Change in Water Level (feet)
Main San Gabriel Basin	
Baldwin Park Key Well	107 [1]
Central Basin	
Montebello Forebay	7
Long Beach Wells	6
West Coast Basin	
Carson	24

Notes:
1. Compared to conditions without PWSC.
PWSC = Pure Water Southern California

These increases in basin storage help with the long-term sustainability of groundwater, which helps to make Metropolitan more resilient. Based on an estimated pump cost of $0.20/AF per foot of lift, a decrease in the depth to groundwater of up to 107-feet can occur compared to future No-Action conditions which would result in an annual avoided pump cost savings of approximately $21 per AF.

Based on an estimated pump cost of $0.20/AF per foot of lift and future region-wide weighted average of 91-foot total increase compared with the No Project conditions, the annual avoided pump cost savings under Alternative would be up to $2.2 million per year. The future region-wide weighted total increase compared with the No Project conditions under Alternative 2 is projected to be 82-feet and consequently the annual avoided pump cost savings under Alternative would be up to $1.8 million per year.

Costs of Supply Losses and/or Well Replacement from Groundwater Depletion. Another potential benefit of Alternatives 1 and 2 is the avoided costs of the loss of pumping from overdrawn wells, which would require Metropolitan to obtain replacement supplies and/or drill deeper replacement wells. In this case, Alternatives 1 and 2 would result in avoided costs that Metropolitan and its member agencies would incur if they needed to purchase replacement water imports to make up for demands not met locally due to the loss of groundwater wells.

The valuation of the groundwater resource impacts presumes that adequate imported water supplies would be available and that affected aquifers would remain functional/feasible with deeper wells. Furthermore, this approach underrepresents the value of those groundwater resources because this approach does not recognize the opportunity cost lost from a permanent reduction in the region's groundwater reserves. As discussed below, unsustainable levels of groundwater use (i.e., extraction that exceeds replenishment rates) will reduce the quantity of "stored" water that is available for use during emergency events (e.g., earthquakes or other natural disasters) or extended drought periods.

Section 2.1.4, Groundwater Basin Conditions, provides a detailed discussion of the declining storage levels of several groundwater basins in Metropolitan's service area. Current groundwater condition deficiencies are most acute in the Main San Gabriel Basin, which was at a historic low water level of 169.4 feet MSL in 2018, almost 31 feet below its established operating range. By October 2023, key well elevations increased to 228 feet MSL due to above-average rainfall. If groundwater levels in the basin drop below 160 feet MSL, as much as 30 percent of the wells in the basin would go dry. Under the No-Action Alternative, water levels in the basin are expected to drop as much as 70 feet, permanently reducing available groundwater supplies by an estimated 56 TAF. With Alternative 1, groundwater levels in the basin are expected to rise 37 feet.

Based on current use and trends, it is expected that permanent losses in the Main San Gabriel Basin could result in a permanent groundwater supply loss of 56 TAF by 2040. Under Alternative 1, the benefit value of this 56 TAF in avoided groundwater supply loss is estimated to correspond to a $71.6 million annual benefit based on an average system-wide water supply cost of $1,279/AF for replacement supplies. As result of it reduced annual supply levels, Alternative 2 is conservatively estimated to result in pro-rata avoided groundwater supply loss benefits of $64.6 million per year.

5.2.6. Emergency Supply Benefit

Metropolitan's imported water supplies are susceptible to a wide variety of physical and other disruptions, which include earthquakes, floods, land subsidence, drought, wildfires, routine infrastructure maintenance, and mechanical or system failures. As a result of a strong earthquake (e.g., the M 7.8 ShakeOut Scenario), the CRA, the SWP, and the Los Angeles Aqueduct, all of which cross the San Andreas Fault, could be severely damaged. The extent of damage from this type of event could potentially cause protracted outages of the facilities and halt the flow of imported water. In the aftermath, the region would need to rely entirely on local supplies such as PWSC, surface storage, and groundwater production to meet public health and safety demands. The action alternatives would enhance Metropolitan's ability to maintain supplies to the Weymouth and Diemer WTPs even if imported waters were cut off.

Based on a study of emergency storage prepared in 2019 (Metropolitan 2023a), the outage due to a seismic event on any one of the source supplies would range from a few months to as long as 5 years. Metropolitan 2023a also estimated that adequate local supply availability during a seismic outage would range from 1 to 1.2 MAF. Since recycled water projects are assumed to be 100 percent available during a seismic outage, Alternative 1 could increase local supplies by up to 15 percent during a seismic emergency. Increasing the effective local supply available during such an emergency would also reduce pressure on Metropolitan's emergency storage reserves.

The beneficial value of this emergency supply increase is difficult to estimate, and its annualized benefit value should reflect the expected occurrence rate of emergency events. Metropolitan typically assumes a 2 percent (i.e., once in 50 years) occurrence rate in their future planning. This factor is used to determine the expected annual value of emergency supply benefits.

The value of emergency water supplies would vary greatly depending on the severity of the resulting shortages— both in terms of the magnitude of the reduction in water availability and the duration of the reduction. At the highest end, the marginal benefit value of essential water to maintain public health and safety would likely be an order of magnitude larger than that attributed for more limited water shortages.

Past research on emergency supply costs during emergency events suggests that water users' consumer surplus and willingness to pay would far exceed their avoided water shortage benefits ranging from $1,300/AF to $9,437/AF (Porse et al. 2018) during non-emergency periods. However, Metropolitan's current authorization to pay for imported water transfers during extreme drought events is $800 per acre-foot. This amount represents the net supply unit benefit of $800 for each acre-foot of water available during drought conditions. Combined with its current imported water cost of $1,279 per acre foot, the total emergency supply benefit value for Metropolitan is estimated to be $2,079 per acre-foot.

In the event of a 1-year interruption in water imports due to a seismic emergency, annual recycled water supplies from Alternative 1 would conservatively have an estimated *net* emergency supply benefit of $94.9 million ($800/AF x 118,590 AF). As a result, the annualized value of the emergency supply benefit is estimated to be approximately $1.9 million per year (based on the 2 percent likelihood that an emergency event occurs) under Alternative 1. Under Alternative 2, the annualized emergency supply benefit would be $1.7 million. These estimates do not recognize the enhancement in groundwater reserves that the action alternatives would also support, which might be expected to result in an additional increase in available supply during a future emergency event.

This avoided cost benefit does not represent the substantial additional use economic losses and damages that the region's residents and businesses would likely incur from the water shortages that would result from such an event.

5.2.7. Interagency Transfers of Imported Water

As a result of the action alternatives' expansion of local supply sources and increased future groundwater storage reserves, Metropolitan expects to have the potential ability to make interagency transfers of its imported water during major drought periods so that SWP and/or CRA supplies could be temporarily redistributed to other water districts in California facing more severe water shortage conditions. Metropolitan's current imported water transfer willingness to pay is $800 per acre-foot, which may be the maximum net compensation that it could receive from any transfer and "resale" of its SWP or CRA imported water supplies. This amount represents the net benefit to Metropolitan of any such sales after its purchase cost of $1,279 per acre of imported supply is subtracted from the actual transfer price paid by the purchasing agency.

For the purposes of the economic analysis, it is conservatively assumed that such transfers of an equivalent quantity to each action alternative's annual production could occur every 20 years. Accordingly, the estimated total $94.97 million interagency transfer for Alternative 1 (based on the $800 per AF surcharge applied to 118,590 AFY) is estimated to have an annualized average benefit value of $4.74 million. The annualized average benefit value from interagency transfers under Alternative 2 are estimated to be $3.35 million.

5.2.8. Benefits for Economic Stability and Development

The availability of highly purified water would support general economic growth to the extent that it would reduce constraints to the quantity, reliability, and environmental impacts that would otherwise occur under the without-project conditions. Continued economic growth and development would yield monetary benefits for growth-related businesses, property owners, and public services. Benefits from increased economic growth and activity may include changes in expenditures, the supply of goods and services, amenities and the quality of life, and lower business operating costs. Similarly, decreased future water availability can be expected to result in increased costs, reduced economic activity, and decreased supply of goods and services. Avoiding such economic losses and costs will be a benefit of the action alternatives, as they both maintain current economic and business conditions and enable future growth to occur. This benefit corresponds to the productivity benefits of the additional water supplies that result from the future use of this benefit.

Southern California's economy is estimated to be $1.6 trillion, making it the 11th largest economy in the world, with Los Angeles County (which constitutes a majority of Metropolitan's service area) accounting for $815 billion, followed by Orange County at $272 billion. Major industries in the region include agriculture, construction, manufacturing, wholesale, retail, finance, professional, and tourism/hospitality—all of which rely on water for their economic vitality.

As discussed in Section 2.2.3, Projected Demands and Supply Imbalances, Metropolitan forecasted supply shortages under all four of its future 2045 planning scenarios. The largest 2045 shortage is projected under Scenario D (high demand with reduced imports), which has a new core supply shortage of 650,000 AF. Under the No-Action conditions, this shortfall and any future disruption in imported water supplies would require the region to meet demands with other local sources and/or implement local shortage plans entailing water delivery cutbacks.

Based on *The Economic Impacts of Water Shortages in Orange County, 2022* (Brattle and MWDOC 2022), with a 15 percent water supply reduction (equivalent to approximately a 60.6 TAF decrease in supplies), businesses would see a $3 billion direct reduction in output and up to 19,000 lost jobs. These direct impacts would also lead to $2.1 billion in additional indirect reduced output impacts, thereby representing a total $5.1 billion loss in output for Orange County's economy. The residential welfare losses are estimated to total up to $241 million/year, and water retailers would lose approximately $37.6 million in revenues.

It is possible that these forecasted impacts to Orange County would be conservative compared to the region-wide impacts that would be expected to result from the larger supply shortage that would be avoided by Alternative 1 and which would extend more broadly across Metropolitan's larger service population and regional economy. Based on a midpoint value of the unit welfare losses, Alternative 1 is estimated to result in economic stability and development benefits (i.e., avoided welfare losses) of $132.2 million per year and $119.3 million under Alternative 2.

5.2.9. Job Creation and Tax Generation

The new economic activity and growth related specifically to the facility construction and its subsequent operations (i.e., in terms of its spending effects) are distinct and independent of the benefits derived from the quantity and use of its produced water.

Construction. A job creation analysis performed by the Los Angeles Economic Development Corporation (LAEDC) in 2021 found that PWSC would provide a positive and widespread fiscal and economic impact. LAEDC's results are adjusted on a pro rata basis for the interim increase in the construction cost for Alternative 1 (to include related conveyance facility improvements) of $6.2 billion and reported in current 2023 dollar terms. Accordingly, Alternative 1 construction may be expected to create an average of 7,794 total jobs annually (direct, indirect, and induced jobs) and $6,300 million in total labor income. Alternative 1 would also be expected to generate approximately $737 million in state and local tax revenues for the region, with direct employment of up to 39,900 jobs. For the purposes of this analysis, these benefits are annualized over 30 years and correspond to a $210 million average annual increase in total labor income (direct, indirect, and induced) and a related $24.6 million increase in state and local tax income resulting from the construction activity for Alternative 1. Based on Alternative 2 ‘s higher construction costs, it would be expected to result in a $242.5 million average annual increase in total labor income (direct, indirect, and induced) and a related $28.4 million increase in state and local tax income

Post-Construction Jobs. Post-construction, ongoing operation, and maintenance activities will also create a long-term positive impact on the regional economy. In total, adjusting LAEDC's estimates for revised OM&R cost projections and converting into current 2023 dollars, future ongoing operation and maintenance activities will create up to 1,690 total jobs (direct, indirect, and induced) under Alternative 1 in the Southern California region, with a labor income of $158 million per year and $46.6 million in generated annual tax benefits. Based on Alternative 2 ‘s marginally higher OM&R costs, it would be expected to result in labor income of $159.4 million per year and $47.4 million in generated annual tax benefits.

5.2.10. Total Monetized Benefits

Table 5-2 provides a summary of the estimated benefits of the action alternatives by benefit category. For periodically occurring events or conditions (e.g., the avoided costs of water shortage after a major earthquake event), the benefit is shown both as a monetized benefit per event occurrence and as an average annual benefit that factors in the expected frequency of the event during the 30-year period of annualization.

5.3. Unmonetized Benefits

The action alternatives would result in many unquantified benefits. These benefits are difficult to monetize but they would nonetheless provide an economic or other type of benefit to the regional water system and/or economy. The key unmonetized benefits expected to result from future implementation of the action alternatives are summarized and ranked (in decreasing magnitude) in Table 5-3.

Table 5-2. Total Monetized Benefits of Alternatives 1 and 2

Category	Benefit Description	PWSC (Alternative 1)		Distributed Recycling Plants (Alternative 2)	
		Monetized Benefit ($/Occurrence)	Annualized Benefit ($/Year)	Monetized Benefit ($/Occurrence)	Annualized Benefit ($/Year)
Water supply	Value of supplied water based on cost of the Distributed Recycled Water Treatment Plants Alternative since water imports and groundwater are not available.	$530,809,000	$530,809,000	$478,932,000	$478,932,000
Water shortage avoidance	Value to water users from avoided water supply shortage	$151,677,000	— [a]	$136,853,000	— [a]
Water supply reliability	Savings from avoided purchases of imported water to offset local groundwater losses and reduced storage capabilities	$151,677,000	$151,677,000	$136,853,000	$136,853,000
Water quality	Avoided cost of treating groundwater supplies due to water quality degradation from declining groundwater tables	$35,577,000	$35,577,000	$32,100,000	$32,100,000
Avoided groundwater costs	Reduced groundwater pumping cost from higher groundwater levels	$2,158,000	$2,158,000	$1,757,000	$1,757,000
	Avoided Metropolitan member agency costs for purchase of additional imported water to meet demands following critical aquifer over-depletion	$71,624,000 [b]	$71,624,000 [b]	$64,624,000	$64,624,000
Emergency supply benefit (e.g., major earthquake event)	Cost to purchase additional imported water or transfer water after a major earthquake or disaster to meet demands	$94,872,000 [c]	$1,897,000 [d]	$85,600,000	$1,712,000

Category	Benefit Description	PWSC (Alternative 1)		Distributed Recycling Plants (Alternative 2)	
		Monetized Benefit ($/Occurrence)	Annualized Benefit ($/Year)	Monetized Benefit ($/Occurrence)	Annualized Benefit ($/Year)
Interagency transfers of imported water	Potential to sell CRA and SWP allocations to other water contractors during drought due to Metropolitan's improved capacity to meet its demand with local groundwater and recycled water supplies	$94,872,000 [c]	$4,744,000 [e]	$85,600,000 [c]	$4,280,000 [e]
Benefits for economic stability and development	Avoided residential welfare decreases.	$132,228,000	$132,228,000	$119,305,000	$119,305,000
Construction job creation and tax generation	Total labor income (direct, indirect and induced) from PWSC construction activities.	$6,300,000,000	$210,000,000	$7,276,295,000	$242,543,000
	State and local tax income from PWSC construction activities.	$736,600,000	$24,550,000	$850,749,000	$28,358,000
OM&R job creation and tax generation	Total labor income (direct, indirect and induced) from PWSC OM&R activity.	$158,000,000	$158,000,000	$159,386,000	$159,386,000
	State and local tax income (direct, indirect and induced) from PWSC OM&R activity.	$47,000,000	$47,000,000	$47,412,000	$47,412,000
Total monetized benefits	—	—	$1,370,270,000	—	$1,317,264,000

Notes:
a. The water shortage avoidance benefit is not assigned since it is recognized by the water supply reliability benefit.
b. Based on future permanent 10 TAFY groundwater aquifer failure.
c. Based on Metropolitan's $800/AF imported water transfer surcharge allowance.
d. Annualized for SOD/NOD failure assuming 1 in 50 years major earthquake or other major disaster occurrence rate.
e. Annualized assuming 1 in 20 years critical drought year event occurrence rate.

— = not applicable
AF = acre-feet
CRA = Colorado River Aqueduct
NOD = North of Delta
OM&R = operation, maintenance, and replacement
PWSC = Pure Water Southern California
SOD = South of Delta
SWP = State Water Project
TAFY = thousand acre-feet per year

Table 5-3. Unmonetized Benefits of Alternatives 1 and 2

Benefit	Description
Operational flexibility	Metropolitan's integrated conveyance and distribution system ensures consistent supplies, reliability, and flexibility throughout the region. Therefore, Metropolitan can address constraints in one area of the system for the benefit of the entire system. Adding highly purified water as an additional water source benefits Metropolitan's overall system flexibility by increasing the supply options available to meet demands throughout the service area.
Additional conveyance capacity for additional storage	Alternative 1 frees up to 118,590 AFY of conveyance and distribution system capacity, which could be used to import water for additional storage within and outside of Metropolitan's service area, which would allow Metropolitan flexibility to capture additional imported water, through transfers, exchanges, or agreements during wet years.
Diversified local water supply portfolio	Metropolitan's local water supply portfolio relies heavily on local groundwater supplies supplemented by stormwater recharge and small recycled water projects. Alternative 1 would add a new local drought-resistant supply, diversifying Metropolitan's local water supply portfolio and thereby increasing the overall resiliency of water supplies by ensuring the availability of water during periods of drought and natural emergencies.
Water supply reliability: economic and regional impacts	Under the 2020 IRP Scenario D (2% chance of occurrence), if there were major disruptions or reductions in imported supplies over an extended period, then Metropolitan's WSA plan could be implemented. Metropolitan would maintain the minimum health and safety water supply to residents using local sources but could impose WSAs on all other uses. The WSA may result in short-term impacts to the local economy and potentially place temporary limits on planned development due to the lack of water to support new customers. WSAs could result in a significant loss for the tourism and business sectors, both key drivers of the region's economy. For example, businesses and industries may need to impose shorter business hours, lower production levels, and/or limit services, all which could be expected to result in output, revenue, and employment losses.
DPR implementation	Augmentation of the raw water supplies to the WTPs with highly purified water could enable Metropolitan to store the replaced imported water in local groundwater basins. Potentially, benefits to raw water augmentation would include (1) an increased number of available raw water sources to the WTPs, which would provide operational flexibility; (2) the ability to provide highly purified water to additional member agencies after treatment at the WTP; (3) improved water quality to the WTP from lower TDS concentrations compared to the TDS concentrations in the current Colorado River water source; and (4) gaining first-time regulatory approval for a completely new water source in the region
Cross-State Collaboration	PWSC would reduce cross-state competition for Colorado River and SWP water supplies. The project implements a collaborative approach to long-term water management and a collaborative approach to regional strategies. PWSC has resulted in better working relationships, which provide opportunities for parties to leverage partner expertise.
Reduced Greenhouse Gas Emissions	PWSC would reduce the "carbon footprint" as the conveyance energy to import SWP/CRA water is far greater than that used by local recycled water supply. The result would be reduced use of fossil fuels, lower carbon emissions, and improved air quality. Furthermore, the design of the PWSC alternatives leverages existing infrastructure to the extent feasible, thereby reducing the overall emissions from construction.

Notes:
AFY = acre-feet per year
CRA = Colorado River Aqueduct
DPR = direct potable reuse
IRP = Integrated Water Resources Plan
Metropolitan = Metropolitan Water District of Southern California
PWSC = Pure Water Southern California
SWP = State Water Project
TDS = total dissolved solids
WSA = water shortage allocation
WTP = Water Treatment Plant

5.4. Benefit-Cost Analysis Findings

5.4.1. Approach

The benefits and costs for the economic analysis are estimated using methodological approaches consistent with Reclamation's guidance. In accordance with Reclamation's Directive and Standards WTR TRMR-128 (Reclamation 2022), the benefits and costs of the alternatives are presented in two ways: (1) in nominal undiscounted terms in current 2023 dollars; and (2) in discounted terms to net present value (with a 2023 base year) using the current federal discount rate of 2.75 percent.

The cost of water for the alternatives is also provided as uniform equivalent annual costs (UEACs) following Reclamation's prescribed approach (Reclamation 2023). This annualized project cost considers the expected service life of the project and the discount rate employed for converting future expenditures to present dollars. The discount rate used is the prescribed rate for plan formation and evaluation of federal water resources (the federal planning rate) as published by the U.S. Department of the Treasury in November 2023 (Reclamation 2023). The UEAC has been divided by the alternatives' AF of annual water supply to determine the annual present cost of the project on a per AF basis—or the annual cost per AF.

5.4.2. Assumptions

The key economic factors and assumptions used for the economic analysis are listed in Table 5-4. These include the relevant variables for time-commensurate evaluation, including first year of construction period, project service life, discount rate, and base year for calculating present value of costs.

Table 5-4. Key Factors and Schedule for Economic Analysis

Factor	Value
Dollar year	2023
Base year (NPV)	2023
Discount rate	2.75%
Loan amortization rate	0%
Escalation rate (MPC)	1.0% [1]
Useful service life (conveyance)	75 years
Useful service life (other facilities)	50 years
Estimated residual value (2063)	$0
Schedule	**Date**
Planning/construction begins	2024
Construction mid-point	2028
Construction end	2032
Operations Begin	2033
Analysis/repayment period end	2062

Notes:
1. Escalation rate is shown in real terms applied to 2023 dollar values.
MPC = mid-point of construction
NPV = Net Present Value

5.4.3. Net Benefits and Benefit-Cost Ratio

Table 5-5 provides a comparison of the costs and benefits of the PWSC (Alternative 1) and the distributed (Alternative 2) alternatives. The benefits for Alternative 2 have been estimated based on pro rata reduction to the Alternative 1 benefits by 9.8 percent in line with its similarly lower level of annual water supply production. The individual benefits monetized for each alternative are shown in terms of both their annualized value and their total net present value over the 30-year analysis period. Table 5-5 also shows the estimated net benefits and the benefit-cost ratio (BCR) of each alternative.

Table 5-5. Benefit and Cost Comparison of Alternatives

Category	PWSC (Alternative 1)		Distributed Recycled Water Treatment Plants (Alternative 2)	
	Annual Value	Net Present Value (30 years)	Annual Value	Net Present Value (30 years)
Benefits				
Water supply	$530,809,000	$8,420,001,000	$478,932,000	$7,597,100,000
Water shortage avoidance	— [a]	— [a]	— [a]	— [a]
Water supply reliability	$151,677,000	$2,405,981,000	$136,853,000	$2,170,840,000
Water quality	$35,577,000	$564,343,000	$32,100,000	$509,189,000
Avoided groundwater costs	$2,158,000	$34,237,000	$1,757,000	$30,891,000
	$71,624,000 [b]	$1,136,141,000	$64,624,000 b	$1,025,104,000
Emergency supply benefit (e.g., major earthquake event)	$1,897,000 [c]	$30,098,000	$1,712,000 c	$27,157,000
Interagency transfers of imported water	$4,744,000 [d]	$75,252,000	$4,280,000 d	$67,898,000
Benefits for economic stability and development	$132,228,000	$2,097,474,000	$119,305,000	$1,892,484,000
Construction job creation and tax generation	$210,000,000	$3,331,140,000	$242,543,000	$3,005,582,000
	$24,550,000	$389,479,000	$28,358,000	$351,415,000
OM&R job creation and tax generation	$158,000,000	$2,506,286,000	$159,386,000	$2,261,343,000
	$47,000,000	$745,541,000	$47,412,000	$672,678,000
Total	**$1,370,270,000**	**$21,735,972,000**	**$1,317,264,000**	**$19,611,680,000**
Costs				
Construction [e]	$215,500,000	$5,538,519,000	$248,900,000	$6,396,809,000
OM&R	$228,000,000	$3,616,666,000	$230,000,000	$3,648,391,000
Total	**$443,500,000**	**$9,155,185,000**	**$478,900,000**	**$10,045,200,000**
Cost-Effectiveness				
Net Benefits	$926,770,000	$12,580,787,000	$838,364,000	$9,566,480,000
Benefit-Cost Ratio	—	2.37	—	1.95

Notes:
a. Water shortage avoidance benefit not assigned because it is offset by the water supply reliability benefit.
b. Based on future permanent 10 TAFY groundwater aquifer failure.
c. Annualized assuming 1 in 50 years major earthquake or other major disaster occurrence rate.
d. Annualized assuming 1 in 20 years critical drought year event occurrence rate.
e. Does not include interest and amortization for project financing.
— = not applicable
OM&R = operation, maintenance, and replacement, PWSC = Pure Water Southern California

A comparison of the respective benefits and costs shown in Table 5-5 indicates that Alternative 1 is estimated to result in the maximum net benefits to the public (with an average annual value of $926.8 million [undiscounted]). Over the 30-year operating period considered, PWSC would result in total net benefits with an estimated $12.6 billion net present value in 2023. Alternative 1 is also the most cost-effective of the PWSC alternatives with an estimated BCR of 2.37 compared with the Alternative 2, which has a lower estimated BCR (1.95) and would result in lower total net benefits (an estimated net present value of approximately $9.6 billion).

6. Selection of the Proposed Water Recycling Project

Selection of the Proposed Water Reclamation, Recycling or Desalination Project.

(a) Provide a justification of why the proposed water reclamation, recycling or desalination project is the selected alternative in terms of meeting objectives, demands, needs, cost effectiveness, and other criteria important to the decision.

(b) Provide an analysis and, if applicable, an affirmative statement of whether the proposed water reclamation, recycling or desalination project would address the following:

(i) reduction, postponement, or elimination of development of new or expanded water supplies;

(ii) reduction or elimination of the use of existing diversions from natural watercourses, or withdrawals from aquifers;

(iii) reduction of demand on existing Federal water supply facilities; and

(iv)reduction, postponement, or elimination of new or expanded wastewater facilities.

This section provides the justification for the selected alternative based on the alternatives evaluation performed in Chapters 4 and 5.

6.1. Alternative Selection

Phase 1 of the PWSC (Alternative 1) is the selected project in this Feasibility Study.

Alternatives were developed to achieve the following objectives:

- Provide a new high-quality local water source that is reliable, cost-effective, and climate-change resilient to help meet regional water demands, with expedited or phased deliveries of such supplies where feasible.
- Diversify Metropolitan's water supply portfolio, increase regional operational flexibility, and provide opportunities for improved coordination and future integration with other water supply and distribution systems.
- Contribute to the water supply and water quality of local groundwater basins.
- Provide improved wastewater treatment to maximize beneficial reuse of wastewater that would otherwise be discharged into the ocean, while complying with water quality requirements for ocean discharge.
- Further statewide goals of increasing use of recycled water as a sustainable, environmentally sound water source for indirect and direct potable reuse.
- Reduce reliance on imported water supplies and provide greater resilience of local water supplies.

- Increase the locally available water supply to protect against seismic events and service disruptions.

A summary of the comparative evaluation of the effectiveness, efficiency, completeness, and acceptability of the two action alternatives considered for a water recycling project is provided in Table 6-1.

Table 6-1. Comparative Evaluation of Alternatives 1 and 2

CRITERION	CONCLUSIONS OF EVALUATION					
	Reduce risk of regional shortages	Reduce risk of earthquake outages	Reduce loss of groundwater production	Reduce imported water reliance	Climate change resilience	Benefit of DPR
Effectiveness	Alternative 1 highest Alternative 2 second No Action – lowest	Alternative 1 highest Alternative 2 second No Action – lowest	Alternative 1 highest Alternative 2 second No Action – lowest	Alternative 1 highest Alternative 2 second No Action – lowest	Alternative 1 highest Alternative 2 second No Action – lowest	Alternative 1 highest Alternative 2 second No Action – lowest
Efficiency	**Alternative 1** would be more efficient than Alternative 2. Alternative 2 would have a higher construction cost and annual cost for OM&R than Alternative 1. No Action would be least efficient.					
Completeness	**Alternatives 1 and 2** are essentially equal in terms of completeness. Both alternatives require additional actions to meet the target of 650,000 AFY identified in the IRP.					
Acceptability	**Alternative 1** has a smaller footprint for disturbed areas than Alternative 2. The smaller footprint would reduce the project impacts, streamline regulatory compliance, and reduce impacts to the public during construction. Therefore, Alternative 1 would have higher acceptability. No Action would be the least acceptable.					

Notes:
DPR = direct potable reuse
MGD = million gallons per day
OM&R = operation, maintenance, and replacement

Alternative 1 produces more high purity water to effectively meet the project objectives. Alternative 1 also has lower capital and operation and maintenance costs and is, thereby, more efficient. The smaller footprint for Alternative 1 reduces environmental impacts and results in higher acceptability.

6.2. Determinations

PWSC (Alternative 1) would reduce the scope of future development of local water supplies and improve water supply sustainability. Phase 2 of the PWSC program would add another 35 MGD of purified water for future DPR.

In addition, PWSC would

- reduce the reliance of Metropolitan on diversions from the Bay-Delta and the Colorado River

- reduce the demand for existing federal water supplies from the CRA (Reductions in the demand for SWP water supplies may also benefit the Central Valley Project [CVP].)
- not provide new or expanded wastewater treatment facilities (PWSC would only allow for the reuse of wastewater that is already being treated.)

6.3. Summary of Selected Alternative

Alternative 1 - PWSC increases the resilience and reliability of Metropolitan's water supply by shoring up core supplies and reducing the chances of a net shortage in the future. More recent data from the 2020 IRP were used to update the needs assessment in *Addendum to White Paper No. 2: Planning, Financial Considerations, and Agreements* (Metropolitan 2023a). Specifically, PWSC would help address the following threats to Metropolitan's water supply:

- **Net Shortage.** By 2045, PWSC would help address the risk of net shortages, especially in the SWP-dependent areas, by reducing the chance of a net shortage from the current risk level of 66 percent of the time to 57% of the time. An additional 650,000 AF of new annual supply is needed to prevent the risk of a net shortage.
- **Low Regional Storage**. PWSC would help address the risk that regional storage would be below 1 million AF, which could result in significant reliability issues for the region. Based on the 2020 IRP analysis, this risk could occur up to 2 percent of the time.
- **Declining Groundwater**. PWSC would help address potential loss of groundwater production capabilities due to a continuing decline in water levels, which could reduce production by up to 10 percent by 2040.

PWSC would offer significant benefits to all of Metropolitan's member agencies. The production of up to 115 MGD of purified water in Phase 1 would help to maintain groundwater production, prevent a strain on regional water supply reserves, and complement other Metropolitan initiatives such as Delta Conveyance by providing reliable replenishment supplies that reduce the need for imported water. PWSC could be integrated into the existing regional system and become part of Metropolitan's network of facilities.

PWSC would provide regional benefits to more agencies than just the member agencies that would directly receive the purified water. PWSC would provide water directly to certain member agencies (and potentially to some industrial users) for groundwater replenishment through IPR, and these deliveries would replace current and future imported deliveries and increase Metropolitan's storage, thereby increasing reliability for all end users. PWSC would also deliver water through DPR via raw water augmentation to Metropolitan's Weymouth and Diemer WTPs. This DPR service would directly serve many member agencies, because potable water from the Weymouth and Diemer WTPs is delivered to most of Metropolitan's service area, including member agencies throughout Los Angeles and Orange Counties.

Additional conceptual planning efforts would be undertaken to extend the reach of PWSC throughout the service area. Because of this increased source in Metropolitan's distribution system, other imported sources would be made available for use in the rest of the service area and for storage.

PWSC would play an important role in Metropolitan's future by improving the regional resilience of Metropolitan's service area and integrated system in the following areas:

- **Reduces Chances of a Net Shortage.** PWSC would reduce the risk of a net shortage, especially in the SWP-dependent areas from 66 percent to 57 percent of the time by 2045. PWSC would also reduce the need for a new annual supply from 650,000 AFY to 495,000 AFY.
- **Reduces Chances of Low Regional Storage.** PWSC would reduce the risk that regional storage would fall below 1 million AF. Based on the 2020 IRP analysis, PWSC would reduce the risk by 50 percent that regional storage would fall below 1 million AF.
- **Improves Groundwater Sustainability.** PWSC would prevent the potential loss of groundwater production capabilities due to declining water levels in the four groundwater basins.

6.3.1. Improved Development of Local Supplies

PWSC would increase local supplies by 155,000 AFY, which would improve the local supply portfolio.

Table 6-2 lists the regional benefits that PWSC would provide by noting how PWSC would address various issues that Metropolitan faces.

Table 6-2. Regional Benefits from PWSC

Topic	Challenges	Benefits
Net Shortage and Drought	• Risk of a net shortage up to 66 percent of the time • Need for up to 650 TAFY of new core supply • Risk of storage below 1 MAF up to 2 percent of the time	• Reduces risk of net shortage by 9 percent • Reduces need for additional supply to 495 TAFY • Reduces risk of storage below 1 MAF by 50 percent
Groundwater Sustainability	• Projected 17 percent of the groundwater basins would be unsustainable • Risk of loss of groundwater production by up to 10 percent	• Prevents a portion of the loss of groundwater production in Main San Gabriel, West Coast, Central, and Orange County Basins • Reduces percent of unsustainable basins from 17 percent to 15 percent
Local Supply Development	• Stagnant growth in local supply development	• Increases local supply by 155 TAFY
Seismic Event	• Significant loss of imported supply capacity for up to 24 months due to catastrophic seismic event	• Increases the effective local supply during a seismic emergency by up to 15 percent • DPR could maintain flow at treatment plants
Operational Flexibility	• Operational flexibility may be limited during time of emergency or drought	• Improves flexibility to meet demands and maintain regional storage

Notes:
DPR = direct potable reuse
MAF = million acre-feet
PWSC = Pure Water Southern California
TAFY = thousand acre-feet per year

Table 6-3 provides a summary table of the net present value of monetized benefits and costs, with all qualitatively assessed benefits ranked in decreasing magnitude for the PWSC.

Table 6-3. Benefit and Cost Comparison of PWSC

Category	Net Present Value (30-year)
Benefits - Monetized	
Water Supply	$8,420,001,000
Water Shortage Avoidance	— [a]
Water Supply Reliability	$2,405,981,000
Water Quality Improvement	$564,343,000
Increased Groundwater Levels	$34,237,000
	$1,136,141,000
Major Earthquake Event	$30,098,000
Imported Water and Inter-Agency Transfers	$75,252,000
Economic Stability and Development	$2,097,474,000
Construction Job and Tax Generation	$3,331,140,000
	$389,479,000
OM&R Job and Tax Generation	$2,506,286,000
	$745,541,000

Category	Net Present Value (30-year)
Total	**$21,735,972,000**
Benefits – non-monetized	
Operational Flexibility	Metropolitan's integrated conveyance and distribution system ensures consistent supplies, reliability, and flexibility throughout the region. Adding PWSC purified water benefits Metropolitan's overall system flexibility by increasing the supply options.
Additional Conveyance Capacity for Additional Storage	PWSC frees up to 118,590 AFY of conveyance and distribution system capacity, allowing Metropolitan the flexibility to capture additional water through transfers, exchanges, or agreements during wet years.
Diversified Local Water Supply Portfolio	PWSC adds a new local drought-resistant supply, diversifying Metropolitan's local water supply portfolio and increasing the resiliency of water supplies.
Water Supply Reliability: Economic and Regional Impacts	Metropolitan would maintain the minimum health and safety water supply to all residents using local sources but could impose WSAs on all other uses. The WSA may result in short-term impacts to the local economy.
DPR Implementation	Potential benefits to raw water augmentation include: (1) increased number of available raw water sources to the WTPs providing operational flexibility; (2) the ability to provide purified water to additional member agencies after treatment at the WTP; and (3) improved water quality to the WTP from lower TDS concentrations compared to the current Colorado River water source.
Cross-State Collaboration	PWSC reduces cross-state competition for Colorado River and SWP water supplies.
Costs	
Construction	$5,538,519,000
OM&R	$3,616,666,000
Total	**$9,155,185,000**
Cost-Effectiveness	
Net Benefits	$12,580,787,000
Benefit Cost Ratio	2.37

Notes:
a The water shortage avoidance benefit is not assigned since it is recognized by the water supply reliability benefit.
— = not applicable
AFY = acre-feet per year
DPR = direct potable reuse
IRP = Integrated Water Resource Plan
OM&R = operation, maintenance, and replacement
PWSC = Pure Water Southern California
SWP = State Water Project
TDS = total dissolved solids
WSA = water shortage allocation

7. Environmental Consideration and Potential Effects

(7) Environmental Consideration and Potential Effects (WTR 11-01).

The review of a water reclamation, recycling or desalination feasibility study report does not require National Environmental Policy Act (NEPA) compliance. The Department of the Interior categorical exclusion 1.11 "Activities which are educational, informational, advisory, or consultative to other agencies, public and private entities, visitors, individuals or the general public" applies to Reclamation's consultative review, and preparation of the water reclamation, recycling or desalination feasibility study reports. As stated in Paragraph 1. Scope, Reclamation is not making a recommendation to go forward with the proposed water reclamation, recycling or desalination project, nor is Reclamation using the water reclamation, recycling or desalination feasibility study report to propose an action to the Congress.

(a) The water reclamation, recycling or desalination feasibility study report must include sufficient information on the proposed water recycling or desalination project to allow Reclamation to assess the potential measures and costs that will be necessary to comply with NEPA, and any other applicable Federal law. Accordingly, the following information is required.

(i) Discussion whether, and to what extent, the proposed water reclamation, recycling or desalination project will have potentially significant impacts on endangered or threatened species, public health or safety, natural resources, regulated waters of the United States, or cultural resources.

(ii) Discussion whether, and to what extent, the project will have potentially significant environmental effects, or will involve unique or undefined environmental risks.

(iii) Description of the status of required Federal, state, tribal, and/or local environmental compliance measures for the proposed water reclamation, recycling or desalination project, including copies of any documents that have been prepared, or results of any relevant studies.

(iv) Any other information available to the study lead that would assist with assessing the measures that will be necessary to comply with NEPA, and other applicable Federal, state or local environmental laws such as the Endangered Species Act or the Clean Water Act.

(v) Discussion of how the proposed water reclamation, recycling or desalination project will affect water supply and water quality from the perspective of a regional, watershed, aquifer, or river basin condition.

(vi) Discussion of the extent to which the public was involved in the feasibility study, and a summary of comments received, if any.

(vii) Description of the potential effects the project will have on historic properties. Discussion must include potential mitigation measures, the potential for adaptive

reuse of facilities, an analysis of historic preservation costs, and the potential for heritage education, if necessary.

(b) If, at a later date, Reclamation provides funds for construction, all appropriate NEPA and other environmental and cultural compliance must be completed prior to any ground disturbing activities beginning in order for the project to be eligible.

7.1. Background/Environmental Documentation Status

This section provides an overview of potential environmental effects of the PWSC on endangered or threatened species, public health and safety, natural resources, regulated waters of the U.S., cultural resources, and historic properties. The chapter also provides a discussion of public scoping and public involvement. The status of anticipated federal, state, tribal, and/or local requirements is described. In addition, the discussion addresses how PWSC would affect water supply and water quality in terms of regional, watershed, aquifer, and river basin conditions (including climate change considerations). Discussion of these topics should assist Reclamation in identifying NEPA and regulatory compliance needs for the project.

Implementation of PWSC would require compliance with the California Environmental Quality Act (CEQA) and the National Environmental Policy Act (NEPA), the Clean Water Act, the Rivers and Harbors Act, the National Historic Preservation Act, the California Fish and Game Code, and the State of California and federal Endangered Species Acts.

Metropolitan is the lead agency under CEQA (California Public Resources Code [PRC] Section 21067) and is responsible for complying with the requirements of CEQA. An initial assessment of the PWSC indicated that the project may have a significant effect on the environment; therefore, Metropolitan has determined that preparation of an Environmental Impact Report (EIR) is appropriate per PRC 21082.2. The environmental documents for the program would do the following: (1) inform decision makers and the public about the potentially significant environmental effects of the proposed activities; (2) identify ways that the significant environmental effects can be avoided or reduced; and (3) identify alternatives to the project that would avoid or substantially lessen the proposed project's impacts.

On September 30, 2022, Metropolitan prepared a Notice of Preparation (NOP) of an EIR and filed the NOP with the California Office of Planning and Research, which initiated the Scoping phase for the PWSC Program under CEQA. The NOP identified probable environmental effects in the following resource categories: air quality, biological resources, cultural resources, energy, geology and soils, greenhouse gas (GHG) emissions, hazards and hazardous materials, hydrology and water quality, land use and planning, noise, transportation, tribal cultural resources; and utilities and service systems. The resource categories not anticipated to have potentially significant environmental impacts are aesthetics, agriculture and forestry resources, mineral resources, population and housing, public services, recreation, and wildfire. The Scoping phase ended on November 14, 2022, and Metropolitan received comments covering a range of topics, including biological, archaeological, and tribal cultural resources; water quality, reliability and accessibility; energy, GHG emissions and air pollutants; continued coordination on planning process and future activities; regional operational flexibility; and future integration with other water supply and distribution systems.

Metropolitan is currently conducting technical studies for various environmental resource categories. The technical studies will provide detailed information and documentation that will be used to analyze project impacts in the EIR. The Draft EIR is anticipated be completed in December 2024, and will be available for public review for 45 to 60 days. The Final EIR is anticipated to be completed and certified by Metropolitan's Board of Directors in October 2025.

The federal lead agency for the project will likely be Reclamation. Per WTR 11-01, review of a water reclamation, recycling, or desalination feasibility study report does not require NEPA compliance; however, providing federal funds for design or construction of a project does. Reclamation may consider use a Categorical Exclusion to comply with NEPA. Funding for construction of the project would require additional NEPA compliance by Reclamation, which would result in an Environmental Assessment (EA)/Finding of No Significant Impact (FONSI) or Environmental Impact Statement (EIS). The EA would determine whether a federal action has the potential to cause significant environmental effects. If Reclamation determines that the proposed federal action would not have significant environmental impacts, the agency will issue a FONSI. If Reclamation determines that the environmental impacts of the proposed federal action would be significant, an EIS would be prepared.

7.2. Overview of Potential Impacts

Potential environmental impacts from PWSC are anticipated to occur during construction and ongoing operation and maintenance (O&M). Construction would involve activities such as site preparation, grading, excavation, erection of buildings and facilities, and site restoration, and would have short-term, temporary impacts. The activities, and therefore, the extent of impact, would vary with the project components (e.g., treatment upgrades, pipelines, pump stations, and storage facilities). Operation would involve distribution of recycled water for urban, agricultural, and environmental uses. Maintenance activities could include periodic inspections, repairs, and replacement of equipment as well as emergency repairs. A brief discussion of the nature of anticipated construction, and operational and maintenance impacts, is provided below. Section 7.3 provides a discussion of potential impacts for each of the issue areas identified in WTR 11-01 and TRMR 128.

7.2.1. Project Construction

Project construction impacts are anticipated to include impacts to hydrology, water quality, biological resources, cultural resources, land use, agriculture, transportation, air quality, noise, utilities, and temporary access to recreational facilities. Because the proposed facilities would mostly lie within disturbed or developed areas (e.g., the Warren Facility or along roadways), the impacts associated with construction are anticipated to be short-term and reduced, to the degree feasible, by the implementation of specific design features and best management practices. These include measures such as: compliance with existing regulations such as the implementation of Stormwater Pollution Prevention Plans, avoidance and minimization techniques such as the use of trenchless technology to cross streams and rivers sensitive biological resources, and infrastructure, as well as preconstruction surveys for biological, paleontological, and cultural resources.

7.2.2. Project Operation

Operation in the PWSC would include the production, distribution, and use of recycled water for urban, agricultural, and environmental uses. The project would be consistent with the state, regional, and local policies that encourage recycled water use. The recycled water would be treated at a level stipulated under the Title 22 CCR requirements for specific end uses, and would be protective of the environment and public health. Section 8 describes California recycled water use regulations.

Overall, the project will increase recycled water use, thereby offsetting imported water use and reducing the amount of treated wastewater discharged into the Pacific Ocean. Long-term impacts associated with operation of the PWSC include an increased use of power and increased GHG emissions, which are mitigated through Metropolitan's Climate Action Plan (CAP) adopted in May 2022.

7.2.3. Project Maintenance

Project maintenance included in the PWSC would include activities ranging from periodic vehicle trips to inspect facilities and equipment to trenching to replace treatment and pipeline appurtenances or conduct emergency repairs.

7.3. Potentially Significant Impacts

This section discusses potentially significant environmental impacts on natural resources, endangered and threatened species, waters of the U.S., cultural resources and historic properties, unique or undefined environmental risks, and public health and safety.

7.3.1. Natural Resources

The PWSC would primarily be developed and constructed within existing road rights-of-way, utility easements, disturbed areas, and other upland areas that lack native habitat value or aquatic resources. Therefore, impacts to natural resources are limited and mostly temporary. Although PWSC facilities have been sited to avoid sensitive natural resources as much as possible, there may still be some limited impacts to these areas. Potential measures to avoid or minimize impacts to these areas include limiting the construction footprint, construction work windows, trenchless pipeline installation, shoring trenched areas, restoring temporary construction areas to their preconstruction condition, and enhancing areas of marginal or poor habitat by restoring these areas with appropriate native vegetation, thereby increasing the quality and quantity of suitable habitat for wildlife. During the planning and design phases, Metropolitan will continue to look for opportunities to minimize impacts to natural resources and enhance habitat, and other natural areas where feasible.

Magnuson-Stevens Fishery Conservation and Management Act, Essential Fish Habitat. The PWSC would be located in areas that lack marine resources and Essential Fish Habitat regulated under the Magnuson-Stevens Fishery Conservation and Management Act, and no Essential Fish Habitat occurs in the immediate vicinity of the project area. Therefore, the PWSC would have no effect on Essential Fish Habitat and would be in conformance with the Magnuson-Stevens Fishery Conservation and Management Act.

Coastal Zone Management Act. The PWSC is not located within the Coastal Zone and no coastal habitat occurs in the immediate project vicinity. Therefore, the PWSC would have no effect on any areas designated as Coastal Zone, and would be in conformance with the Coastal Zone Management Act.

Migratory Bird Treaty Act: Construction of the PWSC could result in the removal and trimming of trees and other vegetation during the bird nesting season; therefore, the PWSC has the potential to adversely affect nesting birds protected under the Migratory Bird Treaty Act (MBTA). As a regulatory requirement, the project must comply with the regulations and guidelines of the MBTA and California Fish and Game Code, which include avoidance of active nests. In addition, standard avoidance and minimization measures would be implemented to avoid impacts to nesting birds. Therefore, the PWSC would result in no effect on migratory birds and would be in conformance with the MBTA.

Wild and Scenic Rivers Act: The PWSC does not occur within or in the immediate vicinity of areas designated as a Wild and Scenic River; therefore, the project would have no effect on any areas designated as a Wild and Scenic River and would be in conformance with the Wild and Scenic Rivers Act.

7.3.2. Endangered and Threatened Species

In 2022 and 2023, Metropolitan conducted general biological, rare plant, and protocol surveys for a variety of sensitive plant and wildlife species along the backbone pipeline and buffer area. Survey methodology and results will be detailed in a technical study in preparation for the EIR. Notification to conduct protocol surveys and letters summarizing the results of surveys were provided to the U.S. Fish and Wildlife Service (USFWS) for each survey conducted for federally listed species or species proposed for listing. The following two federally listed and one candidate wildlife species were documented during these surveys, respectively: coastal California gnatcatcher (*Polioptila californica* californica) and least Bell's vireo (*Vireo bellii pusillus*); and monarch butterfly (*Danaus plexippus*). Based on the proposed PWSC construction areas, which were designed to minimize impacts to sensitive biological resources, and implementation of standard avoidance and minimization measures, no direct impacts are anticipated to these species.

A portion of the backbone pipeline alignment is located in critical habitat for the southwestern willow flycatcher (*Empidonax trailii extimus)* (SWFL*)*. Protocol surveys conducted in 2022 identified migrating willow flycatchers; however, based on various indicators, it is unlikely they were southwestern willow flycatchers. Additionally, the portion of the PWSC that is located within the critical habitat area for SWFL does not support physical or biological features that are essential for the species, as defined by the USFWS (USFWS 2013), which generally include dense riparian vegetation interspersed with openings of open water, or sparser vegetation that contain a variety of insect prey populations. As a result, the project would not result in impacts to designated critical habitat that contains the physical or biological features that are essential for SWFL, and no adverse modification of critical habitat would occur.

No federally or state listed endangered, threatened, or candidate plant species were observed within the PWSC area and buffer during the biological surveys, including the 2022 and 2023 rare plant surveys.

In areas where sensitive species could occur, Metropolitan will implement standard avoidance and minimization measures such as conducting additional surveys, working outside the nesting bird season, limiting construction activities and imposing noise thresholds, providing a biological monitor, and restoring sites to preconstruction conditions or enhancing habitat where possible. Metropolitan will also consult with the USFWS and the California Department of Fish and Wildlife (CDFW), as appropriate, to determine permitting needs, if any, to comply with the federal and state endangered species acts, minimize impacts, and develop mitigation. All general biological, rare plant, and protocol survey results will be included in a biological resources technical report, which is currently in preparation.

7.3.3. Waters of the United States and State

In 2022 and 2023, Metropolitan conducted a jurisdictional delineation of potentially affected waters of the United States (as defined by the Clean Water Act), waters of the State (as defined by the California Water Code) and CDFW jurisdiction (as defined by the Fish and Game Code). Based on a preliminary assessment, the PWSC would result in the following impacts: approximately 0.01 acre of temporary impacts to non-wetland waters of the U.S.; approximately 0.10 acre of temporary impacts to wetland and non-wetland waters of the State, composed of 0.02 acre of non-wetland waters and 0.08 acre of isolated non-wetland waters; and approximately 0.18 acre of temporary impacts to CDFW-jurisdictional habitat, composed of 0.04 acre of riparian-vegetated stream and 0.14 acre of non-vegetated streambed. These areas all occur in existing operational facilities associated with the Santa Fe Dam Basin, according to the USACE's Master Plan for the area (USACE 2011), that are subject to disturbance and maintenance.

The preliminary assessment determined that project impacts would likely qualify for a Nationwide Permit under Section 404 of the CWA from the USACE and a waiver of Water Quality Certification under Section 401 of the CWA from the Regional Water Quality Control Board. A Streambed Alteration Agreement with the CDFW would also be required. In addition, portions of the project would require compliance with Sections 10 and 408 of the Rivers and Harbors Act of 1899. The USACE has preliminarily identified potential project areas and features subject to these permits, and Metropolitan meets with the USACE bi-monthly to provide updates and receive guidance. Metropolitan will continue to meet and work with the USACE to comply with these permits and streamline the permitting process for all permits administered by the USACE.

Results of the jurisdictional delineation will be included in the biological resources technical report, which is currently in preparation, and will be used to apply for any required permits associated with PWSC.

Wastewater from the Warren Facility would be discharged to the ocean outfall consistent with current operations and in accordance with permit requirements. The volume of effluent discharged to the ocean outfall is expected to decrease as a result of PWSC implementation. No new impacts are anticipated.

7.3.4. Cultural Resources and Historic Properties

Metropolitan is currently conducting a cultural resources study of the PWSC area. The study includes a records search with the South Central Coastal Information Center, a Sacred Lands File search from the California Native American Heritage Commission (NAHC), a review of historical aerial photographs and maps, and pedestrian and windshield field surveys. In addition, the California Register of Historical Resources (CRHR) and the National Register of Historic Places (NRHP) have been used to identify potentially affected eligible or listed historical resources and/or historic properties. Survey methodology, results, and significance evaluations will be detailed in a technical study in preparation for the EIR.

Twenty-nine resources have been identified within the project area. Nineteen of the 29 resources are either transmission lines that cross over the backbone alignment and whose towers, poles, and other facilities would not be affected or they are railroad segments that the backbone pipeline would tunnel beneath. Ten of the 29 resources identified would be subject to impacts from PWSC construction, including trenching and shoring for the backbone pipeline. Of the 10 resources that would be subject to impacts, 4 have been previously assessed as not eligible for the CRHR or NRHP; thus, impacts to these 4 resources would not constitute significant effects. Another resource potentially affected by

PWSC is the Santa Fe Dam and Flood Control Basin (P-19-192850). Although this resource has been identified as eligible for listing, impacts to it would not be significant since impacts to the contributing elements of the resource would be avoided.

An additional three historic debris scatters would be subject to impacts from PWSC construction; however, site records indicated that their eligibility had been assessed, but their eligibility, or lack thereof, was not noted on the site records. All three described extreme amounts of disturbance to the resource, which presumably negated their potential significance.

Two newly recorded historical trash scatters could be subject to impacts from construction of PWSC. Although these resources do not appear to be eligible for listing, they have not yet been evaluated. If PWSC cannot avoid impacts to these two resources, they will need to be formally assessed. Although it appears unlikely that they represent significant resources, if they are found to be eligible for the NRHP or CRHR, appropriate mitigation measures would need to be developed and implemented.

Metropolitan contacted the NAHC on April 1, 2022, to request a search of its Sacred Lands File and a list of Native American individuals and organizations that might have knowledge of, or concerns regarding, cultural resources within the project area. Metropolitan sent outreach letters on October 19, 2022, to members of the 12 tribal contacts identified by the NAHC.

Project survey methodology, tribal coordination, findings, and significance evaluations will be included in the cultural resources technical report, which is currently underway. The technical report could be used to support consultation with the Office of Historic Preservation in compliance with Section 106 of the NHPA and CEQA.

7.3.5. Unique or Undefined Environmental Risks

Metropolitan has not identified any unique or undefined environmental risks associated with the PWSC.

7.3.6. Public Health and Safety

Air Quality, Greenhouse Gas Emissions, and Climate Action Plan: The proposed project site is in the South Coast Air Basin (Basin), which is under the jurisdiction of the South Coast Air Quality Management District. Pollutants that are monitored within the Basin are subject to state and federal emissions standards. These pollutants include ozone, carbon monoxide, nitrogen dioxide, and suspended particulates. Temporary and operational emissions will be modeled as part of the technical studies to assess the air quality impacts associated with the project, and design modifications and mitigation measures will be implemented to reduce pollutants, where feasible. Preliminary modeling indicates no air quality impacts associated with operation of the project. However, temporary construction impacts are still being evaluated and are anticipated to exceed air basin thresholds for certain criteria pollutants.

In addition to evaluating air quality impacts, CEQA requires analysis of whether a project's construction and operational impacts conflict with an applicable plan, policy, or regulation adopted for the purposes of reducing GHG emissions. The construction and operation of the facilities for PWSC would produce new GHG emissions that must be addressed during the CEQA process. (CEQA Guidelines Section 15183.5 allow an agency's existing conservation programs to be quantified and used to offset future project GHG emissions.) Therefore, Metropolitan adopted a CAP in May 2022. GHG emissions will be modeled as part of the technical studies, and design modifications and mitigation measures will be implemented to reduce GHG emissions, where feasible.

Noise. Noise impacts are under evaluation due to the expected operation of heavy equipment and vehicles, demolition of facilities, construction materials, deliveries, and hauling during construction and the activities associated with the water treatment facilities (e.g., pumping, vehicular use during operations). Metropolitan will identify the noise impacts and measures that could be implemented to reduce or mitigate those impacts. Measures could include sound walls, noise barriers, limiting construction hours, identifying construction setbacks, directing equipment away from sensitive receptors, and maintaining construction equipment.

Transportation/Traffic Impacts: Construction of the conveyance system would largely be in urban environments and would involve street closures or rerouting of traffic. Metropolitan is currently conducting a traffic study that will be used to evaluate impacts in the EIR. Metropolitan will also coordinate with local jurisdictions to develop traffic plans and obtain permits.

Hazards and Hazardous Materials. Metropolitan is currently conducting a hazardous materials assessment to identify contaminated or potentially contaminated areas and other hazardous materials issues in the project area. The assessment includes a database search of government and regulatory agency environmental lists, a site reconnaissance, and review of online sources such as the California Department of Conservation Geological Energy Management Division and the National Pipeline Mapping System. A technical report detailing methods, findings, and evaluations will be used for EIR preparation. Due to the size of the project, Metropolitan is still analyzing preliminary results. Based on the developed nature of the project area, Metropolitan expects to encounter hazardous materials and will prepare a safety plan to avoid or minimize impacts associated with the project.

Coordinating Agencies. Table 7-1 identifies the agencies regulating environmental resources.

Table 7-1. Coordinating Agencies for PWSC Environmental Resources Permitting

Permitting Element	Coordinating Agencies
Section 404 of Clean Water Act Section 10 and 408 of Rivers and Harbors Act	USACE
Section 401 of Clean Water Act Porter-Cologne Act	RWQCB
Federal Endangered Species Act	USFWS
Section 106 of National Historic Preservation Act	Office of Historic Preservation
Streambed Alteration Agreement State Endangered Species Act	CDFW

Notes:
CDFW = California Department of Fish and Wildlife
PWSC = Pure Water Southern California
RWQCB = Regional Water Quality Control Board
USACE = U.S. Army Corps of Engineers
USFWS = U.S. Fish and Wildlife Service

7.4. Status of Compliance Requirements

7.4.1. Water Resources

Considering the regional nature of PWSC—which would span multiple groundwater basins, counties, and RWQCB jurisdictions—several permitting scenarios could be considered. It is currently envisioned that individual groundwater recharge permits (Waste Discharge Requirements/Water Recycling Requirements [WDR/WRRs]) would be required for each groundwater basin or member agencies. Table 4-4 and Table 4-5 provide information on water quality parameters for groundwater recharge. Table 7-2 indicates key regulatory elements of a groundwater recharge permit and some of the agencies involved. The basin managers are listed because of their potential partnering role in the permitting process; however, activities such as groundwater extraction would be undertaken by individual pumpers within the groundwater basin, and coordination would also be needed with these agencies.

Table 7-2. Coordinating Agencies for Water Reuse Permitting

Permitting Element	Potential Coordinating Agencies
Wastewater Treatment and Residuals Management	Los Angeles County Sanitation Districts
Advanced Water Treatment and Conveyance	Metropolitan Water District of Southern California
Spreading and/or Injection Site Operations, Groundwater Extraction and Monitoring	Metropolitan Water District of Southern California Los Angeles County Flood Control District Orange County Water District Water Replenishment District Main San Gabriel Basin Watermaster

The nature of this regional effort (with multiple partners) may require creative permitting approaches in collaboration with the regulators and project partners. In addition to the permits themselves, agreements would be necessary between Metropolitan and its partners to identify specific roles and responsibilities (see Chapter 8), including those associated with PWSC implementation, project operations, and permit compliance.

The key technical document that contributes to the permitting process is the Title 22 Engineering Report. Results and the data generated from the Innovation Center would be used to develop this report. Hydrogeological assessments and modeling for each groundwater basin would also be conducted to develop the report. Because the regional nature of PWSC encompasses multiple groundwater basins and RWQCB jurisdictions, the structure and development of the program's Title 22 Engineering Report could be approached in several ways. In addition, the phasing of activities may necessitate an engineering report that is flexible and able to be appended. Options and approaches would be discussed further with regulators and partners as PWSC progresses. Metropolitan would work closely with its partners and the regulating authorities to maintain an aggressive schedule for securing the required permits.

Several reports of waste discharge are projected to be submitted to the RWQCBs; these reports essentially serve as a groundwater recharge permit application. After a period of review and consultation with the regulating authorities on the draft Title 22 Engineering Report, with DDW-required public hearings being conducted before the issuance of the report, DDW issues a Conditional Acceptance Letter to agencies. The conditions included in the letter are then incorporated into the groundwater recharge permits (WDR/WRRs), which are ultimately issued by the RWQCBs. The approximate timeline for permitting efforts is shown on Table 7-3.

Table 7-3. Timeline for Key Elements of Permitting Strategy

Milestone	Start Date	End Date
Pilot-scale at joint site–Pilot-scale testing	12/25/2025	03/06/2027
Pilot-scale at joint site–Pilot-scale reporting	12/28/2026	06/27/2028
Sanitation Districts to submit ROWD for Warren Facility and review by RWQCB	01/03/2028	06/30/2028
Estimated Date of NPDES permit renewal	—	07/03/2028
Draft Title 22 Engineering Report	11/03/2025	05/29/2026
Final Title 22 Engineering Report	06/15/2026	03/19/2027
Public hearing(s)	03/22/2027	08/11/2028
Tentative WDR/WRP permit(s)	03/22/2027	10/13/2028
DDW start-up inspection and DDW approval (initial delivery)	08/15/2030	09/13/2030
IPR Engineering Report amendment and DDW approval	02/09/2028	01/04/2033
DPR Engineering Report amendment and DDW approval	03/06/2030	08/22/2033

Notes:
— = not applicable
DDW = Division of Drinking Water
DPR = direct potable reuse
IPR = indirect potable reuse
NPDES = National Pollutant Discharge Elimination System
ROWD = Report of Waste Discharge
RWQCB = Regional Water Quality Control Board
Warren Facility = A.K. Warren Water Resource Facility
WDR/WRP = Waste Discharge Requirement / Water Reclamation Plant

7.4.2. Regional Water Supply

Metropolitan's infrastructure uniquely connects two critical watersheds in the Western U.S.: the Colorado River watershed, fed by the Rocky Mountains; and the Sacramento-San Joaquin River watershed, fed by the western Sierra Nevada mountains. Large-scale water recycling in Southern California can return benefits to both watersheds. SNWA, CAP, the Arizona Department of Water Resources, and Metropolitan have worked together on the development of a long-term water supply strategy on the Colorado River. The partnership developed in PWSC has helped these agencies work better together.

PWSC will use purified water to augment the West Coast, Central, Main San Gabriel and Orange County Groundwater Basins to reduce Metropolitan's reliance on CRA and SWP water supplies. The project would help maintain and augment storage in regional groundwater basins, improve groundwater quality, provide operational flexibility, reduce reliance on imported water, and provide climate change resilience. By strengthening the future water supply reliability of the region, the project also achieves environmental and economic benefits.

Colorado River Obligations. The Colorado River watershed (see Figure 7-1) is a critical water supply source, supplying water for seven states—Wyoming, Colorado, Utah, New Mexico, Arizona, Nevada, and California—as well as 29 federally recognized tribes. The Colorado River originates in the Rocky Mountains and is fed primarily by precipitation that occurs throughout the Colorado River Basin, which extends from southwestern Wyoming to the Gulf

Figure 7-1. Colorado River Watershed

local water supplies. Metropolitan is a partner to Reclamation's three-state plan to reduce water supply allocations by about 13 percent through the end of 2026. A new agreement of

California. The Colorado River has been the backbone of Southern California's imported water supply for over 80 years. Metropolitan, under contract with Reclamation, constructed the CRA in 1941, and has since been responsible for importing Colorado River water through the CRA to Southern California. Metropolitan holds several contracts and is party to agreements with Reclamation, including the Boulder Canyon Project Act; the California Seven Party Agreement of 1931; Metropolitan's 1930 Colorado River Water Delivery Contract with Reclamation, as supplemented; the Coordinated Long-Range Operations Agreement; and the 2003 Colorado River Water Delivery Agreement/Quantification Settlement Agreement.

The Colorado River Basin, providing 20 percent of Metropolitan's imported water supply, has become increasingly stressed due to prolonged drought, climate change, and population growth. To meet Colorado River water allocation reductions, Metropolitan has had to implement aggressive conservation measures; develop collaborative partnerships with agricultural agencies, urban water agencies, and neighboring states; and develop alternative will be required for implementation of PWSC with endorsement by the seven Upper Basin states, who are partners in the Upper Basin and Lower Basin Drought Contingency Plans that were signed in 2019. Metropolitan continues to engage with the lower basin states and watermasters to discuss CRA water allocations beginning in 2027 through 2035. PWSC would provide up to 128,000 AFY of resilient water supplies for local water supply augmentation.

State Water Obligations: Approximately 30 percent of Southern California's water supply is currently transported through the Bay-Delta, which is the hub of California's water supply, via the SWP through the California Aqueduct. SWP water is supplied to the Bay-Delta primarily from the Feather River Watershed, which is dependent on snowpack in the northern Sierra Nevada. Reclamation has a direct interest in and supervision of the CVP, which works in concert with California's SWP to transfer water from Northern California through the Sacramento–San Joaquin River Delta to users in Southern California. Both the SWP and CVP infrastructure use the Delta and the San Luis Reservoir, as shown on Figure 7-2. The SWP can also deliver water to CVP contractors when there is capacity. Because both the CVP and the SWP convey water in the Sacramento River and the Delta, facility operations are coordinated based on the Coordinated Operating Agreement, the Bay-Delta Plan Accord, and many other agreements. Both CVP and SWP supplies have been significantly impacted by extended droughts, with allocations to water contractors from both systems cut to 5 percent in 2021, and CVP allocations further reduced to 0 percent in 2022. As discussed, during periods of drought, Metropolitan has not been able to meet potable water demands from its SWP annual allocations (due to cutbacks) and has had to rely on its groundwater basins and the drought buffer stored in these basins to meet demands. The PWSC project would develop a local drought-resilient water supply that could be used to augment local groundwater basins. Metropolitan and the Sanitation Districts would be able to reduce the region's reliance on SWP allocations and use groundwater supplies to meet demand.

Figure 7-2. SWP and CVP Infrastructure

The Colorado River Basin Water Supply and Demand Study was completed in 2012 with funding—in part—from the WaterSMART Basin Study grant program. The purpose of the Basin Study was to inform and guide future courses of action in response to existing and potential future imbalances between water supplies and demands in the Upper and Lower Colorado River Basins and adjacent areas of the Basin States that receive Colorado River Water through 2062, and to develop and analyze adaptation and mitigation strategies to resolve these imbalances. The Basin Study identified a portfolio of strategies to achieve long-term balance between water supplies and demands, including projects like PWSC, which is an example of a project to achieve long-term water supply balance.

In 2019, the Upper Basin and Lower Basin Drought Contingency Plans for the Colorado River were signed, which outlined strategies to address the ongoing drought in the Colorado River Basin. In supporting Reclamation's Lower Colorado River Drought Contingency Plan, Metropolitan has also committed to contributing up to 325,000 AFY in Lake Mead if the lake continues to decline.

The WaterSMART Implementation Plan states that collaborative partnerships that go beyond political and institutional jurisdictions must be developed to ensure that the nation's limited water resources are used efficiently, enough are retained to protect and restore the environment, and supplies are managed to reliably meet new demands. The PWSC would support water conservation, water recycling and reuse, and regional collaboration to address the competing needs for limited Southern California regional water resources. PWSC is an example of regional collaboration to increase the amount of recycled water in Metropolitan's service area and move the region toward more sustainable water resources management.

7.4.3. Water Quality Considerations

PWSC would improve water quality in groundwater basins by lowering concentrations of constituents such as TDS, nitrate, sulfate, and chloride. Recycled water from PWSC would also help with blending and long-term salt balance for the four groundwater basins served by PWSC. Recycled water would have TDS concentrations of less than 100 mg/L, which compares favorably to imported water from the Colorado River, which has some average TDS concentrations of over 500 mg/L.

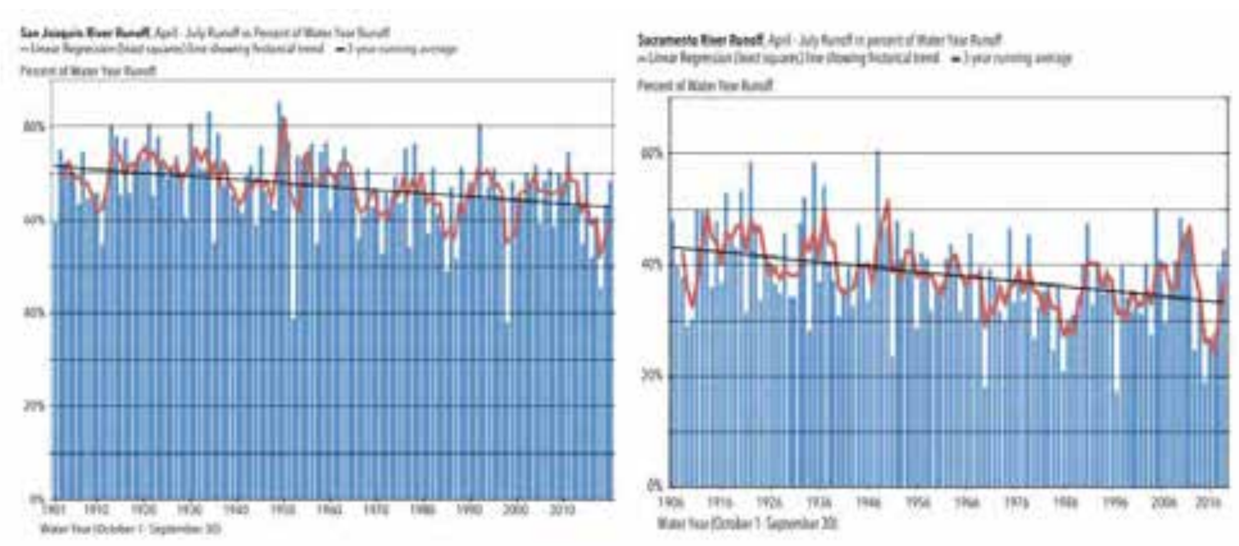
The Warren Facility currently has one of the largest discharges to the Pacific Ocean in Southern California and represents the Sanitation Districts' largest remaining source of wastewater effluent for recycling. The Warren Facility currently uses a high-purity, oxygen-activated sludge system with a low solids retention time to produce non-nitrified secondary effluent that is discharged to the ocean through two existing tunnels and four outfalls. The existing treatment process at the Warren Facility was not designed to reduce ammonia or total nitrogen.

PWSC would reduce the volume of treated wastewater effluent discharged to the ocean from the Warren Facility by about one-half. The MBR processes would reduce both the total nitrogen concentration in the wastewater and the nitrogen loading to the ocean, even with the addition of RO concentrate from the AWPF. RO concentrate from the AWPF would be mixed with the Warren Facility effluent prior to being discharged to the ocean through the effluent tunnel outfall. The anticipated modifications and upgrades to the Warren Facility, along with advanced treatment at the AWPF for IPR and DPR, would significantly reduce the quantity of treated wastewater and associated nutrient loadings discharged to the ocean, and thereby improve the effluent water quality.

7.4.4. Watershed Considerations

Approximately 50 percent of Metropolitan's water supply comes from imported water, with 20 percent coming from the Colorado River via the CRA and the remaining 30 percent coming from the Sacramento–San Joaquin Delta through the SWP.

The Sacramento–San Joaquin River watersheds, containing both the Sacramento and San Joaquin Rivers, and the overall Bay Delta watershed play a critical role in California's water system as one of its largest water supply sources. The snowpack in California's Sierra Nevada mountains serves as a natural form of water storage, as spring warming releases snowmelt runoff to deliver 75 percent of the freshwater flow to the Bay-Delta (Sierra Nevada Conservancy 2022)—the source of SWP water. Figure 7-3 shows that over the century, there has been a 9 percent decline in April to July runoff on the Sacramento River, and a 9.8 percent decline on the San Joaquin River.



Source: DWR 2020, Hydroclimate Report Water Year 2019, Figure 16.

Figure 7-3. Declining Sacramento and San Joaquin River Runoff over the Past Century

Increased environmental regulations and competition for water from outside the region have changed delivery patterns and the timing of imported water supply availability from the

Colorado River. At the same time, the Colorado River has experienced a drying trend over the past 21 years, resulting in reservoir levels that are below historical levels. Shortages along the Colorado River have limited (and continue to limit) the reliability of CRA deliveries to Southern California, reducing this source of Metropolitan's imported supply. In 2007, Metropolitan entered into an agreement with Reclamation (2007 Interim Guidelines) that provided for the coordinated operation of Lake Powell and Lake Mead and the Intentionally Created Surplus program, which allows Metropolitan to store water in Lake Mead. These stored supplies can be used to provide additional water to ensure that Metropolitan can deliver up to 1.25 million AF.

Reclamation, in collaboration with the seven Colorado River Basin States, including California, developed the Colorado River Basin Water Supply and Demand Study under Reclamation's Basin Study Program (Reclamation 2012). The study, which was completed in 2012, defined the current and future imbalances in water supply and demand in the basin and the adjacent areas of the Basin States receiving Colorado River water, and developed and identified adaptation and mitigation strategies to resolve these imbalances. One of these strategies was municipal wastewater reuse in Southern California.

In 2019, in response to declining reservoir levels, the Lower Basin Drought Contingency Plan was signed. The plan requires California, Arizona, and Nevada to store defined volumes of water in Lake Mead and collectively reduce their use of water from the Colorado River by 3 million AFY by 2026. Metropolitan committed to and has stored certain volumes of water in Lake Mead if it is below elevation 1,045 feet. The agreement increases Metropolitan's flexibility to take delivery of water stored at Lake Mead at elevations below 1,075 feet. Although the primary goal of the agreement is to keep Lake Mead above critical elevations, the agreement increases Metropolitan's flexibility to store water in Lake Mead in greater volumes and to take delivery of the stored water as needed.

Metropolitan's focus on these efforts and its investments in system flexibility have allowed the agency to store a record amount of water (1.2 million AF) in Lake Mead, one of Reclamation's two key storage reservoirs, and boost lake levels by 19 feet (see Figure 7-4). Metropolitan is a partner to Reclamation's three-state plan to reduce water supply allocations by about 13 percent through the end of 2026.

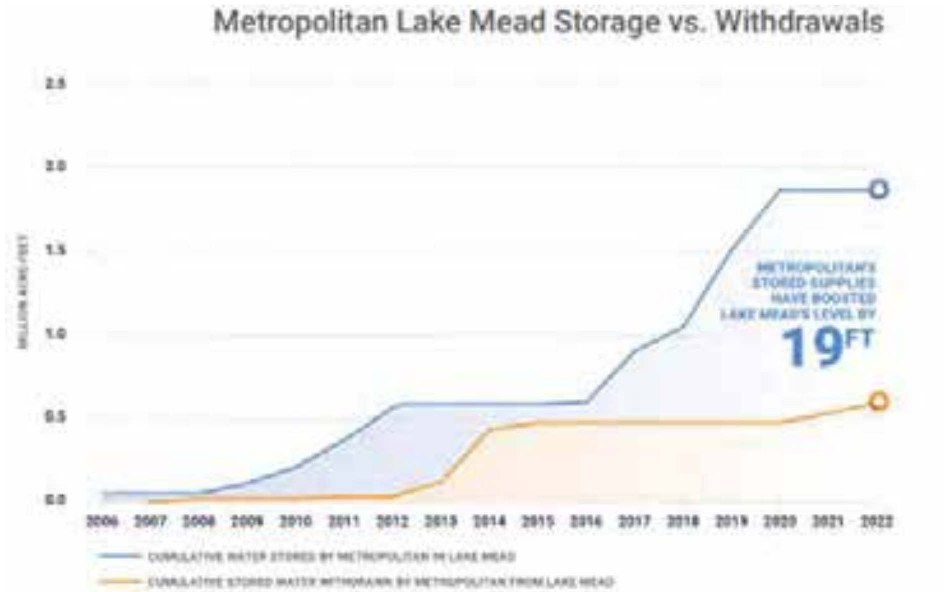


Figure 7-4. Metropolitan's Storage in Lake Mead, 2006 to 2022

PWSC would advance several multi-state plans focused on the Colorado River, including the Lower Basin Drought Contingency Plan, the Colorado River Interim Guidelines for Lower Basin Shortages, and the Coordinated Operations of Lake Powell and Lake Mead (2007 Interim Guidelines), and help establish a framework for sustainable management of the Lower Colorado Basin. In 2026, the Colorado River Basin will adopt new operational guidelines and management actions to protect the stability and sustainability of the Colorado River into the future.

7.5. Public Involvement

Metropolitan is actively engaging the public to increase awareness of the region's water supply issues, the importance of potable reuse, and PWSC.

Outreach and engagement activities began in 2016, with development of a communications plan. Since then, Metropolitan has reached millions of Southern California residents.

The goal of public outreach activities is twofold:

1. Develop public awareness of PWSC and acceptance of the new water supply across the entire region.
2. Conduct targeted outreach in communities near proposed facilities to build support, understand concerns, and seek input.

Several engagement strategies and communication tools are used, including a dynamic project website, social media activities, tours, workshops, presentations, meetings, special events, questionnaires, booths at community events, brochures, multi-lingual materials (e.g., fact sheets, emails, reports in Spanish, Tagalog, Chinese, Khmer, and Vietnamese), press coverage, and partnerships with community-based organizations. To date, the public is supportive of PWSC and its development as described in this Feasibility Study.

Tours of the Grace F. Napolitano Pure Water Southern California Innovation Center are central to outreach. Metropolitan and the Sanitation Districts began operating the Innovation Center in 2019, which features educational exhibits, an interactive learning center, and a robust tour program that attracts visitors of all ages. Public programs at the Innovation Center are offered in person and online to provide information about the facility, its innovative purification process, and the importance of purified water to Southern California's water supply. With nearly 350 tours completed to date, attendees have included students, business groups, environmental leaders, and state and federal officials, including California Governor Gavin Newsom, Congresswoman Grace Napolitano, and Reclamation Commissioner Camille Touton.

The CEQA process provides another opportunity for public engagement on PWSC, especially in communities nearby PWSC facilities. During the scoping period in 2022, Metropolitan implemented a comprehensive engagement strategy to gather public feedback on PWSC. To ensure communities had an opportunity to learn about PWSC and provide input, Metropolitan supported them by hosting booths at community events; providing information in local libraries and information hubs; advertising in local papers; partnering with community-based organizations; and sending information via direct mail to more than 10,000 residences. Furthermore, a project website, social media posts, e-newsletter blasts, videos on how to participate, multilingual materials, and four public scoping meetings created a public input process that was accessible and easy to understand. Comments were received through the scoping process to inform the progression of PWSC as described in the Feasibility Study. As the project continues through the environmental review and permitting period, additional opportunities for public input will be available.

The environmental community, including organizations such as Heal the Bay, LA Waterkeeper, and Sierra Club, are key stakeholders and actively engaged in PWSC development. They are strong advocates of water reuse and PWSC, investing time and resources towards their progress. Metropolitan and the Sanitation Districts meet regularly with them to provide updates and seek input. With Metropolitan and LA County Sanitation Districts' support, LA Waterkeeper is organizing a Regional Wastewater Recycling Technical Convening in February 2024 to review the proposed water reuse projects in the region and provide additional input.

Metropolitan continues to further its public outreach program to develop support of PWSC and potable reuse. Staff is developing collaborative relationships with cities, water agencies, and other entities such as Caltrans to advance PWSC and its proposed facilities. An outreach plan for the design and construction phases of PWSC are in progress. Metropolitan staff is also conducting research and developing outreach strategies on public acceptance of direct potable reuse.

Furthermore, outreach efforts have been expanded to engage additional stakeholders, including disadvantaged, underserved, and environmental-justice-identified areas. Metropolitan and its partner agencies recognize the importance of opportunities to advance equity and inclusion through the planning, implementation, and operation of PWSC. These opportunities include:

- Identifying strategies to advance local hiring and Disadvantaged Business Enterprise / Minority-owned Business Enterprise (DBE/MBE) hiring in project design and construction.
    - Engaging with local communities to incorporate criteria and practices that further equitable outcomes and build community advocacy and a sense of project ownership. Strategies include incorporating co-benefits and community benefits into the project, creating signage or interactive displays collaboratively with community participants, and developing local community ambassadors.
    - Identifying ways to incorporate local hire and workforce development programs into facility O&M Historic Properties.

Figure 7-5 shows a local outreach activity and the Innovation Center, where tours are conducted.

Figure 7-5. Sample Local Outreach Activity and the Innovation Center, Where Tours Are Conducted

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8. Legal and Institutional Requirements

Legal and Institutional Requirements (WTR 11-01).

(a) Analysis of any water rights issues potentially resulting from implementation of the proposed water reclamation, recycling or desalination project. All proposed water reclamation, recycling or desalination projects must comply with state water law.

(b) Discussion of legal and institutional requirements (e.g., contractual water supply obligations, Indian trust responsibilities, water rights settlements, regional water quality control board requirements), state, and/or local requirements with the potential to affect implementation of the project. Water reclamation, recycling or desalination projects using Reclamation project water must address contractual requirements as described in RM D&S, Reuse of Bureau of Reclamation Project Water (PEC 05-09).

(c) Discussion of the need for multi-jurisdictional or interagency agreements, any coordination undertaken, and any planned coordination activities.

(d) Discussion of permitting procedures required for the implementation of water reclamation, recycling or desalination projects in the study area, and any measures that the non-Federal project sponsor can implement that could speed up the permitting process.

(e) Discussion of any unresolved issues associated with implementing the proposed water reclamation, recycling or desalination project, how and when such issues will be resolved, and how the project would be affected if such issues are not resolved.

(f) Identification of current and projected wastewater discharge requirements resulting from the proposed water reclamation, recycling or desalination project (e.g., RO concentrate disposal).

(g) Description of rights to wastewater discharges resulting from implementation of the proposed water reclamation, recycling or desalination project.

This section identifies legal and institutional requirements for and barriers to implementing PWSC.

8.1. Water Rights

Under the CWC, wastewater treatment plant owners hold the exclusive right to the treated wastewater from those plants (CWC § 1210). Users that discharge to the sanitary sewer system effectively “abandon” that water, and therefore, those users do not have legal rights to it (unless otherwise provided by agreement). Accordingly, the Sanitation Districts hold the exclusive rights to the wastewater treated at the Warren Facility, and this wastewater would be used as source water for PWSC. In addition, under California Health and Safety Code Sections 4744 and 4745, the Sanitation Districts have the right to sell or beneficially use any recycled water produced at their treatment facilities. There are no anticipated water rights issues resulting from implementation of the proposed water recycling project.

8.2. Legal Requirements

This section discusses contractual water supply obligations, Indian trust responsibilities, water rights settlements, RWQCB requirements, and the state and local requirements that have the potential to affect implementation of PWSC.

8.2.1. Contractual Water Supply Obligations

As discussed in Section 8.3, below, several legal agreements will be required to implement PWSC. Topics addressed in these agreements include the volume, timing, and location of water deliveries for replenishment; use of spreading basins and other delivery facilities needed to recharge the basins; water quality specifications; groundwater monitoring requirements; and other details associated with potential water deliveries. Metropolitan will collaborate with member agencies, groundwater managers, and other essential stakeholders to develop preliminary terms and conditions that would be mutually acceptable if PWSC proceeds.

In addition, institutional arrangements for the storage, recharge, and extraction of PWSC water and the acquisition of regulatory approvals and permits are important parts of PWSC. The arrangements can be complex and may involve multiple parties with multiple points of view. Therefore, engagement with these parties early in the process is important. Institutional arrangements will be required for each groundwater basin (Table 8-1).

Table 8-1. Summary of Institutional Arrangements

Basin	County	Agencies	Arrangements/Permits Needed
Central Basin	Los Angeles	WRD	Coordination of Recharge
		Central Basin MWD	Purchase Agreement/Institutional Arrangements
		Long Beach Utilities	Purchase Agreement/Institutional Arrangements
		Los Angeles County Flood Control District	Coordination of Recharge/Operating Agreement
		Los Angeles RWQCB, Region 4	NPDES Permit Water Recycling Requirements / Permit
		DDW	Water Recycling Requirements / Permit
		Central Basin Watermaster	Approval of Storage and Extraction
West Coast Basin	Los Angeles	WRD	Coordination of Recharge
		West Basin MWD	Purchase Agreement/Institutional Arrangements
		City of Torrance	Purchase Agreement/Institutional Arrangements
		Los Angeles Department of Water and Power	Purchase Agreement/Institutional Arrangements
		Los Angeles RWQCB, Region 4	NPDES Permit
		DDW	Recycled Water Recharge Permit
		West Coast Basin Watermaster	Approval of Storage and Extraction
Main San Gabriel Basin	Los Angeles	Main San Gabriel Watermaster	Approval of Storage and Extraction (a supplemental storage arrangement is required – could be part of cyclic storage)
		Upper San Gabriel Valley MWD	Purchase Agreement/Institutional Arrangements
		Three Valleys MWD	Purchase Agreement/Institutional Arrangements
		SGVMWD	Purchase and Exchange Agreement/Institutional Arrangements
		Los Angeles County Flood Control District	Coordination of Recharge
		Los Angeles RWQCB, Region 4	NPDES Permit Recycled Water Recharge Permit
		DDW	Recycled Water Recharge Permit
Orange County Basin	Orange	OCWD	Approval of Storage and Extraction
		Municipal Water District of Orange County	Purchase Agreement (if necessary)/Institutional Arrangement
		Santa Ana RWQCB, Region 8	NPDES Permit Recycled Water Recharge Permit
		DDW	Recycled Water Recharge Permit

Notes:
DDW =Division of Drinking Water
MWD =Municipal Water District
NPDES = National Pollutant Discharge Elimination System
OCWD = Orange County Water District
RWQCB = Regional Water Quality Control Board
SGVMWD = San Gabriel Valley Municipal Water District
WRD = Water Replenishment District of Southern California

8.2.2. Indian Trust Responsibilities

The area for PWSC is not located within or adjacent to tribal lands, reservations, assets, or areas protected by tribal treaty rights. In compliance with CEQA, Metropolitan researched and conducted studies on the potential environmental impacts of PWSC on tribal cultural resources (TCRs). Metropolitan notified tribes that requested notice of PWSC and provided them with the opportunity to consult. This notification included notices to the Soboba Band of Luiseño Indians, Morongo, San Manual Band of Mission Indians, and Gabrieleño Indian tribes. Of these, only the Gabrieleño requested consultation. Metropolitan is currently engaged in this consultation. Metropolitan's goal is to mitigate any potentially significant environmental impacts to TCRs by developing mitigation in good faith and in conjunction with the consulting tribes. An agreement has been reached with the Gabrieleño for tribal monitoring and mitigation of any potentially significant impacts.

8.2.3. Water Rights Settlements

Metropolitan is unaware of any water rights settlements that directly affect PWSC. However, the water rights settlements in the adjudicated groundwater basins that may receive PWSC water are relevant. The requirements of each of these adjudicated basins will have to be complied with and addressed in the purchase agreements and institutional arrangements developed with PWSC partners. The parties are currently engaged in discussions on these arrangements, and these discussions are expected to continue as PWSC is developing.

8.2.4. Regional Water Quality Control Board Requirements

As described in Section 8.6, below, RWQCB requirements for long-term operation of the PWSC will be governed by Sanitation Districts' permits and any necessary amendments thereto. However, Metropolitan will also have to address the relevant RWQCB requirements during construction for each relevant region. These discussions will include compliance with any regional permitting requirements for water collected or impacted during construction.

8.2.5. State and Local Requirements with the Potential to Affect Implementation of PWSC

This study has identified numerous state and local requirements that may be applicable to PWSC. Of primary importance are the state's recycled water regulations, which are discussed in Sections 8.4 and 8.5, below.

8.3. State and Regional Policies and Plans

PWSC will play a key role in meeting the water supply and water quality goals and objectives of multiple integrated resources management plans and state and regional resource management plans.

The 2023 California Water Resiliency Portfolio encourages water supply diversity, treatment of compromised supplies, infrastructure improvements, reduced reliance on the SWP, and climate impact preparedness. PWSC will support a key strategy of the portfolio—that local and regional agencies reuse at least 2.5 MAF by 2030.

PWSC will also support the goals of the SWRCB's Recycled Water Policy. This policy encourages water supply diversity and sustainability, including increased use of recycled water in California. The SWRCB has adopted the following goals to implement the policy:

- Increase the use of recycled water from 714,000 AFY in 2015 to 1.5 million AFY by 2020 and to 2.5 million AFY by 2030.
- Reuse all dry weather direct discharges of treated wastewater to enclosed bays, estuaries and coastal lagoons, and ocean waters that can be viably put to a beneficial use. For this goal, treated wastewater does not include discharges necessary to maintain beneficial uses and brine discharges from recycled water facilities or desalination facilities.
- Maximize the use of recycled water in areas where groundwater supplies are in a state of overdraft to the extent that downstream water rights, instream flow requirements, and public trust resources are protected.

The California Water Plan is the state's strategic plan for managing and developing water resources. This plan establishes the following goals: (1) strengthening the resiliency and operational flexibility of water infrastructure; and (2) ensuring more resilient and sustainably managed water systems that can better withstand inevitable and unforeseen pressures in the coming decades.

PWSC will meet the state's sustainability goals through sustainable groundwater management practices, improving water infrastructure, and promoting long-term water supply management through portfolio diversification.

Metropolitan's Climate Adaptation Master Plan for Water (CAMP4Water) integrates complex climate modeling, water resources, hazard mitigation, and financial planning to ensure the region is well positioned to make sustainable decisions. The CAMP4Water will address Metropolitan's water supply future considering resilience, reliability, affordability, and financial sustainability. As a climate-resilient project, PWSC will be integral to the success of the CAMP4Water process.

8.4. Multijurisdictional and Interagency Agreements

PWSC builds on the history of collaboration between agencies throughout the Southern California region. In particular, PWSC is a product of the creative and collaborative relationship between Metropolitan, a regional wholesale water provider, and the Sanitation Districts, a regional wastewater service provider. PWSC has resulted in the development of a large-scale regional recycled water project that will benefit 19 million people in Southern

California. PWSC requires a high degree of collaboration, and it has more than 15 program partners, including Metropolitan member agencies (Central Basin MWD, West Basin MWD, City of Torrance, Long Beach Utilities, Three Valleys MWD, LADWP, Upper San Gabriel Valley MWD, and others); groundwater basin managers (Water Replenishment District, Main San Gabriel Basin Watermaster); Colorado River partners (Southern Nevada Water Authority, Arizona Department of Water Resources, Central Arizona Project); and other partners (USACE, the SWRCB's DDW, Southern California Edison, Los Angeles County Public Works, California Department of Transportation, and other regulators) (see Figure 8-1). PWSC has been a catalyst for regional collaboration with stakeholders across disciplines, with divergent interests working side by side to reduce reliance on Colorado River and SWP supplies, increase groundwater sustainability, and solve other regional challenges.

Figure 8-1. PWSC Program Partners

The extent of interest in PWSC is seen in the letters of interest and cost sharing agreements executed with the Colorado River partners. The Southern Nevada Water Authority and Arizona Department of Water Resources have contributed funds for the planning phase of PWSC. The PWSC Program website includes copies of several letters of intent and agreements (including funding agreements) that are already in place with partnering project agencies (see Appendix A).

8.4.1. Sanitation Districts

Throughout the development of the PWSC, Metropolitan and the Sanitation Districts have collaborated successfully to advance a pilot program, nitrogen management studies, and source control investigations. In 2015, Metropolitan and the Sanitation Districts entered into an agreement for the construction and operation of the Innovation Center. The agreement also laid the groundwork for potential terms and conditions for future construction of a full-scale AWPF at the Warren Facility. The Innovation Center has been operational since fall 2019 and has provided invaluable operating experience that will guide the design and permitting of the AWPF. In 2020, an amendment was executed to guide the two agencies through the environmental planning phase of PWSC, including the preparation of a Conceptual Facilities Plan and an EIR. Metropolitan and the Sanitation Districts are working together under the 2015 agreement that includes full-scale implementation of PWSC. Future updates to the agreement may be made through an amendment or there may be a new agreement to cover the specifics of cost sharing, operation, source control, and other requirements.

8.4.2. Member Agencies, Groundwater Managers, and the Los Angeles County Department of Public Works

The potential overall ability of PWSC to achieve regional benefits and meet the unit cost estimates in this Feasibility Study depends on the willingness of agencies to make appropriate arrangements for the delivery, storage, and extraction of delivered water produced by PWSC. These arrangements could take many forms, such as operational programs and adopted rates, contract commitments, project-specific partnerships, or other appropriate instruments. Preliminary discussions with the primary parties needed to accomplish PWSC did not identify any insurmountable technical, legal, or institutional barriers. Establishing these arrangements is a prerequisite to PWSC implementation.

Metropolitan already has initial estimates for the delivery of IPR water, with planned uses varying by member agency from groundwater recharge to direct use for industrial and non-potable applications and eventual raw water augmentation for DPR. LADWP plans to use PWSC water for non-potable industrial uses, and West Basin MWD plans to accept water for both non-potable uses and groundwater recharge via injection wells. Other member agencies would manage IPR water using regional spreading grounds operated by the Los Angeles County Flood Control District or injection wells for groundwater recharge. The member agencies currently planning to receive NPR and IPR water from PWSC are the following:

- LADWP
- West Basin Municipal Water District
- Long Beach Utilities
- Central Basin Municipal Water District
- Upper San Gabriel Valley Municipal Water District
- Three Valleys Municipal Water District

Ongoing collaboration between Metropolitan and PWSC partners to optimize the regional benefits of PWSC is integral to its implementation. Metropolitan continues to explore potential collaboration opportunities both within and outside the region to foster water supply diversity and reliability and to address region-wide water issues.

8.5. Permitting Procedures

Per California Water Code Section 13050(n), recycled water is defined as “water which, as a result of treatment of waste, is suitable for a direct beneficial use or a controlled use that would not otherwise occur and is therefore considered a valuable resource.” Recycled water is primarily municipal sewage that has been treated in a wastewater facility and complies with recycled water regulations for specific types of beneficial use, including requirements to protect public health. There are different levels of treatment for recycled water depending on how it would be used; these different levels are categorized as either non-potable reuse or potable reuse (SWRCB 2023). In general, recycled water should be treated to the level necessary for the end uses (known as “fit for purpose”), although water treated for potable reuse is usually suitable for most non-potable uses due to the higher levels of treatment it often receives.

8.5.1. Non-Potable Reuse Regulations

Non-potable reuse refers to the use of recycled water for applications other than drinking water, including crop and landscape irrigation, recreational and landscape impoundments, industrial and commercial cooling and air conditioning, construction, hydrostatic testing, fire suppression, and industrial processes. Supplying recycled water for non-potable uses requires submission of a Notice of Intent (NOI) to the RWQCB to obtain coverage under the SWRCB’s Water Reclamation Requirements for Recycled Water Use (Order WQ 2016-0068-DDW), referred to as the General Order, which SWRCB adopted in June 2016. The NOI serves as a permit application. Permits for NPR may be enrolled in the General Order or may be considered on a case-by-case basis.

The non-potable design criteria, treatment train, and anticipated uses of non-potable reuse will be described in Metropolitan’s Title 22 Engineering Report. Considerations to include in the Title 22 Engineering Report will include inclusion of IPR water as a source for NPR, any possibility that the NPR water will not undergo full Advanced Water Treatment, and water quality goals.

The Title 22 Engineering Report must also demonstrate that the water quality goals for NPR under the General Order conform to the Uniform Statewide Recycling Criteria and fall under at least one of four different recycled water categories, depending on the proposed use.

The allowable reuse applications under each of these recycled water categories under the General Order, required treatment, and use area requirements are defined in the Water Recycling Criteria (22 CCR Division 4, Chapter 3).

Definitions, including water quality goals, are included below:

- Undisinfected secondary recycled water (22 CCR § 60301.900.): "Undisinfected secondary recycled water" means oxidized wastewater.
- Disinfected secondary-23 recycled water (22 CCR § 60301.225.): "Disinfected secondary-23 recycled water" means recycled water that has been oxidized and disinfected so that the median concentration of total coliform bacteria in the disinfected effluent does not exceed a most probable number (MPN) of 23 per 100 milliliters utilizing the bacteriological results of the last 7 days for which analyses have been completed and the number of total coliform bacteria does not exceed an MPN of 240 per 100 milliliters in more than one sample in any 30-day period.
- Disinfected secondary-2.2 recycled water (22 CCR § 60301.220.): "Disinfected secondary-2.2 recycled water" means recycled water that has been oxidized and disinfected so that the median concentration of total coliform bacteria in the disinfected effluent does not exceed an MPN of 2.2 per 100 milliliters utilizing the bacteriological results of the last 7 days for which analyses have been completed and the number of total coliform bacteria does not exceed an MPN of 23 per 100 milliliters in more than one sample in any 30-day period.
- Disinfected tertiary recycled water (22 CCR § 60301.230.): "Disinfected tertiary recycled water" means a filtered and subsequently disinfected wastewater. The filtration process must meet the criteria described in § 60301.320 (a) or (b). The disinfection process must meet the criteria described in §60301.230(a)(1) or (2). The median concentration of total coliform bacteria measured in the disinfected effluent must not exceed an MPN of 2.2 per 100 milliliters utilizing the bacteriological results of the last 7 days for which analyses have been completed and the number of total coliform bacteria does not exceed an MPN of 23 per 100 milliliters in more than one sample in any 30-day period. No sample shall exceed an MPN of 240 total coliform bacteria per 100 milliliters.
    - Recycled water used for the following shall be a disinfected tertiary recycled water, except that for filtration pursuant to Section 60301.320(a) coagulation need not be used as part of the treatment process provided that the filter effluent turbidity does not exceed 2 Nephelometric Turbidity Units (NTU), the turbidity of the influent to the filters is continuously measured, the influent turbidity does not exceed 5 NTU for more than 15 minutes and never exceeds 10 NTU, and that there is the capability to automatically activate chemical addition or divert the wastewater should the filter influent turbidity exceed 5 NTU for more than 15 minutes
        - Surface irrigation defined in § 60304.(a)
        - "Other purposes" defined in § 60307.(a)

Due to the requirements of industrial users, all NPR from PWSC will be treated with the full treatment train used for IPR.

8.5.2. Indirect Potable Reuse Regulations

CWC Section 13561 defines IPR for groundwater recharge as the planned use of recycled water for replenishment of a groundwater basin or an aquifer that has been designated as a source of water supply for a public water system, as defined in Section 116275 of the Health and Safety Code.

Regulatory oversight of recycled water projects is carried out by the SWRCB through the DDW and the individual RWQCBs. The DDW is statutorily directed to establish uniform statewide reclamation criteria for the various uses of recycled water that are set forth in 22 CCR §§ 60301 to 60355. The RWQCBs have the exclusive authority to establish WDRs/WRRs or through permit issuance. The RWQCBs rely on the DDW's expertise to establish the permit conditions necessary to protect public health. Water Recycling Criteria have been established for the protection of public health and are codified in 22 CCR Division 4, Chapter 3, §§ 60301 to 60355. These sections establish statutory authorities over water recycling; they include specified approved uses of recycled water, numerical limitations and requirements, treatment requirements, reporting mechanisms, and performance standards.

The Water Recycling Criteria and the Groundwater Replenishment Regulations are implemented and enforced through WDRs/WRRs, which are adopted by the RWQCBs. The existing NPDES permit (which also serves as a WDR) for the Sanitation Districts' Warren Facility is anticipated to be amended to address the RO concentrate when the permit is renewed, which is anticipated to occur in mid-2028, and discussions about the project with the Los Angeles RWQCB are ongoing so that they will be prepared to address this project in a timely manner.

For the spreading basins and injection wells, the MCLs established in 22 CCR are often used as a basis for effluent limitations in water recycling permits to protect municipal and domestic supply beneficial uses. CWC § 13260 requires that a Report of Waste Discharge be filed with the appropriate RWQCB for any project proposing discharges that could affect the quality of the waters of the state.

The RWQCB prescribes WRRs and/or WDRs that reasonably protect all beneficial uses and implement relevant water quality control plans and policies. An entity proposing to recycle water must file a Title 22 Engineering Report with the DDW and the RWQCB for the proposed use(s) of the recycled water. The purpose of the engineering report is to describe how a project will comply with 22 CCR §§ 60301 through 60355 and protect public health. The report should describe the design of the water reclamation system and clearly indicate the means for regulatory compliance. The report should also include a contingency plan to ensure that no untreated or inadequately treated wastewater will be delivered to the area of use. In addition to the 22 CCR criteria, the Title 22 Engineering Report includes a comprehensive hydrogeological assessment of the project area and addresses compliance with water quality standards and objectives in the applicable Basin Plan.

The DDW has developed *Guidelines for the Preparation of an Engineering Report for the Production, Distribution and Use of Recycled Water* (DDW 2023b). After receipt of the Title 22 Engineering Report, additional requests for information from the project sponsor, and consultation with the RWQCB, the DDW then holds one or more public hearings, together with the project sponsor. After the public hearing(s), the DDW provides recommendations to the RWQCB, and these recommendations are then incorporated into the WRRs and/or the WDRs for the proposed use. Figure 8-2 summarizes the Title 22 Engineering Report and permit approval process for a water recycling project.

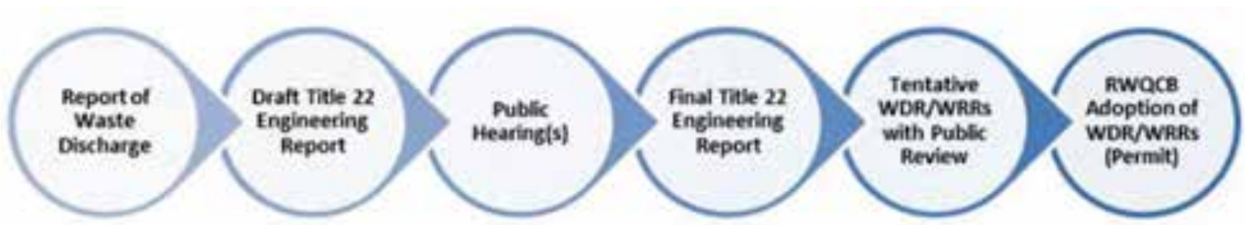

Figure 8-2. Permit Approval Process for Recycled Water

Accordingly, Metropolitan will be required to complete a Title 22 Engineering Report as part of the permitting process for the PWSC. The Title 22 Engineering Report would follow the demonstration testing described later in this chapter and would be prepared in partnership with the Sanitation Districts and groundwater management agencies.

8.5.3. Groundwater Replenishment Requirements

Final regulations for groundwater replenishment reuse projects using surface application (i.e., spreading) and subsurface application (i.e., injection) went into effect in June 2014. Table 8-2 summarizes the key requirements of the Groundwater Replenishment Regulations.

Table 8-2. Groundwater Replenishment Regulations

Constituent | Parameter	Type of Recharge	
	Surface Application	**Subsurface Application**
Pathogenic Microorganisms		
Filtration	≤ 2 NTU	≤ 2 NTU
Disinfection	450 CT mg-min/L with 90 min. modal contact time or 5-log virus inactivation; and <2.2 total coliform per 100 mL	450 CT mg-min/L with 90 min. modal contact time or 5-log virus inactivation; and <2.2 total coliform per 100 mL
Pathogen Control	12-10-10 log reduction for enteric virus, *Cryptosporidium*, and *Giardia* reduction	12-10-10 log reduction for enteric virus, *Cryptosporidium*, and *Giardia* reduction
Response Retention Time	≥ 2 months (depending on estimating method used)	≥ 2 months (depending on estimating method used)
Regulated Constituents		
Drinking Water Standards	Meet all drinking water MCLs in recycled water (or recharge water, as applicable); quarterly for primary MCLs; annually for secondary MCLs	Meet all drinking water MCLs in recycled water (or recharge water, as applicable); quarterly for primary MCLs; annually for secondary MCLs
Nitrogen Compounds	TN ≤ 10 mg/L in recycled or recharge water	TN ≤ 10 mg/L in recycled or recharge water [1]
Unregulated Chemicals Control		
Total Organic Carbon	TOC ≤ 0.5 $\frac{mg}{1.}$ Compliance point is in recycled water or in recycled water after soil aquifer treatment not impacted by dilution (no blending)	TOC ≤ 0.5 $\frac{mg}{1.}$
Recycled Water Contribution		
RWC Definition	RWC = $\frac{Vol.of\ Recycled\ Water}{Vol.of\ Recycled\ Water + Diluent\ Water}$	
RWC_{max} Initial	Up to 20% without RO/AOP* Up to 100% with RO/AOP*	Up to 100% (RO/AOP* required for entire waste stream)
Increased RWC_{max}	≥ 20% subject to add'l requirements	Up to 100% subject to add'l requirements

Notes:
* RO/AOP represents treatment using RO and an advanced oxidation process that meets requirements as outlined in the regulation.
1. Individual groundwater basins may have more restrictive criteria.
CT = contact time
MCL = Maximum Contaminant Level
mg-min/L = milligram-minute(s) per liter
mL = milliliter(s)
NTU = nephelometric turbidity unit
RO/AOP = reverse osmosis / advanced oxidation process
RWC = Recycled Municipal Wastewater Contribution
TN = total nitrogen
TOC = total organic carbon

Source Control: Recycled water providers must administer a comprehensive source control program that includes the following: (1) an assessment of the fate of DDW- and RWQCB-specified contaminants through the wastewater and recycled-water systems; (2) provisions for contaminant-source investigations and contaminant monitoring that focus on these contaminants; (3) an outreach program to industrial, commercial, and residential communities; and (4) an up-to-date inventory of contaminants.

Some CECs for IPR projects may not fall under the authority of the federal statutes that address wastewater source control and must be addressed through proactive efforts. Industrial sources make up approximately 19 percent of the source water for the Warren Facility and 30 percent of its organic load (pounds per year of chemical oxygen demand). The Sanitation Districts have a comprehensive source control program and are currently investigating opportunities to enhance current efforts in the Warren Facility sewer-shed to safeguard the proposed AWPF processes and attain the requirements for the anticipated end uses of the recycled water. Metropolitan will coordinate with the Sanitation Districts on this issue; high source water quality will protect the safety, reliability, and cost-effectiveness of the advanced treated water delivered.

Advanced Water Purification Facility: The AWPF would produce purified water for groundwater recharge, industrial use, and DPR. The AWPF would also meet the performance criteria established in 22 CCR § 60320.201. Metropolitan, in collaboration with the Sanitation Districts, may perform an occurrence study for the municipal wastewater to identify indicator compounds representative of various functional groups. The removal of select indicator compounds must be demonstrated in the 22 CCR ER. As an alternative to conducting an occurrence study, Metropolitan may demonstrate at least a 0.5-log reduction of 1,4-dioxane through the AOP, with challenge tests conducted to confirm findings. Monitoring and reporting requirements are also established in the regulations to demonstrate the efficacy of the AOP.

Pathogen Control: At a minimum, recycled water quality for a groundwater replenishment reuse project must meet 22 CCR definitions for filtered wastewater (§ 60301.320) and disinfected tertiary recycled water (§ 60301.230). The treatment system must also achieve a 12-log enteric virus reduction, a 10-log Giardia cyst reduction, and a 10-log *Cryptosporidium* oocyst reduction using at least three treatment barriers (generally referred to as a 12-10-10 pathogen log reduction). The log reduction represents the treatment that must be given to the wastewater during its conversion from raw municipal wastewater to recycled water reaching a drinking water well. Each treatment barrier must achieve at least a 1.0-log reduction and no treatment process can be credited with more than a 6-log reduction. A project is also credited with a 1-log virus reduction for each month the recycled water is retained underground (up to a 6-log reduction) based on a tracer test.

During the demonstration phase, Metropolitan would validate the log reduction credits for each treatment process by using challenge tests and/or submitting a report for DDW approval. Evidence would be provided to the DDW of the ability of the treatment process to meet the log reduction requirements using DDW-approved monitoring procedures reliably and consistently.

Nitrogen Control: The concentration of total nitrogen in recycled water must not exceed 10 mg/L. (The Basin Plan requirements for specific groundwater basins may include more stringent nitrogen limits.) The Basin Plan water quality goals associated with the groundwater basins proposed for the PWSC are provided in Table 4-4, and the key requirements of the groundwater replenishment regulations are provided in Table 4-5.

Regulated Chemicals Control: Recycled water must be monitored for regulated chemical constituents and must meet the primary and secondary drinking water MCLs. Failure to meet the MCLs would require follow-up sampling, notification to the DDW and the RWQCB, and/or discontinuation of recycled water use until the problem is corrected.

Constituents with Notification Levels: NLs represent the level of a constituent in drinking water that DDW has determined does not pose a significant health risk but warrants notification to the public. NLs are nonregulatory, health-based advisory levels for constituents for which MCLs have not been established. Metropolitan will monitor the recycled water quarterly for NLs, with accelerated monitoring and notification to the DDW and the RWQCB if any results are greater than the NLs.

Unregulated Chemicals Control: TOC is used as a surrogate for unregulated and unknown organic chemicals. Control of unregulated or emerging chemicals for all groundwater replenishment projects is accomplished through limits for TOC and treatment performance for indicator compounds. For surface applications (i.e., spreading), soil aquifer treatment is assessed through monitoring TOC, along with other parameters approved by the DDW. The maximum TOC is 0.5 mg/L divided by the recycled water fraction of the total water applied.

For subsurface application projects (i.e., injection), the entire recycled water flow must be treated using RO and UV/AOP. After treatment, TOC levels cannot exceed an average of 0.5 mg/L (with 100 percent recycled water contribution). Specific performance criteria for RO and AOP are included in the regulation.

Recycled Municipal Wastewater Contribution: Recycled Municipal Wastewater Contribution (RWC) is the fraction of the quantity of recycled water applied for a groundwater replenishment project divided by the total quantity of recycled water and credited diluent water (e.g., stormwater, imported water, subsurface underflow). The diluent water must be a DDW-approved drinking water source (recharge water may be monitored in lieu of diluent water), and a source water evaluation (i.e., watershed sanitary survey) must be conducted. The initial maximum RWC for surface application projects must not exceed 0.20 (or 20 percent) or an alternative initial RWC approved by the DDW. An alternative RWC of up to 1.0 may be approved based on review of the 22 CCR ER, information obtained through public hearings, and a demonstration that treatment before surface application will reliably achieve TOC levels equal to or less than 0.5 mg/L.

For subsurface applications, the initial RWC may be assigned up to 1.0 based on the same criteria. Any increases in RWC during project operations must be approved by the DDW and the RWQCB. As discussed later in this chapter, a short ramp-up period to achieve an RWC of 1.0 is anticipated for PWSC.

Response Retention Time: The intent of the response retention time within a groundwater basin is to provide sufficient time to identify any treatment failures so that inadequately treated recycled water does not enter a potable water system.

Sufficient time must elapse to allow for a response that would protect the public from exposure to inadequately treated water and provide an alternative source of water or remedial wellhead treatment, if necessary. The response retention time is the aggregate period for the following: (1) identification that the recycled water is out of compliance; (2) treatment verification samples or measurements; (3) analysis of the sample; (4) evaluation of results; (5) decisions regarding the appropriate response; (6) activation of a response; and (7) verification that the response is effective. The minimum response retention time is 2 months, but it must be justified by the project sponsors (i.e., Metropolitan and partnering groundwater agencies) and approved by the DDW. A tracer study can be conducted to establish the response retention time to be credited for groundwater retention time.

Monitoring Programs: Comprehensive monitoring programs are required for the recycled water and groundwater for regulated and unregulated constituents. If monitoring demonstrates failure to meet specific requirements, the project sponsor must notify the DDW and the RWQCB, investigate the cause and take corrective actions, and in some cases, discontinue the use of recycled water. Groundwater monitoring, with consideration of seasonal variations, must be conducted within targeted basins before the operation of a groundwater replenishment project. Metropolitan and its partners would seek to use existing groundwater monitoring wells to the extent possible.

Operation Optimization Plan: Metropolitan, in conjunction with its PWSC partners, would submit an operation optimization plan to the DDW and the RWQCB for review and approval. The intent of the plan is to ensure that facilities are operated to achieve compliance with the Groundwater Replenishment Regulations, achieve optimal reduction of contaminants (including achieving the credited pathogen log reductions), and identify how the project would be operated, maintained, and monitored. The operation optimization plan(s) would address both the AWPF and the groundwater spreading/extraction systems. Considering the regional nature of PWSC, coordination among Metropolitan, its partnering groundwater agencies, and regulators would be necessary to determine whether separate plans would be completed to address each facility or if a combined plan is appropriate. High levels of operator expertise, along with specialized and ongoing training, must be described in the plan(s) and will be critical to the success of the PWSC).

Drinking Water Well Locations: For each replenishment area, Metropolitan and partnering groundwater agencies must establish a "zone of controlled well construction," which represents the horizontal and vertical distances that reflect the underground retention times required for determination of pathogen control and response retention time. Drinking water production, wells cannot be located in this zone. Initial groundwater modeling has been conducted to represent zones of varying underground retention times; this modeling is described in Chapter 4. PWSC sponsors must also create a secondary boundary that represents a zone of potential controlled well construction—this boundary may be beyond the zone of controlled well construction and would require additional study before a new drinking water well is sited within it.

Managerial, Financial, and Technical Capability: Metropolitan must demonstrate to the DDW and the RWQCB that it possesses adequate managerial, financial, and technical capabilities to comply with applicable regulations. The DDW developed a Technical Managerial and Financial Assessment form for public water systems to enable these systems to demonstrate their capability to provide a safe drinking water supply. Portions of this form can be used to demonstrate compliance with the managerial and technical capability requirements in the Groundwater Replenishment Regulations. Metropolitan, in partnership with the Sanitation Districts, will provide required information on project operational capabilities, including information on certified operators, training, and emergency response.

Alternative Provisions: An alternative to any of the provisions in the Groundwater Replenishment Regulations is allowed if the project sponsor can demonstrate that: (1) the alternative provides the same level of public health protection; (2) the alternative has been approved by the DDW; and (3) an expert panel has reviewed the alternative (unless it is otherwise authorized by the DDW). In addition, if required by the DDW and the RWQCB, a public hearing must be conducted on the proposed alternative. Further, before operation of the proposed project, Metropolitan and the partnering groundwater agencies must have a DDW-approved plan that outlines the steps to provide an alternative source of water supply or a wellhead treatment mechanism that would ensure protection of public health in the event of the following: (1) an MCL violation; (2) degraded groundwater quality that is no longer a safe drinking water source; or (3) failure to meet pathogen reduction criteria.

Public Hearing: Metropolitan, in conjunction with the DDW, must hold one or more public hearings before the RWQCB issues a tentative permit. In addition, a public hearing must be held when increases in the maximum RWC are proposed, if not addressed in a prior hearing. Relevant project information must be made accessible to the public at least 30 days before the hearing.

Groundwater Plans and Policies: The RWQCB regulates groundwater replenishment projects under its Basin Plans and other applicable regulations and policies to protect water quality and the beneficial uses of surface water and groundwater. Basin Plans reflect applicable portions of a number of national and statewide water quality plans and policies, including the CWC and Clean Water Act. RWQCB permit requirements are based on the assigned beneficial uses of surface water and groundwater and the applicable numeric or narrative water quality objectives. CWC defines water quality objectives as “the limits or levels of water quality constituents or characteristics which are established for the reasonable protection of beneficial uses of water or the prevention of nuisance within a specific area” (CWC § 13050(h)).

Four groundwater basins are being considered as part of PWSC. These basins are listed in Table 8-3. Beneficial uses for these basins include municipal and domestic water supply (MUN), industrial service supply (IND), industrial process supply (PROC), and agricultural supply (AGR). Because MUN is typically the most stringent standard, permit limits are often based on protection of this beneficial use. To protect the MUN beneficial use, Basin Plans include groundwater objectives based on primary and secondary MCLs, numeric objectives for coliforms, narrative objectives to prevent taste and odor issues, and basin-specific mineral objectives.

Table 8-3. Basins for Groundwater Replenishment

Basin	County	Basin Plan Region	Beneficial Uses
Central Basin	Los Angeles	Los Angeles (Region 4) [1]	MUN, IND, PROC, AGR
West Coast Basin	Los Angeles	Los Angeles (Region 4)	
Main San Gabriel Basin	Los Angeles	Los Angeles (Region 4)	
Orange County Basin	Orange County	Santa Ana (Region 8) [2]	

Notes:
1. http://www.waterboards.ca.gov/losangeles/water_issues/programs/basin_plan/.
2. http://www.swrb.ca.gov/santaana/water_issues/programs/basin_plan/index.shtml.
AGR = agricultural supply
IND = industrial service supply
MUN = municipal and domestic water supply
PROC = industrial process supply

The Basin Plan water quality objectives that apply to the groundwater basins currently being considered for PWSC are shown in Table 8-4.

Table 8-4. Basin Plan Water Quality Objectives

Constituent	Units	Central Basin	West Coast Basin	Main San Gabriel Basin	Orange County Basin
Aluminum	mg/L	1.0	1.0	1.0	NA [6]
Antimony	mg/L	0.006	0.006	0.006	NA [6]
Arsenic	mg/L	0.01	0.01	0.01	0.05
Bacteria, Coliform	1/100 mL [2]	1.1	1.1	1.1	2.2
Barium	mg/L	1.0	1.0	1.0	1.0
Boron	mg/L	1.0	1.5	0.5	0.75

Constituent	Units	Central Basin	West Coast Basin	Main San Gabriel Basin	Orange County Basin
Beryllium	mg/L	0.004	0.004	0.004	NA [6]
Cadmium	mg/L	0.005	0.005	0.005	0.01
Color	–	– [6]	– [6]	– [6]	No adverse impact to beneficial uses
Copper	mg/L	– [6]	– [6]	– [6]	1.0
Chloride	mg/L	150	250	100	500
Chromium	mg/L	0.05	0.05	0.05	0.05
Cobalt	mg/L	– [6]	– [6]	– [6]	0.2
Cyanide	mg/L	0.15	0.15	0.15	0.2
Fluoride	mg/L	2.0	2.0	2.0	1.0
Gross Alpha	pCi/L	15	15	15	15
Gross Beta	pCi/L	50 [7]	50 [7]	50 [7]	50 [7]
Hardness	–	– [6]	– [6]	– [6]	No adverse impact to beneficial uses
Iron	mg/L	– [6]	– [6]	– [6]	0.3
Lead	mg/L	– [6]	– [6]	– [6]	0.05
Manganese	mg/L	– [6]	– [6]	– [6]	0.05
MBAs [3]	mg/L	– [6]	– [6]	– [6]	0.05
Mercury	mg/L	0.002	0.002	0.002	0.002
Nickel	mg/L	0.1	0.1	0.1	– [6]
Nitrate (as N)	mg/L	10 [3]	10 [3]	10 [3]	3.4 [4,5]
Oil and Grease	–	– [6]	– [6]	– [6]	No adverse impact to beneficial uses
Perchlorate	mg/L	0.006	0.006	0.006	– [6]
pH	–	– [6]	– [6]	– [6]	Between 6 and 9
Radium-226 and Radium-228 (combined)	pCi/L	5	5	5	5
Selenium	mg/L	0.05	0.05	0.05	0.01
Silver	mg/L	– [6]	– [6]	– [6]	0.05
Sodium	mg/L	– [6]	– [6]	– [6]	180
Strontium-90	pCi/L	8	8	–	8
Sulfate	mg/L	250	250	100	500
Taste and Odor	–	No adverse impact to beneficial uses	No adverse impact to beneficial uses	No adverse impact to beneficial uses	No adverse impact to beneficial uses
Thallium	mg/L	0.002	0.002	0.002	– [6]
Total Dissolved Solids	mg/L	700	800	450,600 [1]	580 [4]

Constituent	Units	Central Basin	West Coast Basin	Main San Gabriel Basin	Orange County Basin
Toxic Substances	—	—[6]	—[6]	—[6]	No detrimental physiological responses in human, plant, animal, aquatic life
Tritium	pCi/L	20,000	20,0000	20,000	20,000
Uranium	pCi/L	20	20	20	20

Notes:
1. Dependent on location in basin (Western Area, Eastern Area).
2. Median over any 7 7-day period.
3. MBAs = methylene blue-activated substances.
4. Based on assimilative capacity findings.
5. Also shall not exceed 10 mg/L nitrogen as Nitrate-N plus Nitrite-N
6. Not specifically addressed in Basin Plan; would default to MCL where applicable.
7. 4 millirem/year annual dose equivalent to the total body or any internal organ
— = not applicable
mg/L = milligram(s) per liter
mL = milliliter(s)
pCi/L= picocurie(s) per liter

Of note are the different nitrate limits for the individual groundwater basins. The Central, West Coast, and Main San Gabriel Basins each have nitrate as nitrogen (nitrate-N) limits of 10 mg/L, matching the nitrate MCL. Due to basin-specific nitrate issues in the Orange County Basin, lower nitrate limits have been applied by the Santa Ana RWQCB. Due to a nitrate-N Basin Plan limit of 3.4 mg/L in the Orange County Basin, the Orange County Water District's permit for its groundwater replenishment system requires meeting a nitrate-N level of 3 mg/L. Therefore, the Basin Plan objectives help to determine the treatment technologies applied at the AWPF. This issue is also discussed in Section 4.

Boron is another example of a basin-specific limit. The State NL for boron is 1 mg/L; however, the Basin Plan limit for the Main San Gabriel Basin is 0.5 mg/L. Elevated boron levels affect the AGR beneficial use, particularly for use on citrus crops. The Warren Facility pilot study conducted between 2010 and 2012 indicated that the boron levels exceeded 0.5 mg/L at times. Further actions to address boron include monitoring wastewater quality and treatment efficacy, conducting source control investigations, and pursuing regulatory options to minimize or preclude the need for additional boron treatment.

Although the Main Basin does have an adopted SNMP incorporated into the Basin Plan, it does not specifically evaluate boron concentrations and does not evaluate a recycled water recharge project that utilizes AWPF. Consequently, a supplemental boron antidegradation analysis would likely be useful for obtaining a RWQCB permit for PWSC to demonstrate compliance with basin antidegradation guidelines. Given the totality of proposed project benefits to the Main Basin and the relatively low assimilative capacity utilization, it is not anticipated that the boron assimilative capacity utilization would limit regulatory approval of the Carson project (Stetson Engineers 2021).

The SWRCB adopted a Recycled Water Policy in 2009. The Policy was amended in 2013, to address monitoring requirements for CECs (SWRCB 2018). The purpose of the policy is to increase the use of recycled water over 2002 levels by at least 1 million AFY by 2020, and by at least 2 million AFY in 2030, in a manner consistent with existing regulations.

A key element of this policy is the development of salt and nutrient management plans for every groundwater basin in California. These plans address basin-specific water quality issues associated with salts and nutrients as well as other constituents found in recycled water that may impact groundwater basins. These include CECs, and the monitoring strategy for them is based on recommendations by an expert panel.

The Recycled Water Policy also provides guidance on conformance with the State's Antidegradation Policy (discussed in the following section) by allowing a project to use up to 10 percent of a groundwater basin's assimilative capacity or up to 20 percent for multiple projects, with an antidegradation analysis completed and submitted to the RWQCB for approval.

In addition, the Recycled Water Policy indicates the potential need for additional permit requirements based on the effect that a groundwater recharge project may have on the fate and transport of a contaminant plume in a specific groundwater basin. For example, there are areas of groundwater contamination in the San Gabriel Valley that are included on the USEPA National Priorities List that must be considered for a groundwater recharge project in the Main San Gabriel Basin. The policy also requires evaluation of the effect that a groundwater replenishment project may have on the geochemistry of an aquifer that could cause dissolution of chemicals, such as arsenic, from the geologic formation into the groundwater. These issues would be important for Metropolitan, and its groundwater agency partners to investigate and coordinate with regulators as part of PWSC.

Federal antidegradation regulations are identified in Title 40 Code of Federal Regulations § 131.12. The SWRCB has interpreted Federal policy through adoption of Resolution No. 68-16, Statement of Policy with Respect to Maintaining High Quality of Waters in California, which established antidegradation policy in California and included the following requirement:

> "Whenever the existing quality of water is better than the quality established in policies as of the date on which such policies become effective, such existing high quality will be maintained until it has been demonstrated to the State that any change will be consistent with maximum benefit to the people of the State, will not unreasonably affect present and anticipated beneficial uses of such water and will not result in water quality less than that prescribed in the policies."

This policy applies to both surface water and groundwater in California. The SWRCB has also developed implementing guidelines (APU 90-004) for its Antidegradation Policy (SWRCB

1984). The Antidegradation Policy is not an absolute bar to reductions in water quality. The policy may allow lowering of water quality in surface water or groundwater if the change is consistent with providing a maximum benefit to the people of the State and does not unreasonably affect present and anticipated beneficial uses. However, depending on the level of assimilative capacity available for a particular constituent in a groundwater basin, some water recycling projects may have to meet levels below Basin Plan objectives, and potentially, current ambient groundwater constituent levels.

Recognizing that some groundwater basins contain salts and nutrients that exceed or threaten to exceed the water quality objectives established in the applicable Basin Plans, SNMPs were mandated by the SWRCB. The Recycled Water Policy required that local water and wastewater entities, together with local stakeholders, develop an SNMP for each groundwater basin in California by May 2014. The purpose of the plans was to ensure preservation or attainment of Basin Plan water quality objectives. Several groundwater basins received extensions for the submittal of their plans. The SNMPs for the groundwater basins targeted for PWSC are complete (see Table 8-5, which also lists the regulatory approval status of the SNMPs). Metropolitan would consider and ensure compliance with the SNMPs in the implementation of the PWSC. Additional groundwater modeling and an assimilative capacity analysis may need to be conducted. Effects on a specific basin—considering the volume of recycled water recharged—for constituents such as TDS, chloride, and nitrate would be evaluated and incorporated into future updates of the SNMP.

Table 8-5. Applicable Salt and Salinity Management Plans

Salt and Nutrient Management Plan	Agency Lead	Regional Board Jurisdiction	Status
Central and West Coast Basins	WRD of Southern California	Los Angeles RWQCB	Complete; Basin Plan amendment in February 2015 [1, 2]
Main San Gabriel	Main San Gabriel Basin Watermaster	Los Angeles RWQCB	Complete 3; Basin Plan amendment in December 2016 [3]
Santa Ana Region	Santa Ana Watershed Project Authority	Santa Ana RWQCB	Complete; Basin Plan amendments in January 2004 and April 2014 [4]

Notes:
1. http://wwwwaterboards.ca.gov/losangeles/water_issues/programs/basin_plan/RECUR/2015_06/FinalBasinPlanAmendmentCentralandwestCoastBasins'SNMP.pdf.
2. http://www.waterboards.ca.gov/losangeles/water_issues/programs/basin_plan/RECUR/2015_06/150212_FINALSaltNutrientMngtPlanforCentral&WestCoastBasins.pdf.
3. waterboards.ca.gov/losangeles/water_issues/programs/salt_and_nutrient_management/docs/san_gabriel/3_SanGabriel_SNMP_Final_pg 28-607.pdf
4. http://www.swrcb.ca.gov/santaana/water_issues/programs/basin_plan/index_shtml.

RWQCB = Regional Water Quality Control Board
SNMP = Salt and Nutrient Management Plan
WRD = Water Replenishment District

8.6. Pending Issues

8.6.1. Direct Potable Reuse Requirements

CWC § 13561 defines DPR as the planned introduction of recycled water either directly into a public water system, as defined in Section 116275 of the Health and Safety Code, (treated drinking water augmentation) or into a system of pipelines or aqueducts that deliver raw water to a drinking water treatment plant that provides water to a public water system, as defined in Section 116275 of the Health and Safety Code (raw water augmentation). DDW has been developing DPR regulations since 2017. The SWRCB approved these regulations on December 19, 2023, and they are anticipated to take effect in spring 2024.

As with IPR, an entity must file a 22 CR ER with the DDW and the RWQCB for DPR projects, and the ER must describe the project design, compliance, and contingency plan. The DDW reviews the report, consults with the RWQCB, holds public hearings, and makes recommendations for the WRRs and/or WDRs. Metropolitan will develop the DPR portion of the ER to demonstrate how they will comply with DPR requirements. The report will include a Wastewater Source Control Program and Water Safety Plan, both of which need Independent Advisory Panel reviews. A summary of these and other key requirements is provided below.

Public Meeting, CWC § 64669.25: The direct potable reuse responsible agency (DiPRRA) must hold at least one public meeting before obtaining a permit from the SWRCB and provide information about the DPR project, including its sources, treatment, monitoring, and start date. The DiPRRA must also notify the public of the meeting and the information availability by mail, direct delivery, and other methods.

Technical, Managerial, and Financial Capacity, CWC § 64669.30: The DiPPRA must demonstrate the skills, resources, and funding capacity to comply with the DPR requirements. These requirements include funding for the ongoing costs of the project and its sources, the availability and backup of these resources, and the tools and processes for management and accounting.

Operator Certification, CWC § 64669.35: The DiPPRA needs certified chief and shift operators to oversee operation of the treatment train. Each shift must have a chief operator with a T5 certificate and a shift operator with a T3 certificate. Operators must be on-site unless the SWRCB grants a waiver based on an operations plan that shows equivalent reliability and oversight.

Wastewater Source Control Program, CWC § 64669.40: The DiPPRA must source water from an entity that meets waste discharge requirements and has or can implement an industrial pretreatment and pollutant source control program. The entity must also limit wastewater contaminants, assess chemical fate, investigate chemical sources, educate customers to reduce chemical discharges, keep an inventory of detected chemicals, and undergo audits every 5 years. The DiPPRA must document local limits and have an early warning program.

Pathogen Control, CWC § 64669.45: The treatment train must monitor three pathogens using a supervisory control and data acquisition (SCADA) system and meet the minimum log reductions 100% of the time and meet more stringent requirements at least 90% of the time. At all times, the system must achieve 16 log reduction for enteric virus, 10 log reduction for Giardia lamblia cyst, and 11 log reduction for *Cryptosporidium* oocyst. For at least 90% of the time, it must also achieve 20 log reduction for enteric virus, 14 log reduction for Giardia lamblia cyst, and 15 log reduction for *Cryptosporidium* oocyst. The DiPPRA must execute corrective action if it doesn't achieve these reductions.

Chemical Control, CWC § 64669.50: The wastewater must undergo three separate and diverse processes for chemical reduction: ozone/BAC, reverse osmosis membrane, and advanced oxidation, in that order. The ozone/BAC process can be substituted by a continuous blending process with a low wastewater contribution, and both the ozone/BAC and the BAC processes must achieve a certain level of reduction of four indicators (formaldehyde, acetone, carbamazepine, and sulfamethoxazole) by at least 1.0 log each. The advanced oxidation process must reduce the indicator 1,4-dioxane by at least 0.5 log.

Water Safety Plan, CWC § 64669.55: The DiPPRA must address wastewater contaminants and their hazards in the drinking water supply chain and outline risk management controls such as treatment efficacy, critical limits, monitoring, corrective actions, and an operation plan.

Other Source and Process Chemical Monitoring, CWC § 64669.60, 65, 85, 90: The DiPPRA shall monitor priority toxic pollutants, chemicals with notification levels specified by the SWRCB, solvents (including acetone, N,N-dimethylacetamide, methanol, and methyl ethyl ketone), treatment byproducts, and others not regulated by the SWRCB.

Operations Plan, CWC § 64669.80: The operations plan must include details on the treatment processes, performance monitoring, personnel training, optimization strategies, and SCADA system used to ensure compliance with the California Safe Drinking Water Act and its regulations. The operations plan must be submitted to and approved by the SWRCB, along with the permit application for the DPR project.

8.7. Current and Projected Waste Discharge Requirements

Currently, the Warren Facility must meet secondary treatment standards for discharge to the Pacific Ocean, and generally the constituent levels in the Warren Facility's effluent are far below the effluent limits prescribed by the *Water Quality Control Plan: Ocean Waters of California* (SWRCB 1972 [2019]). In addition, the side-stream centrate treatment system that is part of PWSC would reduce nitrogen levels in the effluent discharged to the ocean. The AWPF would be designed to comply with requirements in water recycling permits, which are based on applicable Basin Plans, including applicable Salt and Nutrient Management Plans, and 22 CCR regulations for NPR, IPR, and DPR (projected to be finalized in late 2023 or early 2024). A new AWPF would provide a proven, four-step, state-of-the-art purification process consisting of RO and UV/AOP that would produce near-distilled quality water (exceeding California standards for IPR). The stabilized water would then be conveyed for recharge or surface spreading into groundwater basins, which would improve basin water quality through long-term recharge operations.

The existing NPDES permit (WDRs) for the Warren Facility is provided in Appendix D. No change in treatment limits is anticipated after the implementation of PWSC.

8.8. Opportunities to Expedite Permitting

In Governor Newsom's 2022 water resiliency plan (entitled "California's Water Supply Strategy: Adapting to a Hotter, Drier Future"), the governor committed to several actions that would advance the goals of reusing at least 800,000 AFY by 2030 and 1.8 MAF per year by 2040, with most of that additional recycling involving direct wastewater discharges that are now going to the ocean. Among other things, the state indicated that (1) it would consider greater investments and leverage federal dollars where possible to build on the $3.2 billion in financing for water recycling projects that the SWRCB has provided to 94 projects since 2012; (2) the SWRCB will work with local water and sanitation agencies to identify recycled water projects that hold the potential to be operational by 2030 and by no later than 2040 by January 1, 2024; (3) the SWRCB will formalize a process currently underway by convening a strike team to identify and resolve permitting and funding obstacles; (4) the SWRCB will track the permitting and funding status of recycled water projects with a public, digital dashboard; and (5) the state will support local water sustainability plans that use water recycling, including (but not limited to): Metropolitan's Integrated Water Resources Plan and CAMP4Water, which include the development of PWSC.

With respect to permitting, the SWRCB's Division of Water Quality convened a recycled water strike team on January 31, 2023, consisting of representatives from each of the nine regional water boards, the DWR, and SWRCB staff from the Division of Water Quality, Division of Financial Assistance, Division of Drinking Water, and Division of Water Rights. Representatives from WateReuse California, California Association of Sanitation Agencies, and the California Coastkeeper Alliance also attended to provide preliminary input on the strike team's charge to identify and resolve permitting and funding obstacles for recycled water projects under development. Staff developed a charter for the strike team's activities and a list of recycled water projects planned to be operational by 2030. Since PWSC aims to deliver recycled water for non-potable uses by 2030, IPR water by 2032, and DPR by 2035, Metropolitan and the Sanitation Districts will contact the SWRCB to engage in this effort and ensure that the SWRCB and RWQCBs will work with the project team to expedite permitting for PWSC.

8.9. Rights to Wastewater Discharges

See Section 8.1.

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9. Financial Capability

Financial Capability of Sponsor (WTR 11-01).

At the water reclamation, recycling or desalination feasibility study stage, Reclamation must request enough information to determine that the non-Federal project sponsor is likely to demonstrate financial capability if the project moves to construction. Reclamation will request more detailed information to make a determination that the non-Federal project sponsor is financially capable of funding the non-Federal share of the project's costs before a funding agreement covering construction can be executed. Accordingly, the following information is required to be included in the water reclamation, recycling or desalination feasibility study report.

(a) Proposed schedule for project implementation.

(b) Discussion of the willingness of the non-Federal project sponsor to pay for its share of capital costs and the full operation, maintenance, and replacement costs.

(c) A plan for funding the proposed water reclamation, recycling or desalination project's construction, operation, maintenance, and replacement costs, including an analysis of how the non-Federal project sponsor will pay construction and annual operation, maintenance, and replacement costs.

(d) Description of all Federal and non-Federal sources of funding and any restrictions on such sources, for example, minimum or maximum cost-share limitations. Generally, for water reclamation, recycling or desalination projects, the Federal cost share is limited to 25 percent, or $20,000,000, whichever is less.

The purpose of this section is to demonstrate that the project sponsor or sponsors are financially capable of funding PWSC's cost. The following analysis conforms with Reclamation's Directives and Standards (D&S) WTR 11-01 guidance (Reclamation 2007).

9.1. Applicability

9.1.1. Total Project Cost and Non-Federal Cost Share

As discussed in Section 4, the total construction cost for PWSC is estimated to be $6,174 million (in 2023 dollars and without any escalation). Over the PWSC construction period, Metropolitan may seek Federal funding assistance of up to the maximum allowed 25 percent of this cost, which would result in a federal contribution of $1,543 million. In this case, the non-Federal construction cost share for PWSC is estimated to be $4,631 million.

9.1.2. Operations, Maintenance, and Repair Cost

As discussed in Section 4, the annual OM&R cost for PWSC is estimated to average $228.0 million per year (in 2023 dollars). All OM&R costs will be paid by the PWSC sponsor(s) and partners.

9.2. Schedule for Project Implementation

PWSC would provide initial deliveries in 2030, would reach build-out by 2033, and produce DPR by 2035. The PWSC schedule, shown in Figure 9-1 includes design, permitting, awarding contracts, and construction activities that would be required for project implementation.

Figure 9-1. PWSC Construction Schedule

9.3. Non-Federal Project Sponsor Commitment

Metropolitan is willing to pay for its share of capital costs and the full operation, maintenance, and replacement costs. As discussed in Section 8.4, Multijurisdictional and Interagency Agreements, PWSC builds on the history of collaboration between agencies throughout the Southern California and Colorado River regions. PWSC is a product of the creative and collaborative partnership between Metropolitan, a regional wholesale water provider, and the Sanitation Districts, a regional wastewater service provider. Project capital funds will be provided by a combination of funds from Metropolitan and willing project partners. Bringing PWSC to fruition requires collaboration, and has more than 15 program partners, including Metropolitan member agencies as well as groundwater basin managers, Colorado River partners, and other agencies.

Metropolitan Water District's Board Approval of the Authorizing Resolution is anticipated in April 2024.

9.4. Funding Plan

Metropolitan plans to fund and pay for the project's construction and future OM&R costs using a mix of the various financing and cost recovery mechanisms available to it. As discussed below, Metropolitan will obtain the revenues necessary to meet its repayment and ongoing expenses predominantly from service rates and charges paid by its customers. Financing for project planning, design, and construction will be obtained through a combination of debt borrowing (either from federal/state loan programs or self-issued capital bonds) supplemented by contributions from the Sanitation Districts and other program partners and any state and federal grant funding support that can be obtained. Potential contributions from partners and from federal and state funding sources that may be available to the project are subsequently discussed in Section 9.5.

9.4.1. Cost Recovery

Metropolitan currently recovers revenues to cover its operating and capital costs through an existing rate structure that includes various rate design elements. Metropolitan volumetric-based rate charges to its member agencies include the following rates:

- A Supply Rate consists of a two-tiered charge on water sales that recovers Metropolitan's cost for water supply and transfers.
- A System Access Rate recovers the costs of conveyance, distribution, and portions of storage facilities.
- A System Power Rate recovers the cost of energy required to pump water to Southern California through the SWP and the CRA.
- A Treatment Surcharge recovers the cost of providing treatment capacity and operations; it is applied to all transactions involving treated water.
- Metropolitan also imposes a fixed charge to its member agencies, which includes a Capacity Charge and a Readiness-to-Serve Charge:
    - A Capacity Charge recovers the cost of peak capacity within the distribution system; it is based on each member agency's 3-year trailing peak day demand measured in cubic feet per second.
    - A Readiness-to-Serve Charge recovers the portion of the system that is available to provide emergency service and available capacity during outages and hydrologic variability. This charge is based on each agency's share of a ten-fiscal-year rolling average of all firm demands.

Metropolitan's primary considerations and objectives for identifying and selecting cost recovery alternatives for PWSC are:

- Consistency with Metropolitan's adopted Rate Structure Framework:
  - The rate structure should be fair.
  - The rate structure should be based on the stability of Metropolitan's revenue and coverage of its costs.
  - The rate structure should provide certainty and predictability.
  - The rate structure should not place any customers at significant economic disadvantage.
  - The rate structure should be reasonably simple and easy to understand.
  - Any dry-year allocation should be based on need.
- Consideration of the benefits provided by PWSC to member agencies
- Consistency with water utility industry cost recovery principles, providing a nexus between the charges and the benefits received
- Transparency of the benefit and cost allocation approach and understandability to the beneficiaries funding the PWSC's costs
- Ease of implementation and administration
- Consistency with common industry practices for recovery of water resiliency projects
- Consideration of aligning fixed costs with fixed-cost recovery
- Providing member agencies with at least one alternative that provides for direct investment by member agencies in the PWSC

More specifically, to address these primary objectives, Metropolitan is currently considering six cost recovery alternatives:

- Cost recovery consistent with existing rates and charges
- Cost recovery with a functionalized fixed charge
- Cost recovery through member agency subscriptions as direct investors
- Cost recovery through surcharges on supply and conveyance functions
- Cost recovery through a general obligation bond serviced with ad-valorem property taxes

- Cost recovery through surcharges on recycled water and direct-potable-reuse water purchases

Each alternative's potential implementation approaches and their relative advantages and drawbacks have been evaluated by an external consultant (Raftelis 2023).

9.4.2. Debt Funding

Bond or Issuer Credit Rating. Metropolitan has consistently received excellent credit ratings from the nation's top rating agencies. After their most recent rating reviews, Metropolitan received the following bond ratings (in June 2023) from: (1) AAA/stable from Standard & Poors; (2) Aa1/stable from Moody's; and (3) AA+/stable from Fitch Ratings (Metropolitan 2023c). All three of the rating agencies' bond rating scores qualify as "high acceptable" scores per Reclamation's D&S WTR 11-02 Table A criteria and demonstrate Metropolitan's strong borrowing potential.

Debt Policy. Metropolitan is subject to limitations on its future revenue bond issuance. Resolution 8329 (the Master Revenue Bond Resolution) was adopted by Metropolitan's Board in 1991 (and subsequently supplemented and amended); the resolution provides for the issuance of Metropolitan's revenue bonds and limits the issuance of additional obligations payable from Net Operating Revenues, among other things, through the requirement that Metropolitan must meet an Additional Bonds Test, as defined in the resolution. Metropolitan's Master Subordinate Bond Resolution, Resolution 9199, adopted by the board in March 2016 (and subsequently supplemented and amended) also incorporates limitations on additional revenue bonds.

The Metropolitan Act provides two additional limitations on indebtedness. It provides for a limit on general obligation bonds, water revenue bonds, and other indebtedness at 15 percent of the assessed value of all taxable property within Metropolitan's service area. As of May 1, 2023, outstanding general obligation bonds, water revenue bonds, and other evidence of indebtedness in the amount of $3.68 billion represented approximately 0.10 percent of the fiscal year (FY) 2022/2023 taxable assessed valuation of $3,625 billion. The bonds issued for the PWSC would not cause Metropolitan's indebtedness to exceed the 15 percent assessed value limitation.

The second limitation under the Metropolitan Act specifies that no revenue bonds may be issued, except for the purpose of refunding, unless the amount of the net assets of Metropolitan (as shown on its balance sheet as of the end of the last financial year before the issuance of the bonds) equals at least 100 percent of the aggregate amount of revenue bonds outstanding after the issuance of the bonds. The net assets of Metropolitan as of June 30, 2022, were $7.46 billion. The aggregate amount of revenue bonds outstanding as of May 1, 2023, was $3.66 billion (Metropolitan 2023c).

Metropolitan has also established its own policy regarding debt management. The purpose of this policy is to maintain a balance between current funding sources and debt financing to retain Metropolitan's financing flexibility. This flexibility allows Metropolitan to use a variety of revenue or debt-financing alternatives, including issuing low-cost variable rates and other revenue-supported obligations.

Metropolitan's debt management policy is to do the following:

- Maintain an annual revenue-bond debt coverage ratio of at least 2.0 times coverage.
- Maintain an annual fixed-charge coverage ratio of at least 1.2 times coverage.
- Limit debt-funded capital to no more than 40 percent of the total capital program over the 10-year planning period.
- Limit variable-rate debt so that the net interest cost increase due to interest rate changes is no more than $5 million and limit the maximum amount of variable rate bonds to 40 percent of outstanding revenue bond debt (excluding variable-rate bonds associated with interest-rate swap agreements).

Debt Coverage. To comply with the debt management policy, Metropolitan has taken the following measures:

- **Revenue Bond Debt Coverage Ratio:** This policy ensures that Metropolitan has sufficient annual operating revenues to pay its operating expenses and meet its debt-service obligations on its revenue bonds and other senior debt. The revenue bond debt coverage ratio is defined as Metropolitan's net operating revenue (current year's operating revenue less the current year's operating expenses) divided by the current year's debt service on all revenue bonds and other senior debt. The target is 2.0 times coverage. In FY 2022/2023 and FY 2023/2024, the projected debt coverage ratio is 1.4- and 1.5-times coverage, respectively. The 10-year forecast projects that Metropolitan's revenue bond coverage ratio ranges from 1.4 times to 1.9 times coverage over the 2022 to 2032 period (Metropolitan 2022c).
- **Fixed-Charge Coverage Ratio:** In addition to revenue bond debt service coverage, Metropolitan also measures total coverage of all fixed obligations after payment of operating expenditures. This additional measure is used to account for Metropolitan's recurring capital costs for the State Water Contract; these costs are funded after debt service on revenue bonds and other parity obligations. Rating agencies expect that a financially sound utility consistently demonstrates an ability to fund all recurring costs, whether they are operating expenditures, debt-service payments, or other contractual payments.

    - Metropolitan's fixed-charge coverage ratio target is 1.2 times coverage. In both FY 2022/2023 and FY 2023/2024, the projected fixed charge coverage ratio is 1.4 times coverage. Metropolitan's 10-year forecast projects that the fixed-charge coverage will exceed 1.2 times coverage in all years. These levels help maintain strong credit ratings and access to the capital markets at low cost (Metropolitan 2022c).

- **Implications of the PWSC to Coverage Ratios:** Issuing debt during the 11-year construction period of the PWSC may affect Metropolitan's revenue bond debt coverage and fixed-charge coverage ratios. The full effects of the additional debt-service payments on the coverage ratios cannot be determined at this time because most of the effects are beyond the time frame of current long-term finance forecasts. One way to mitigate the impact of the additional debt service on the coverage ratios is to reduce the amount of revenue bonds issued by using operating revenues ("pay as you go"). Use of operating revenues during construction would lower the cost impact when PWSC is complete, because revenue bond debt service would be reduced. However, the trade-off is that Metropolitan's rate increases during the construction period would need to be higher than they would be otherwise to generate the additional revenue.
    - It is anticipated that there will be about $6.2 billion of capital expenditures over the 10-year period 2023 to 2032. Of this amount, $4.65 million, or 75 percent of future capital expenditures, are anticipated to be funded by debt proceeds. Outstanding debt, including revenue and general obligation bonds, as of May 1, 2023, is $3.66 billion. The net position of Metropolitan on June 30, 2021, was $7.2 billion. Total outstanding debt is forecast to increase $7.2 billion by FY 2031/2032 as planned capital projects are financed with new bonds. Nonetheless, there should still be more than adequate headroom between the value of net assets and the outstanding revenue bonds to debt financer PWSC.

9.5. Sources of Funding

Grant and loan funding opportunities are available from one or a combination of sources including the Federal and State government, as well as potentially from non-profit research funds, public-private partnerships, and local agency partnering. Grant and loan funding is an attractive source of supplemental funding for PWSC but has various eligibility, matching fund, and reporting requirements.

Federal funding for PWSC is primarily available through Reclamation. Funding from USEPA, Federal Emergency Management Agency (FEMA), National Oceanic and Atmospheric Administration (NOAA), or other Federal sources may be available for the PWSC in the future. The SWRCB and DWR are the primary State agencies that fund recycled water projects. The SWRCB's Division of Financial Assistance administers the State Clean Water and Drinking Water State Revolving Fund programs, the Water Recycling Funding Program (WRFP), and the Sustainable Groundwater Management Grant Program. The following discussion provides an overview of the known funding sources available for the PWSC.

Metropolitan currently anticipates prioritizing grant opportunities, followed by funding requests through the Clean Water State Revolving Fund (CWSRF) and Drinking Water State Revolving Fund (DWSRF) low-interest loan programs because the interest rate is half the general obligation bond rate (approximately 2 percent), and the repayment period is up to 30 years. There are some significant concerns with the CWSRF and DWSRF loan requirements regarding lien parity, limitations on future bond issuances, and mandatory bond reserve funds that need consideration.

9.5.1. Existing and Potential Future Partnering Agency Contributions

To date, Metropolitan has received funding contributions from several of its partners for planning and design activities, and there is potential for additional contributions, subject to reaching further agreements with the partners. The status of these agreements is provided below. However, future additional potential contributions of partners cannot be determined at this time.

Los Angeles County Sanitation Districts. The Sanitation Districts are a confederation of 24 independent special districts created under the County Sanitation District Act, California Health & Safety Code Section 4700, et seq., to provide sanitation services. The Sanitation Districts provide environmentally sound, cost-effective wastewater and solid waste management for approximately 5.5 million people in Los Angeles County. The Sanitation Districts' service area covers approximately 850 square miles and encompasses 78 cities and unincorporated territory within the County, excluding the majority of the City of Los Angeles. The wastewater management system consists of approximately 1,400 miles of trunk sewers, 49 pumping plants, 11 wastewater treatment plants, and one biosolids composting facility. Of these facilities, 1,200 miles of sewers, 47 pumping plants, and 7 wastewater treatment plants, including the Warren Facility, comprise the Joint Outfall System (JOS), which serves 17 member Districts in the Los Angeles basin. In fiscal year 2022/2023, the budget for the wastewater management system was $891 million, and actual expenses were $812 million.

The primary sources of revenue for the wastewater management system are wastewater service charges, industrial waste service charges, and property tax revenues. In FY 2022/2023, to finance various wastewater capital projects, the Sanitation Districts received approximately $12 million in loans from the CWSRF, and have agreements in place for another $158 million. The Sanitation Districts have also been awarded approximately $441 million in loans through the Water Infrastructure Finance and Innovation Act and a grant of $1.8 million for site remediation (not part of PWSC), both administered by the United States Environmental Protection Agency. When necessary, the Los Angeles County Sanitation Districts Financing Authority (Authority) facilitates the issuance of long-term debt on behalf of the member Districts. The Authority's governing body is composed of the chairs of the member Districts' Boards of Directors, and the Authority provides services only to the Districts. The Authority has no daily operations and does not conduct business on its own behalf. The latest bond issuance by the JOS Districts was the 2022 Series A Revenue Bonds (Joint Outfall Districts), with a AAA rating by Standard & Poor's.

In terms of the Sanitation Districts' participation in PWSC, as noted in Section 8.3.1, Metropolitan and the Sanitation Districts have successfully developed a pilot program, built and operated a Demonstration Facility, conducted nitrogen management studies and source control investigations, and collaborated on public outreach and education regarding PWSC. This work has been done under the auspices of a 2015 Regional Recycled Water Program Agreement and a 2020 Amendment to the Agreement. The 2020 amendment included cost-sharing commitments for environmental evaluation (50-50 split of costs, estimated at $4 million total); engineering support (1/6 to be paid by Sanitation Districts, estimated at a total of $12 million); and public outreach (50-50 split of costs, estimated at a total of $800,000). These commitments amount to an estimated $4.4 million in funding support from the Sanitation Districts for these activities, which together comprise Environmental Planning Phase Services. Additionally, the Sanitation Districts are leading the site investigation and remediation efforts for the proposed AWPF site at an estimated $10 million, and have spent approximately an additional $4 million to prepare technical studies on brine collection and the biological treatment at the Warren Facility. Metropolitan and the Sanitation Districts are currently working to develop the terms of an agreement for the implementation of the full-scale AWPF, which may include items such as the lease terms for the AWPF site property, the terms for provision of secondary effluent to Metropolitan for the AWPF, and disposal of treatment residuals, among other things. The "Proposed Terms and Conditions Applicable to the Full-Scale Project" may be found in Exhibit B to the 2015 Agreement.

Southern Nevada Water Authority and Arizona Department of Water Resources/Central Arizona Water Conservation District. In 2020 and 2021, respectively, Metropolitan finalized agreements that specified that the Southern Nevada Water Authority and Arizona Department of Water Resources/Central Arizona Water Conservation District would contribute 24 percent (up to $6 million) each for Environmental Planning Phase Services. These contributions will help pay for the costs for conducting analyses, investigations, evaluations, studies, and public outreach, as needed, to complete any environmental review and documentation required for design and construction of PWSC. These Environmental Planning Phase Services include environmental evaluation, engineering and other technical support, and public outreach, and will conform to and comply with the requirements of the CEQA and any other applicable environmental requirements, permitting processes, and laws.

9.5.2. Grant Funding Opportunities

Metropolitan has identified the following Federal and State grant funding program that could potentially provide future funding support for PSWC construction.

WaterSMART Program. The WaterSMART program was established in 2010 to implement the SECURE Water Act to secure water supplies for future generations. WaterSMART contains several grant programs, including the WaterSMART Grants, Title XVI Water Reclamation and Reuse Program (Title XVI), Basin Studies, Watershed Management, Drought Response, and Water Conservation and Field Service Programs. The USBR is the primary agency administering these WaterSMART programs. The two Federal grant programs that may provide funding for the PSWC are the WaterSMART Grant program and Title XVI.

Grant funding, typically announced in the fall, is a competitive grant program at 25 percent Federal cost share, with no per-project maximum. Metropolitan received a $700,000 grant for an On-Site Recycled Water Retrofit Pilot program in 2014 and a $750,000 grant in 2019 to Demonstrate Pathogen Removal through alternate treatment methods. Metropolitan applied for and was awarded a WaterSMART: Water Recycling and Desal Planning Grant for PWSC for $5 million in September 2023, pending completion of a funding agreement.

WaterSMART Large-Scale Water Recycling Program. This program includes approximately $450 million in FY 2024 to FY 2029 for large projects (i.e., greater than $500 million cost) that can play an important role in helping communities develop local, drought-resistant sources of water supply by turning currently unusable water sources into a new source of water supply that is less vulnerable to drought and climate change. The program can provide up to 25 percent federal cost share, with no per-project federal funding maximum. Projects can become eligible to compete for Large-Scale Water Recycling Program funding once Reclamation has reviewed a feasibility study submitted by the non-federal project sponsor and has informed Congress that the project meets Reclamation's requirements.

Metropolitan and the Sanitation Districts have submitted a grant application in response to Reclamation's WaterSMART Large-Scale Water Recycling Projects for Fiscal Year 2023 and 2024, NOFO: R23AS00433. The cost of the initial phase of PWSC for which funding is being sought during the funding period (anticipated to be April 2024 through November 2026) is $501.9 million for required planning and design activities. Metropolitan is seeking a federal funding share in the amount of up to $125.5 million.

Title XVI Water Reclamation and Reuse Program. Title XVI, established through the Reclamation Wastewater and Groundwater Study and Facilities Act of 1992, provides grant funding for projects in the 17 western United States and Hawaii that reclaim and reuse municipal, industrial, domestic, or agricultural wastewater, and naturally impaired ground and surface waters.

Currently, there are 64 Title XVI projects that are eligible to compete for Title XVI WIIN Act funding. Metropolitan received approval of its prior *Title XVI Feasibility Study for RRWP Portfolio* in April 2020, and is eligible to compete for Title XVI WIIN Act funding, and therefore is one of 44 Title XVI WIIN funding–eligible projects in California. Title XVI generally provides up to $20 million or 25 percent of project costs to selected congressionally authorized projects for construction. Project sponsors provide the remaining 75 percent of the funding necessary to carry out the projects. Title XVI provides funding of approximately $30 million a year (5 to 10 projects) for planning, design, or construction. Funding for a project is typically secured over 5 to 10 years in $3 million to $5 million increments. Approximately $629 million in Federal funding has been leveraged with nonfederal- funding to implement approximately $2.4 billion in water reuse projects. Approximately $407 million in Title XVI grants have been provided to projects in Metropolitan's service area, including $50 million in the mid-1990s for the first phase of West Basin MWD's water recycling project.

FEMA Building Resilient Infrastructure and Communities (BRIC). The FEMA pre-disaster hazard mitigation program incentivizes new and innovative large infrastructure projects that build resilient communities and reduce risks from hazards. BRIC requires a cost share of 25 percent for the Non-Federal contribution. There is a $50 million limit per project. The project must be included in a FEMA-approved Hazard Mitigation Plan and comply with 2018 and 2021 International Building Codes.

Proposition 1: The Water Quality, Supply and Infrastructure Act of 2014. On November 4, 2014, California voters approved Proposition 1 (Assembly Bill 1471, Rendon), which authorized $7.545 billion in general obligation bonds for water projects, including surface and groundwater storage, ecosystem and watershed protection and restoration, drinking water protection, groundwater sustainability, regional water management, and water recycling and desalination. There is a high demand for funding and the majority of remaining funding is already allocated. However, more funding may become available in the longer-term future once currently funded projects are operational and begin to repay their funded loans.

- **Groundwater Management:** Proposition 1 authorized $900 million for grants and loans, for projects that prevent or clean up groundwater contamination that serves as a drinking water source, of which SWRCB will administer $800 million of the funds. Approximately $80 million is available for treatment and remediation activities that prevent or reduce the contamination of groundwater that serves as a source of drinking water. Funding under this program for PWSC is uncertain due to the focus on groundwater treatment. DWR also administers the Sustainable Groundwater Management Grant Program under Proposition 1 to promote projects that provide multiple benefits while also improving groundwater supply and quality. Funding is awarded through a competitive application process for activities that help the basins reach sustainability through investments in groundwater recharge and/or projects that prevent or clean up groundwater contamination. Projects must be included in a medium or high priority basin. Estimated Awards are between $1 million and $20 million. No match is required. Metropolitan received four $75,000 ground water planning grants in 2017 and a $1M Pilot Project from the Water Recycling Funding Program in 2020.

- **Integrated Regional Water Management:** Proposition 1 authorized $510 million for grants to implement Integrated Regional Water Management (IRWM) plans; $98 million of this was allocated to the Los Angeles Region. The IRWM Grant Program is intended to improve regional water self-reliance and address changes to the water supply arising out of climate change. DWR is the primary State agency for funding IRWM projects. Proposed projects must be consistent with adopted IRWM Plans and priorities. Water reuse and recycling projects are generally eligible. However, all Proposition 1 funding has been awarded, and at this time, no additional state funding is available for the IRWM program. Future funding availability is uncertain, but existing state policies and priorities may result in additional funding in the future.

Water Recycling: The Budget Act of 2021 and 2022 authorized $625 million for water recycling projects that are administered through the SWRCB's WRFP for water recycling and treatment technology projects. Water recycling projects may receive grant funds of up to 35 percent of actual eligible construction costs incurred, with a maximum of $15 million. The project sponsor must provide at least a 50 percent local cost share match. Projects have been funded on a first-come and ready-to-proceed basis. Projects must meet at least 50 percent annual deliveries within 5 years of construction completion or demonstrate adequate future demands. Metropolitan received a $1 million pilot project grant for Innovation Center research supporting PWSC.

AB 179: Amendment to Budget Act of 2022. The Governor of California signed Assembly Bill (AB) 179 in September 2022 to include allocation of funds for water recycling projects. Metropolitan secured an $80 million direct appropriation in the State of California FY 2022/2023 budget to initiate PWSC's preliminary design and design activities. Part of the state funds will be used as Metropolitan's non-federal matching funds. planning and design activities.

Congressionally Directed Spending (CDS) is a mechanism by which members of Congress can request funding for specific projects in their home state that have been submitted for consideration by state and local government entities and nonprofits. CDS requires a state/local match. The average funding awarded for CDS ranges from $2 million to $5 million; but it can be higher. Projects are ultimately selected by the U.S. House and Senate, with funding, if approved, distributed as part of the federal appropriations process the next fiscal year (October through September).

9.5.3. Loan Opportunities

As discussed in Section 9.3, Metropolitan is in a strong financial position to issue capital bonding to fund the PWSC. However, Federal and State low-interest loan programs may offer more favorable repayment terms for Metropolitan.

Water Infrastructure Finance and Innovation Act (WIFIA) Program: The WIFIA program was authorized under the Water Resources Reform and Development Act of 2014 and is modeled after the successful Transportation Infrastructure Finance and Innovation Act of 1998. WIFIA provides low-interest-rate financing for large-dollar--value projects. Projects must cost no less than $20 million (projects can be combined and submitted as a group of projects) with the maximum amount of the loan not exceeding 49 percent of the project costs. Maximum loan term is 35 years (including a 5-year repayment deferment) from date of substantial completion of the project. The interest rate is equal to the U.S. Treasury rate of a similar maturity. Funds can be used to cover planning/design (retroactive) and construction activities. WIFIA is similar to State Revolving Fund (SRF) programs but is intended to provide subsidized financing for large-dollar-value projects. Eligible recipients include corporations, partnerships, municipal entities, and SRF programs. Eligible projects must be nationally or regionally significant and cost at least $20 million.

- As of December 2022, USEPA had completed 96 loans that have financed $17 billion of a total $36 billion in water infrastructure development. The program's FY 2022 appropriation was $7.7 billion, of which the program had invited 18 communities to apply for $2.7 billion as of December 2022.

Clean Water State Revolving Fund Program: The CWSRF is a low-interest loan program administered by the SWRCB that provides funding to agencies to plan, design, and construct wastewater treatment, sewer collection, or water-recycling facilities, among other things. Applications are accepted through the Financial Assistance Application Submittal Tool electronic application program by the SWRCB. Projects must submit applications that include a project description, financial information, and CEQA compliance before being considered for funding. The CWSRF is composed of both Federal and State monies. California receives annual capitalization grants from USEPA and provides a 20 percent match via State bonds and local funds. Because most of the CWSRF funding comes from USEPA, the CWSRF program requires applicants to provide additional environmental documents to comply with Federal NEPA requirements. Currently, CWSRF loans have payment terms up to 30 years at half the State's current general obligation bond rate. The amount of the loan is dependent on the proponent's ability to repay the principal. The size of the loan can be up to 100 percent of the project cost, but CWSRF loan funding is likely to be limited to a maximum of $50 million per project. Since the inception of the program, SWRCB has closed 861 CWSRF assistance agreements totaling $11.833 billion as of June 30, 2020.

- **Drinking Water State Revolving Fund Program:** The DWRSF program assists public water systems in financing the cost of drinking water infrastructure projects needed to achieve or maintain compliance with Safe Drinking Water Act requirements. Loan terms are up to 30 years. Planning costs may include the preparation of planning/design documents such as feasibility studies and project reports, plans and specifications, engineering and specifications, environmental documents, and capital improvement plans. Other costs such as legal costs and fees, environmental review, TMF assessments, water rate studies, and test wells are also eligible for funding planning projects. Construction costs may include wastewater treatment plants, local sewers, sewer interceptors, water reclamation and distribution, stormwater treatment, combined sewers, and landfill leachate treatment. Consolidation project funding may be available.

9.5.4. Future Funding Opportunities

Metropolitan and the Sanitation Districts are interested in pursuing future state and federal funding opportunities for PWSC, and, as such, will advocate for additional funding for water recycling projects to be made available in the California State Legislature and the U.S. Congress. Such opportunities may include annual appropriations bills for potential funding programs (e.g., State Revolving Funds, WIFIA), bond bills (such as Senate Bill 867 and AB 1567, which are two climate resiliency bond bills under consideration by the California Legislature), extension of the Large-Scale Water Recycling Program, and any other possibilities that may arise.

10. Research Needs

WTR 11-01 Research Needs

At a minimum, the report must include a statement on whether the proposed water reclamation, recycling or desalination project includes basic research needs, and the extent that the proposed project will use proven technologies and conventional system components. The following information is required only if further research is necessary to implement the proposed water reclamation, recycling or desalination project:

(a) description of research needs associated with the proposed water reclamation, recycling or desalination project, including the objectives to be accomplished through research;

(b) description of the basis for Reclamation participation in the identified research;

(c) identification of the parties who will administer and conduct necessary research; and

(d) identification of the timeframe necessary for completion of necessary research.

This section describes ongoing and future research. Research necessary to implement the proposed recycling project is specifically identified.

PWSC will largely rely on proven technology and conventional system components. Many of the research activities identified for Phase 1 support optimization of advanced water treatment processes and various aspects of PWSC. The research activities for the Phase 2 DPR will target demonstrating the equivalency of the alternative approaches to ozone/ BAC where the recycled water makes up more than 10 percent of the potable water.

10.1. PWSC

PWSC is a partnership between Metropolitan and the Sanitation Districts. PWSC targets the creation of a new water supply to help meet the region's water supply needs. Using either primary or secondary effluent from the Sanitation Districts' Warren Facility, Phase 1 of the planned AWPF would produce up to 115 MGD of purified water for both IPR and DPR, with expansion to 150 MGD in Phase 2. Purified water will be transported via new conveyance systems to spreading grounds, injection wells, and Weymouth and Diemer Water Treatment Plants to augment water supplies throughout Metropolitan's service area.

The PWSC will be implemented in phases to maximize the use of purified water. The first phase of the program will achieve groundwater augmentation, which is classified as IPR and Raw Water Augmentation, which is classified as DPR.

The SWRCB has adopted the regulations for DPR on December 19, 2023, including the last version of the proposed regulations dated October 4, 2024, in the resolution. The proposed regulations cover Raw Water Augmentation, the placement of advanced treated water into a raw water conveyance system upstream of a drinking water treatment plant; and Treated Water Augmentation, the placement of advanced treated water into a public water system's drinking water distribution system. DPR regulations require ozone and biological activated carbon (ozone/BAC) upstream of RO and UV/AOP where the recycled water makes up more than 10 percent of the potable water.

The first phase of the PWSC focuses on groundwater augmentation IPR and the initial DPR component augmenting less than 10 percent of the minimum daily flow at the Weymouth and Diemer WTPs. For Phase 1, Metropolitan will continue with research activities supporting optimization of advanced treatment processes and various Phase 1 elements. For Phase 2, the DPR component of the PWSC will be expanded to achieve raw water augmentation with more than 10 percent, requiring the addition of ozone/BAC for the entire PWSC flow. This would result in significant additional life-cycle cost. Therefore, Metropolitan and other Southern California agencies plan to investigate alternative approaches to ozone/BAC, while achieving an equivalent level of chemical reduction and public health protection for DPR. Metropolitan has initiated the planning of the research activities required to explore cost-effective alternatives to ozone/BAC for Phase 2 DPR implementation.

10.2. Grace F. Napolitano Pure Water Southern California Innovation Center

Between 2010 and 2012, Metropolitan and the Sanitation Districts team conducted pilot-scale studies on the treatability of Warren Facility effluent. When California IPR regulations were promulgated in 2014, several key questions remained regarding pathogen removal and treatment efficacy. During 2017-18, Joint Metropolitan and Sanitation Districts Nitrogen Workgroup recommended additional studies to investigate 5 process trains of which most were MBR-based. This led to the development of the need for demonstration testing and the commissioning of the Innovation Center (Figure 10-1). Metropolitan, in partnership with the Sanitation Districts, has been operating the Innovation Center and conducting field testing and investigations on MBR, RO, and UV/AOP treatment processes for PWSC since 2019. The 0.5 MGD Innovation Center and the encompassing learning center and other facilities is a critical component of PWSC, providing operational and performance data to inform the process selection and design criteria, serving as a basis for establishing cost clarity for treatment, confirming the operational interfaces with the Sanitation Districts, and optimizing the future facility. The Innovation Center also serves as a valuable resource for public outreach and education, including for the training of operations staff in advanced water treatment technologies.

Figure 10-1. Grace F. Napolitano Pure Water Southern California Innovation Center.

The Innovation Center has provided Metropolitan and the Sanitation Districts with testing and optimization data for major advanced treatment processes, including MBR, RO, and UV/AOP (as shown on Figure 10-2).

Figure 10-2. Overview of Grace F. Napolitano Pure Water Southern California Innovation Center

MBRs are widely used for wastewater treatment and research studies completed by Metropolitan, and the Sanitation Districts found that MBRs may be a cost-effective treatment barrier in the advanced purification process. California DDW has granted pathogen LRVs for MBR for Phase 3 of the Santa Monica Sustainable Water Infrastructure Project. However, those LRVs are lower than the pathogen reduction expected in the MBR system. The extensive MBR research efforts undertaken using the primary and secondary effluents from Warren Facility and conducting MBR challenge testing have played a crucial role in confirming the viability of the MBR process for PWSC, demonstrating the reliability of MBR as a pathogen barrier to California DDW, and supporting the path forward in granting higher pathogen LRVs for MBR compared to what has been granted to date by DDW. As part of MBR pathogen removal research, the Metropolitan team has developed comprehensive microbial sampling and analytical methods and protocols and undertaken a significant level of effort to generate the information. The Bureau of Reclamation WaterSMART research grant was utilized for Metropolitan's MBR research work between 2019 and 2023.

10.3. Research Needs Statement

PWSC will largely rely on proven technology and conventional system components. Three main treatment processes, MBR, RO, and UV/AOP, have been used by numerous facilities currently in various stages of construction and operation, as summarized in Table 10-1. Research activities for Phase 1 will focus on optimizing treatment process design and operational strategies and various aspects of PWSC.

Table 10-1. Partial List of IPR and DPR Projects Based on MBR, RO, and UV/AOP

Process	IPR and DPR Projects		
	Operating	**Start-up and Commissioning**	**Under Construction**
MBR Followed by RO and UV	Metropolitan Grace F. Napolitano PWSC Innovation Center, California	LASAN Hyperion MBR Pilot Facility, California	—
	Santa Monica, Sustainable Water Infrastructure Project, California	LASAN Hyperion LAWA MBR Facility, California	
	Singapore Public Utilities Board, NEWater Factories, Singapore	City of Morro Bay, Water Reclamation Facility, California	
RO followed by UV/AOP	Orange County Water District, Groundwater Replenishment System, California	—	East County Advanced Water Purification, California
	Water Replenishment District Leo J. Vander Lans Advanced Water Treatment Facility, California		Pure Water Soquel, California
	West Basin Municipal Water District, Edward C. Little Water Recycling Facility, California		—
	Pure Water Oceanside, California		
	Pure Water Monterey, California		
	Terminal Island Water Reclamation Plant Advanced Water Purification Facility, California		
	Colorado River Municipal Water District, Big Springs Raw Water Production Facility, Texas		
	Pure Water San Diego Demonstration Plant, California		
	Water Replenishment District of Southern California, ARC AWPF		

Notes:
— = not applicable
ARC = Albert Robles Center
AWPF = Advanced Water Purification Center
DPR = direct potable reuse
IPR = indirect potable reuse
LASAN = Los Angeles Sanitation
LAWA = Los Angeles World Airports
MBR = membrane bioreactor
PWSC = Pure Water Southern California
RO = reverse osmosis
Sanitation Districts = Los Angeles County Sanitation Districts
UV = ultraviolet
UV/AOP = ultraviolet advanced oxidation process

Phase 2 DPR can be implemented using ozone/BAC treatment processes, which are proven water treatment technologies. However, use of ozone/BAC upstream of RO and UV/AOP during Phase 2 DPR requires significant additional costs and operational complexity. Therefore, additional research activities are needed for Phase 2 DPR to enhance the cost-effectiveness and operational flexibility.

10.4. Further Research

Further research activities will target optimizing Phase 1 elements and demonstrating the equivalency of the alternative approaches to ozone/BAC for Phase 2 DPR.

Research activities planned for Phase 1 include RO system optimization, UV/AOP oxidant selection, purified water stabilization and blending studies, assessment of water treatment plant impacts, optimization of nitrogen management strategies, evaluation of options for achieving 1-log reduction of *Cryptosporidium* by chemical disinfection and assessment of byproduct formation.

For Phase 2, the alternative approaches to ozone/BAC could be a potential satellite facility downstream that treats only flow to be used for DPR (as shown on Figure 10-3). The Innovation Center will be fully used and expanded for Phase 2 DPR research activities, with testing of additional treatment processes that are part of alternative approaches to ozone/BAC.

Figure 10-3. Conceptual Layout of PWSC Facilities for a Potential DPR Scenario

10.4.1. Description of Research Needs

The following objectives are to be accomplished with research related to the Phase 1 elements:

- Process optimization: Performance of RO and UV/AOP treatment processes will be further optimized under various design and operational conditions. The goals of the advanced treatment process optimization steps include sustaining overall water recovery in RO and selection of best-suited oxidant type and dose for UV/AOP.

- Post-treatment studies: The research activities will include product water stabilization, determination of disinfectant residual requirements, evaluation of various blending scenarios, and assessment of water treatment plant impacts.

- Optimizing nitrogen management strategies: These research activities will seek to enhance the ease of operation and process reliability.

- Additional pathogen LRVs: Evaluating options for achieving 1-log *Cryptosporidium* through chemical disinfection and assessing byproduct formation.

The following objectives are to be accomplished with research related to the Phase 2 DPR:

- Evaluate, based on bench-scale and pilot-scale testing, the performance and efficacy of alternative technologies and process trains that can be used in lieu of ozone/BAC upstream of RO for meeting the 1-log (90 percent) removal of target chemicals listed in the recently adopted California DDW (2023a) "DPR Regulations," including acetone, formaldehyde, sulfamethoxazole, and carbamazepine.

- Demonstrate that the alternative approaches provide equivalent chemical reduction and public health protection and meet the intent and requirements of the DPR regulations.

- Evaluate the potential improvements to RO concentrate water quality when ozone/BAC is added upstream of RO.

- Develop comparative analysis of various alternative approaches that focus on the key criteria, including capital cost, O&M cost, robustness, reliability, impact to the environment, carbon emissions, and operational flexibility.

Otherwise, PWSC will use proven technology. Other research will be limited to optimization studies for the facilities and operations.

10.4.2. Description of the Basis for Reclamation Participation in the Identified Research

Phase 1 Research Activities. Although Phase 1 will largely rely on proven technology and conventional system components, full-scale implementation of PWSC and other similar large-scale recycled water projects will require optimization of various elements to achieve operational reliability and meet regulatory compliance goals. Research identified for Phase 1 elements, including RO and UVAOP performance optimization, post-treatment investigations, nitrogen management optimization, and evaluation of additional chemical barrier for pathogens and associated byproduct formation, are highly applicable to other recycled water programs looking to implement groundwater augmentation and raw water augmentation.

Phase 2 Research Activities. Several California agencies, including PWSC, are planning to implement DPR. DPR regulations require the addition of ozone/BAC upstream of RO where the recycled water makes up more than 10 percent of the potable water. For many projects, including PWSC Phase 2 DPR, the addition of ozone/BAC upstream of RO would not be cost-effective for the following reasons:

- If ozone/BAC must be installed upstream of RO and UV/AOP during Phase 2 DPR, then the ozone/BAC must be sized for the much higher combined IPR and DPR flows, even though the ozone/BAC barrier is required only for the DPR flow. Therefore, California recycling programs considering both IPR and DPR will incur significant capital costs with the addition of ozone/BAC treatment processes sized for higher flows.

- Ozone/BAC treatment systems will include numerous treatment components, including oxygen generation or storage, ozone generation, ozone dissolution, ozone contactor, and BAC filter cells with backwashing capabilities; these components require a large footprint, and add significant operational complexity in addition to MBR, RO, and UV/AOP.

- The BAC treatment process will require membrane filtration before RO as a pretreatment step.

The aforementioned factors related to the ozone/BAC upstream RO requirement where the recycled water makes up more than 10 percent of the potable water could limit widespread implementation of DPR in California. Therefore, Reclamation's involvement in the proposed Phase 2 DPR research being led by Metropolitan on alternative approaches to ozone/BAC upstream of RO will support developing comprehensive datasets and a knowledge base on alternative approaches that will benefit other agencies that may employ a similar satellite DPR facility arrangement, making the implementation of DPR more cost-effective for utilities.

10.4.3. Research Administration

The research activities will be administered by Metropolitan, with support from the Sanitation Districts that build on their successful record of accomplishment in overseeing the research activities completed at the Innovation Center so far.

10.4.4. Time Frame

Phase 1 Research Activities. Research activities identified under Phase 1 are mostly a continuation of activities completed by Metropolitan and will be completed over the next 3 years.

Phase 2 Research Activities. Planning for future research activities is already underway. It is anticipated that the DPR research activities will be conducted over the next 5 years as listed below:

- Finalization of pilot components and configurations: 2024–2025

- DPR pilot design/procurement: 2025–2026

- DPR pilot construction: 2026–2027
- DPR testing and reporting: 2027–2030

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11. Independent Review Process

Independent Peer Review (TRMR 128).

For projects considered under the Large-Scale Water Recycling Program, the following information is required:

(a) Description of all independent peer review and/or quality assurance/quality control conducted on the analyses presented in the study and the scope and charge to the reviewers.

(b) Identification of the number of technical reviewers and the technical expertise and affiliation of the independent reviewers.

(c) Provide a comment disposition summary describing issues raised during peer review and/or quality assurance/quality control and how they were addressed.

This section describes the review processes that have been used in the development of the PWSC project, including the review of the material presented in this feasibility study.

PWSC is an essential element of Metropolitan's response to the findings of the IRP and providing a reliable water supply. Work to date has undergone extensive review, with additional review processes anticipated throughout the remainder of the planning and design process. This Feasibility Study has been based on several reports, opinions of probable costs, and technical memoranda that were reviewed in advance of their incorporation into this report. These supporting documents have been through a variety of review processes, including reviews by Metropolitan and Sanitation Districts staff, Metropolitan's consultants, and an independent panel of reviewers.

11.1. Problems and Need and Without-Project Conditions

The problems and needs, without-project conditions, project objectives, and No-Action Alternative are based on two important regional planning processes. The first is the 2020 UWMP (Metropolitan 2021a), which provides an overall assessment of supply and demand. The 2020 UWMP was submitted to DWR for review and adoption. The second is the 2020 IRP–Regional Needs Assessment (Metropolitan 2022a). The 2020 IRP, which is an ongoing process, is a forward-looking plan for future water supply, including the evaluation of different scenarios for growth and climate change. The IRP has established a target for an additional supply of 650,000 AFY. PWSC is an important component of the regional strategy to achieve the additional supply needed.

Metropolitan convened a panel of experts in support of their evaluation of water demands for the 2020 IRP. The experts participated in a 3-hour workshop with the Metropolitan board on March 23, 2021. The experts on the panel were:

- Lisa Maddaus: Co-owner and senior water resources engineer with Maddaus Water Management Inc.
- Stephen Levy: Director and Senior Economist of the Center for Continuing Study of the California Economy in Palo Alto, California
- Dan Rodrigo: Senior Vice President and Global One Water Practice Leader for CDM Smith
- Dr. Thomas Chestnut: CEO of A & N Technical Services, Inc.
- Dr. Kurt Schwabe: Expert on economic issues and water use, agricultural production, urban water conservation, ecosystem services, and environmental regulation

A summary of the experts' findings and suggestions is provided in Appendix E.1. A recording of the workshop is available on the IRP website at mwdh2o.com/how-we-plan/integrated-resource-plan.

A second panel was convened to assess the effects of climate change on Metropolitan's long-term water strategy. A workshop was held on May 25, 2021, to inform the board. The panel members were:

- Dr. Heidi Roop: Assistant Professor, University of Minnesota Department of Soil, Water and Climate
- Julie Vano: Research Director at Aspen Global Change Institute
- Brad Udall: Senior Water and Climate Research Scientist at Colorado Water Institute, Colorado State University
- Heather Cooley: Director of Research at the Pacific Institute

A summary of the experts' findings and suggestions is provided in Appendix E.2. A recording of the workshop is available on the IRP website at mwdh2o/how-we-plan/integrated-resource-plan.

The IRP website also includes several presentations by member agencies commenting on the planning process and whiteboards from two stakeholder workshops to inform the planning process. These efforts informed the 2020 IRP Resource Needs Assessment, which is the primary source for information in Chapter 2 of this report and was used to define the No-Action Alternative.

11.2. Initial Alternative Development and Evaluation

In early 2016, Metropolitan and the Sanitation Districts convened a panel of eight key subject matter experts to provide independent review and critical input on the scope and direction of the Pure Water Southern California Program. The panel reviewed the 2016

RRWP Feasibility Study, which supported Title XVI funding for initial planning activities. Although engineering, cost estimates, and planning have significantly advanced since the 2016 review panel, the efficacy and viability of the primary components of PWSC (advanced treatment at the Warren Facility and new conveyance to support DPR and groundwater recharge) have not changed.

To ensure objectivity, the National Water Research Institute, a nonprofit organization with extensive experience in the water reuse industry, selected the panel and managed its activities. The panelists represented industry and academic experts in drinking water treatment, wastewater treatment, advanced water treatment, toxicology, chemistry, microbiology, hydrogeology, pipeline corrosion, and drinking water and recycled water regulations and permitting. The members of the initial Feasibility Study Advisory Panel were:

- Richard Atwater, Co-Chair: Former Executive Director of the Southern California Water Committee; expert on recycled water programs
- Margie Nellor, Co-Chair: Nellor Environmental Associates, Inc.; expert on recycled water reuse programs, pretreatment, and related regulatory issues
- Shivaji Deshmukh: Assistant General Manager of West Basin Municipal Water District; expert on recycled water engineering and operation of advanced water treatment facilities
- Thomas Harder: Thomas Harder and Associates (Hydrogeology); expert on Southern California's groundwater basins
- David Jenkins: Professor Emeritus, University of California, Berkeley; expert on biological wastewater treatment processes and water and wastewater chemistry
- Edward Means: President, Means Consulting LLC; expert on water quality and water resources management
- Joseph Reichenberger: Professor, Loyola Marymount University; expert on water, wastewater, and recycled water systems and treatment
- Paul Westerhoff: Professor, Arizona State University; expert on advanced water treatment processes

Comments from the Feasibility Study Advisory Panel are provided in Appendix E.3. This effort guided the early planning process and the initial development of alternatives (see Chapter 4, Description of Alternatives).

11.3. Ongoing Independent Science Advisory Panel Activities to Confirm Treatment Technologies, Groundwater Recharge, Water Deliveries, and Implementation

These reviews have guided the approach to further develop and evaluate the PWSC alternatives. A second advisory panel was formed in 2018 to guide the research associated with the Innovation Center. This Independent Science Advisory Panel meets periodically in a workshop format to provide input on overall feasibility and work plans, the design of the Innovation Center, groundwater basins and water delivery assessments, and ideas and approaches to implementation. The Independent Science Advisory Panel has published six reports of findings to date. The review of the research program is an ongoing review process that will continue throughout the remainder of the planning process. The findings of the panel to date are provided in Appendix E.4.

The members of the Independent Science Advisory Panel are:

- Paul Anderson: Adjunct Professor, Center for Energy and Environmental Studies, Geography Department, Boston University; expert in toxicology, with more than 25 years of experience in toxicological research

- Joe Cotruvo: President of Joseph Cotruvo and Associates, LLC; an expert in chemistry, with more than 45 years of experience conducting research and writing policy related to drinking water quality

- Charles Haas: Betz Chair, Professor of Environmental Engineering and Head, Department of Civil, Architectural and Environmental Engineering, Drexel University; expert in microbiology, with more than 45 years of experience conducting research

- Thomas Harder: Thomas Harder and Associates (Hydrogeology); expert on Southern California's groundwater basins

- Nancy Love: Borchardt and Glysson Collegiate Professor, Department of Civil and Environmental Engineering, University of Michigan; expert in fate and removal of pathogens and contaminants of emerging concern in water with relevance to public health and the environment and advanced technologies that recover useful resources from water

- Adam Olivieri: Principal/Founder, EOA Inc.; expert in water regulations and permitting, with over 30 years of experience in leading technical and regulatory projects associated with wastewater and water recycling and reuse

- Vernon Snoeyink: Professor Emeritus at the University of Illinois; expert in pipeline corrosion, with a research career that has focused on aquatic chemistry and corrosion control for drinking water distribution systems

- Paul Westerhoff: Professor, Arizona State University; expert on advanced water treatment processes

11.4. Engineering and Opinions of Probable Cost

Detailed cost backup, including pay items, quantities, and unit costs, is provided in Appendix C to this Feasibility Study. Separate estimates are provided for treatment and for conveyance. Other ancillary facilities and PWSC activities are less defined at the planning stage. Appendix C includes an estimate crosswalk that identifies how ancillary features and activity costs were estimated at the planning stage (see Appendix C.0).

11.4.1. Advanced Water Treatment Facility Components

The concept design for the Flex MBR™ was developed by Jacobs under the direction of Paul Swaim, PE, and reviewed by Tim Constantine and Dawn Riekenbrauck, PE.

The feasibility design and cost estimate supporting the Advanced Water Treatment Facility were developed by Stantec which incorporates the cost estimate of the Flex MBR separately prepared by Jacobs in Appendix C.3. Jim Loucks, certified cost practitioner, developed the estimate of probable cost. The estimate was developed based on the quantity take-offs (QTOs) from the first building information modeling (BIM) work and equipment quotes for the AWPF. The design and cost estimate were reviewed by Jim Borchardt, PE, and Zakir Hirani, PE.

In the future, Stantec plans to update the cost estimate using updated BIM QTOs and recent equipment quotes. The most recent estimate is published in *Updated Opinion of Probable Costs for the NdN Tertiary MBR-Based Advanced Water Treatment Facility* (Stantec 2022c). The report is provided as Appendix B.2.

11.4.2. Conveyance Facility Components

Feasibility planning and engineering for the conveyance system are based on Feasibility Level Design Report: Backbone Conveyance Facilities (B&V 2020). This report was prepared by Lane Pagano, PE, and independently reviewed by David Haug. Black and Veatch (B&V) convened a panel of independent reviewers within and external to their firm to conduct a technical review of the assumptions, methodologies, and conclusions presented in the Feasibility-Level Design Report for the conveyance system corridors. The peer review panel consisted of:

- Paul R. Kneitz, PE, B&V: Panel coordinator, overall review, and pipeline subject matter expert (SME)
- Bill Whidden, PE (state other than California), Woolpert Inc.: Pipeline SME
- Robert Goodfellow, PE, Aldea: Trenchless/tunneling SME

This report is provided as Appendix B.3.

The initial opinion of probable cost, which was prepared by Lane Pagano, PE, incorporated trenchless cost information from Glenn Boyd and Rachel Martin (Delve Underground) and pump station information from Chris Ott (CDM Smith). The cost opinion was then peer-reviewed by Matt Thomas, PE and Andy Stanton, PE.

11.5. Additional Quality Assurance/Quality Control Processes

This Feasibility Study for PWSC represents a realistic approach to achieving the project's functional goals and demonstrating feasibility. No speculative assumptions (e.g., future improvements in treatment technology efficiencies, future changes in regulatory requirements, favorable outcomes on negotiated terms and conditions) have been included in evaluating the PWSC.

Reasonable cost contingencies and ranges for certain values (e.g., interest rates on borrowed funds) have been applied to the analysis. They are considered reliable and conservative for the purposes of evaluating overall feasibility.

The contractors supporting PWSC are required to employ quality assurance / quality control (QA/QC) in executing their work for the project.

The economic analysis presented in this Feasibility Study was performed by Nik Carlson of AECOM, with independent review and detail checking performed by Jason Weiss.

This Feasibility Study was prepared under the direction of Jeff Herrin of AECOM, with independent technical review led by Seema Chavan of Brown & Caldwell.

11.6. Ongoing Quality Control and Review Processes

Metropolitan and the Sanitation Districts continue to use a variety of QA/QC measures as work on PWSC proceeds. It is likely that additional independent review panels will be convened to review key findings and decisions as the project progresses.

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