THE METROPOLITAN WATER DISTRICT
OF SOUTHERN CALIFORNIA

Regional Recycled Water Program

White Paper

Program Implementation and Delivery

July 16, 2019

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SUMMARY

This paper addresses two topics that will be the focus of the first Metropolitan Board Workshop on the implementation of the Regional Recycled Water Program (RRWP). It begins with a brief overview of the program and environmental review process and describes additional activities that could be undertaken during the environmental review. One topic relates to actions that could accelerate program ***implementation***, and the other relates to Metropolitan's potential role in the development of ***direct potable reuse (DPR)*** through raw water augmentation.

The ***implementation*** topic describes two options for accelerating (1) the start of construction on conveyance, and (2) the first deliveries of purified water for replenishment and industrial uses. Descriptions of the scope, estimated budgets (ranging from $20 to $60 million), and preliminary timelines for each option are provided. Benefits and risks of acceleration measures are discussed.

The ***DPR discussion*** acknowledges the primary purpose of the RRWP is to meet demands on Metropolitan for regional groundwater replenishment and describes opportunities to supplement the program's replenishment goals with DPR, when regulations allow. The paper offers steps Metropolitan could take in preparing for those regulatory changes.

In both cases, the paper is intended for discussion purposes only. Based on the Board's direction and input received, future recommendations will follow.

1.0 INTRODUCTION

The conclusions of the Conceptual Planning Studies Report (Report 1618, February 21, 2019) include a recommendation that Metropolitan should "proceed with the environmental review process" for the RRWP (program). It is anticipated that a future Metropolitan Board action will be proposed to undertake that effort. The proposed action is expected to include a scope of work and budget to accomplish the environmental review at a programmatic level, with the supporting engineering and planning services needed to complete it. This paper presents a summary description of the scope of work and a preliminary estimate of costs for those activities. The paper also presents two additional options for work that could be accomplished in parallel with the environmental review to advance planning and preparation for implementation of the RRWP, if approved.

The additional scope falls into two broad categories. The first addresses RRWP implementation options for accelerating (1) the commencement of construction for the conveyance facilities, and (2) the initial deliveries of purified water to users in close proximity to the proposed advanced water treatment (AWT) plant in Carson. The second focuses on the proposed level of effort to be undertaken by Metropolitan in development of DPR opportunities through raw water augmentation at a water treatment plant. These topics are intended to support Board discussions around two broad questions:

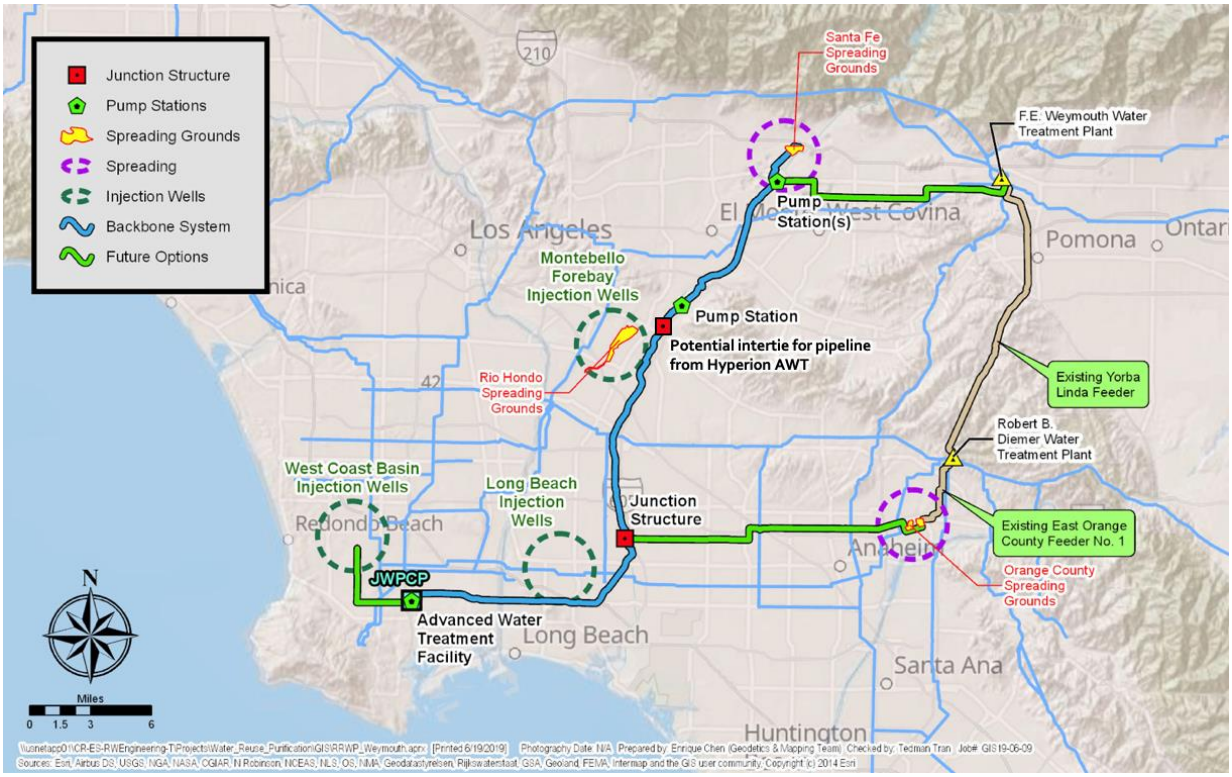
1. What additional activities (if any) should Metropolitan undertake during the environmental review process in order to accelerate program implementation?

2. How would Metropolitan proceed in developing raw water augmentation opportunities, considering DPR regulations are not currently in place?

2.0 PROGRAM OVERVIEW

As described in the Conceptual Planning Studies Report, a primary objective of the full-scale program is to deliver purified water from an AWT plant at the Joint Water Pollution Control Plant (JWPCP) in Carson to injection and spreading facilities for groundwater replenishment. Four groundwater basins in Southern California were considered as potential recipients of this purified water: Central Basin, Main San Gabriel Basin, Orange County Basin, and West Coast Basin. This system will also have the flexibility to accommodate industrial users whose needs are consistent with the quality of water produced by the AWT plant. Finally, future use of this system for DPR applications appears feasible once applicable regulations are established. The conveyance system for the program will feature a backbone system from Carson to the Santa Fe Spreading Grounds sized to accommodate existing and future uses. Figure 1 shows the full program as described in the Conceptual Planning Studies Report.

Figure 1: Full Regional Recycled Water Program Elements



The Conceptual Planning Studies Report recommended the program be implemented in two major phases: a 100 million gallon per day (mgd) first phase, followed by a 50 mgd second phase. The first phase includes construction of a backbone conveyance system (indicated in Figure 1 in blue) delivering water approximately 38 miles, from the AWT plant in Carson to the Central and Main San Gabriel Basins.

The backbone pipeline would be capable of conveying 150 mgd or more to the Santa Fe Spreading Grounds. Preliminarily sized at 84-inches internal diameter, the backbone system provides for initial program demands and future operational flexibility, including the potential adaptation for DPR

applications, the addition of expanded treatment capacity at the JWPCP beyond the initial 150 mgd, and potential interconnections to other purified water reuse programs.

For example, the City of Los Angeles is currently embarking on a comprehensive program to maximize and reuse 100% of available secondary effluent from the Hyperion Water Reclamation Plant by 2035. The feasibility of a connection between the City of Los Angeles purified water program and Metropolitan's backbone system is being examined and future studies are planned. Integration of the two programs may produce additional operational flexibility and benefits for both Metropolitan and the City of Los Angeles. The information developed in future studies can be included in the RRWP environmental review.

The second phase of the program would fully build out the treatment and conveyance components of the system by adding an additional 50 mgd or more of treatment at the JWPCP, and by building additional conveyance pipelines (indicated on Figure 1 in green). This second phase would expand the program by adding additional basin replenishment options and/or potential DPR connections. Further discussion of DPR opportunities for the program are presented in Section 9 of this paper. As described in Section 3 below, a programmatic environmental impact report (PEIR) would cover the AWT plant in Carson, a conveyance system for the full-scale program, including the potential for DPR connections, additional treatment, and potential future interconnections to the City of Los Angeles and other purified water reuse programs.

As this program is being developed, it is recognized that additional water recycling projects are currently being pursued at many different locations within Metropolitan's service area. These other programs vary in size and levels of water quality depending on the intended use of the specific project. Going forward, Metropolitan will continue to work collaboratively with other parties to prevent redundant investments of public funds, avoid stranded capacity, and ensure these programs are appropriately captured in the regional planning for its service area. As described above, an example includes the current collaborative efforts between Metropolitan and the City of Los Angeles to study potential integration of two significant programs that are within relatively close geographical proximity to one another. Metropolitan has executed a Letter of Intent (LOI) to collaborate on the development of a future memorandum of understanding related to advanced treated water delivery systems between The Metropolitan Water District of Southern California and City of Los Angeles, through the Los Angeles Department of Water and Power. A copy of the LOI is provided as Attachment 1.

3.0 ENVIRONMENTAL REVIEW PROCESS

3.1 Programmatic Environmental Impact Report

For large multi-year, multi-phase infrastructure programs like the RRWP, the California Environmental Quality Act (CEQA) allows the environmental analysis to proceed in a tiered approach when the development of the large program will occur over time in discrete stages. The environmental process will begin with an overall PEIR, including near- and long-term program components. From CEQA (Title 14, California Code of Regulations §15168), the PEIR may be prepared on a series of actions that can be characterized as one large program and are related either: geographically; as logical parts in the chain of contemplated actions; and in connection with issuance of rules, regulations, plans, or other general criteria to govern the conduct of a continuing program. The PEIR typically analyzes certain discernable effects of the entire program. Where data is not initially available to allow certain impact areas to be fully analyzed

in the PEIR, analyses of these areas are deferred. At a later date, when additional design and site information is available, a subsequent project-specific environmental analysis will be conducted.

Use of a PEIR allows Metropolitan to consider broad policy alternatives and program-wide mitigation measures at an early stage of a program's development. Ultimately, this approach provides for greater flexibility down the road to deal with basic issues or cumulative impacts and reduces the potential need to repeat analyses. A PEIR undergoes the same steps as a project-level environmental impact report, with additional subsequent environmental review conducted as stages of the project become sufficiently stable and defined to allow the completion of project-level analyses.

As recently as 2017, Metropolitan utilized the PEIR approach to develop the programmatic environmental clearance for the $2 billion prestressed concrete cylinder pipe (PCCP) program. The PCCP PEIR has since been supplemented with project-specific documentation. For example, in May 2019, the Board certified an addendum to the PEIR for one of the Second Lower Feeder construction projects. A similar approach is recommended for the RRWP.

3.2 Integration of Federal and State Environmental Reviews

It is anticipated that certain aspects of the RRWP will have impacts to resources within federal jurisdictions. In these cases, the National Environmental Policy Act (NEPA) requires that federal agencies assess the environmental effects of proposed agency action and any reasonable alternatives before deciding on whether and/or how to proceed. Where a proposed project will require decisions from both state and federal agencies, joint CEQA and NEPA reviews are required. In 2014, the United States Council on Environmental Quality and the California Office of Planning and Research published a handbook that details how to integrate CEQA and NEPA planning to streamline project approvals. Presently, it is not anticipated that NEPA reviews will be required to complete PEIR development and certification. If future investigations and studies identify the need for NEPA reviews, those reviews will be addressed in subsequent tiered environmental documents.

4.0 DESCRIPTION OF PROGRAM IMPLEMENTATION OPTIONS

This section provides an overview of implementation strategies that would be part of a traditional programmatic environmental review process, as well as strategies that could be undertaken in parallel to accelerate program implementation. The first option proposes to conduct the environmental planning and subsequent design and construction activities in a traditional 'step-wise' approach where subsequent activities are started once the predecessor activity is completed. The second option accelerates the timeline for initial construction of the conveyance system only by conducting preliminary design activities on a reach of pipeline simultaneously with the development of the PEIR. The third option accelerates potential for early water deliveries by conducting preliminary design on both conveyance and treatment systems while the PEIR is being developed. For each option, scopes of work, estimated budgets, and estimated schedules for an initial 24-month period, which coincides with the anticipated duration of the PEIR development, have been assembled. Table 1 summarizes the options, followed by a brief description of each. Further discussion of the accelerated options is included in the two subsequent sections.

Table1: Summary of Program Implementation Options

Option	Program Objective	24-Month Scope	Milestone Targets
Traditional Option: PEIR only.	Complete PEIR before starting preliminary engineering.	PEIR scope with engineering and technical support as needed.	PEIR certification and Board approval of program.
Accelerated Construction: PEIR plus Tiered Project-Level CEQA document for conveyance from the AWT plant towards Long Beach.	Complete PEIR and project-level CEQA documents in parallel with preliminary engineering needed to award initial construction contract as soon as possible after CEQA document certification and Board approval of program.	PEIR and tiered CEQA document; engineering support, permitting, studies & investigations; and preliminary engineering for approximately 3.5 miles of conveyance towards Long Beach.	Award of initial construction contract.
Accelerated Water Delivery: PEIR plus Tiered Project-Level CEQA documents for 3.5 miles of conveyance, initial AWT plant (approximately 20 mgd), and additional conveyance from the AWT plant towards the West Coast Basin.	Complete PEIR and project-level CEQA documents in parallel with preliminary engineering needed for initial deliveries of purified water as soon as possible following CEQA document certification and Board approval of program.	PEIR and tiered CEQA document(s); engineering support, permitting, studies and investigations; preliminary engineering for conveyance and injection wells; and preliminary engineering for AWT plant.	Award of initial construction contract and commencement of deliveries to West Coast Basin for replenishment and to Harbor Area for industrial users.

4.1 Accelerated Construction Option

The objective of the second option is to start construction of the conveyance system only as soon as possible following completion of the appropriate CEQA document(s) and Board approval. This option includes completion of the overall PEIR, combined with additional environmental analysis and review to complete a project-level tiered document for the initial 3.5-mile portion of the backbone system (Segment 1; see Figure 2). This tiered approach to the PEIR will enable final design of this pipeline to commence immediately following the completion of the PEIR.

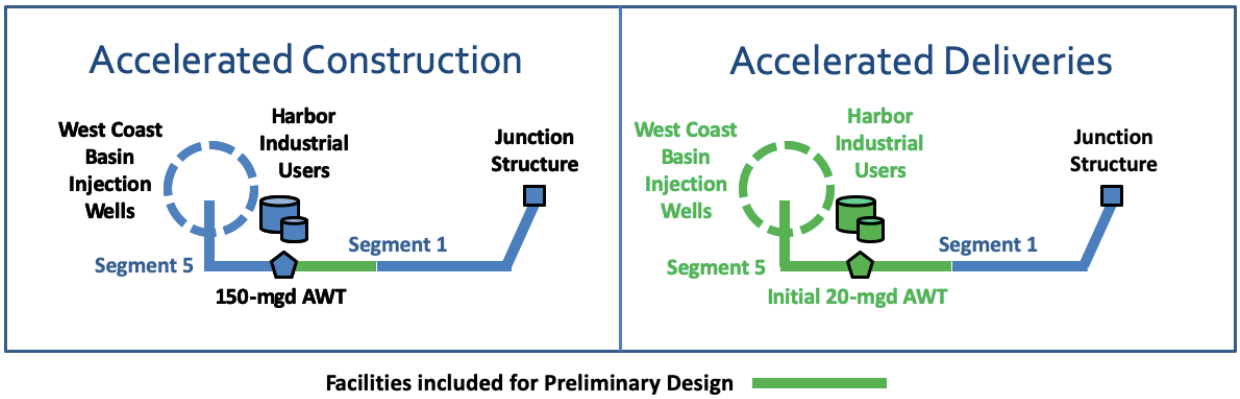
The approximately 3.5-mile pipeline reach to be considered under this option has been preliminarily identified as running between the AWT plant at the JWPCP and the Alameda Corridor. While the exact alignment of this pipeline reach has not been finalized, it is expected that this section is entirely within the street right-of-way. Consequently, complex permitting or easement issues that will need to be addressed during preliminary and final design are not anticipated. Hence, design and commencement of construction can be accelerated. The preliminary design activities and project-level environmental review for this first

conveyance reach will run concurrently with the PEIR activities. Under this option, it is anticipated that construction would commence approximately 24 to 36 months following PEIR certification.

4.2 Accelerated Water Delivery Option

In comparison to the two prior options, the third option presents the most aggressive approach to scheduling and implementation. The objective is to develop a project plan that puts a premium on making initial deliveries of purified water as soon as possible following completion of the appropriate CEQA document(s) and Board approval. The scope for this option includes everything described in the accelerated construction option plus additional project-level tiered environmental document(s) for conveyance facilities and approximately 20 mgd of purified water production from an AWT plant at the JWPCP. At the current time, it is anticipated that uses for this purified water would be industrial users in the Harbor Area, as well as potential West Coast Basin replenishment demands. The environmental review and permitting that would take place under this option would include a more extensive investment in early engineering and other technical efforts to allow for these early deliveries of purified water. The conveyance facilities in this option include both 3.5 miles of Segment 1 and the Segment 5 pipeline, and the injection wells needed for basin replenishment (see Figure 2). The AWT facilities required under this option include a partial retrofit of existing secondary basins at the JWPCP with new membrane bioreactor (MBR) process equipment, as well as the reverse osmosis (RO) and ultraviolet (UV)/advanced oxidation process (AOP) equipment, along with other plant process and support facilities required to produce up to 20 mgd of purified water.

Figure 2: Facilities included in Preliminary Design Scope by Option During PEIR Process



Under this option, preliminary and final design of both the conveyance pipelines and the initial increment of treatment capacity at the JWPCP would begin once the environmental review document(s) is completed and the Board has approved the program. The result of the PEIR, tiered project-specific documents, and the preliminary design efforts would ultimately lead to the accelerated delivery of water from the program when compared to either the traditional option or the accelerated construction option.

4.2.1 Testing, Technical Studies, and Preliminary Design Investigations

In order to proceed with the accelerated water delivery option, a series of questions must be investigated on an expedited timeline. Some of these technical issues include testing of a secondary MBR application at Metropolitan's demonstration facility, developing criteria for overall AWT product water quality requirements, determining firm demands for the initial system capacity, and development of an overall

purified water process treatment train capable of producing the required water quality within an accelerated timeframe.

Additional Demonstration Facility Testing

The current phase of testing at the demonstration facility (Phase 1) located at the JWPCP is focused on obtaining regulatory acceptance for the tertiary MBR system identified in the November 2016 Feasibility Study. This process is referred to as tertiary MBR because the water source to the MBR process is secondary effluent from the JWPCP secondary clarifiers. The key to gaining this regulatory approval for the tertiary MBR process will be the demonstration of pathogen removal in the secondary effluent that will be processed by the MBR system. In addition to pathogen removal studies, the demonstration facility will be used to determine the effectiveness of the planned process to remove nitrogen (in the form of ammonia) from the secondary effluent that enters the demonstration facility. Removal of nitrogen is important so that the downstream treatment process will not be fouled by biological growth, which is otherwise stimulated by the presence of ammonia in the secondary effluent.

For the accelerated water delivery option discussed, the secondary MBR process will be investigated during the PEIR preparation. This process is referred to as secondary MBR because the water source to the MBR process is primary effluent from the JWPCP. It is envisioned that a secondary MBR process, utilizing a retrofitted existing clarifier basin at the JWPCP, could reduce the construction schedule for initial AWT plant water deliveries. However, in order to accomplish this retrofit, secondary MBR testing must be completed. A secondary MBR testing and monitoring plan is currently being developed for coordination with the Sanitation Districts of Los Angeles County (Sanitation Districts), State Water Resources Control Board (State Board) Division of Drinking Water, and the RRWP Independent Scientific Advisory Panel. Secondary MBR testing would follow completion of the initial 15-month tertiary MBR testing and would provide the necessary design criteria to support a potential retrofit of a portion of the JWPCP for the initial MBR treatment, as further discussed below.

Retrofit of JWPCP Existing Basins for Initial MBR Treatment

The current demand in the Harbor Area and West Coast Basin for water from this program is estimated to be approximately 20 mgd. As described above, to accelerate deliveries of purified water for these demands, Metropolitan and the Sanitation Districts have discussed the potential of converting one JWPCP high purity oxygen activated sludge (HPOAS) secondary treatment train to accommodate the MBR system.

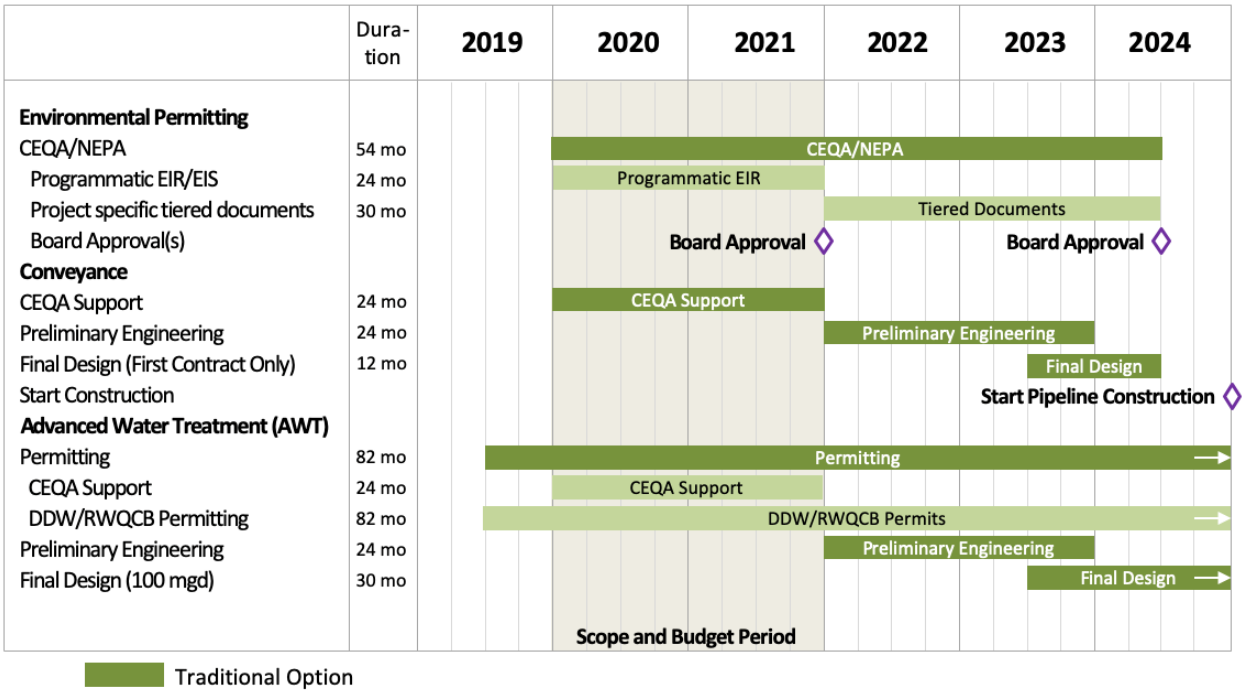
In order to achieve this result, extensive investigations and studies of the retrofit would be undertaken during the PEIR process. At the same time, demonstration facility testing on primary effluent from the JWPCP would be conducted, as described above, to verify the efficacy of the secondary MBR process. Other fast-tracked technical studies would be undertaken to support this effort to investigate the secondary MBR process and the desire to convert existing JWPCP basins to MBR process trains. The goal of these efforts would be to complete studies and investigations on all aspects of the secondary MBR process coincident with the completion of the PEIR. This option would facilitate the start of preliminary and final design for the initial AWT treatment phase immediately following completion of the PEIR.

5.0 MILESTONE SCHEDULES FOR OPTIONS

5.1 Traditional Option

Figure 3 presents a schedule for the traditional option to implementing programmatic environmental review. The dark shaded area on the schedule covers the 2-year period in which it is expected PEIR activities will take place, with all work on the PEIR to be completed in late 2021. Figure 3 also presents the potential schedule for near-term activities that would take place in close proximity to the completion of the PEIR—activities that would be closely linked to the award of the program's first construction contract. This schedule assumes that the Metropolitan Board authorizes commencement of the work in late 2019 or early 2020. Preliminary design activities for the AWT plant and conveyance facilities are expected to start in early 2022, with the first project specifications being advertised for construction bids in mid-2024. It is anticipated that the first construction bids will be for portions of the conveyance system.

Figure 3: Traditional Tasks and Durations

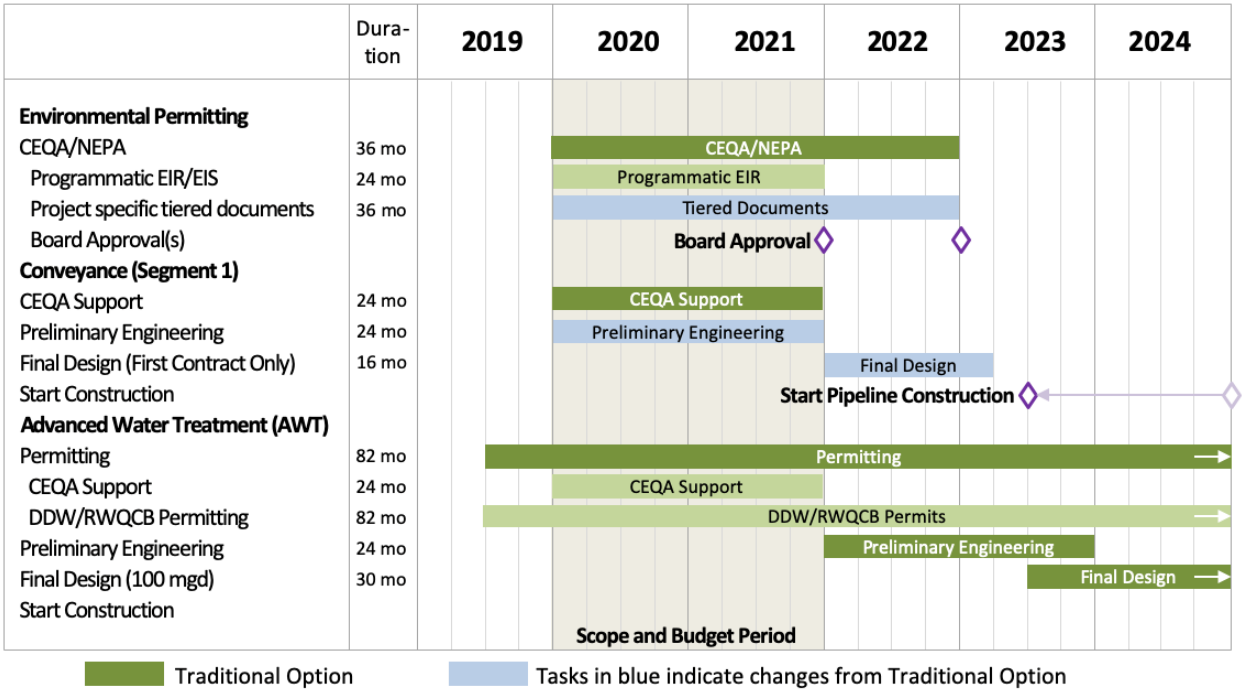


Under the traditional option, after the PEIR is certified by the Board, staff will commence work on tiered project-level CEQA and NEPA reviews (as well as permitting). Tiered or project-level documents are generally started after certification of the PEIR and will take from 9 to 16 months depending on the facility to be constructed. Work on these tiered project-level activities will proceed in coordination with design activities and will be rolled out as each segment of the program is implemented. Based on the information developed to date on the program, some of the most challenging permitting and environmental clearances are expected to be those associated with the segment(s) of pipeline currently proposed to be built within the San Gabriel River. In these locations, it is expected that segments may require more detailed environmental reviews, as well as numerous regulatory permits and potential mitigation.

5.2 Accelerated Construction Option

Should the Board elect to implement the program in a manner that prioritizes accelerating the start of construction, the above-described tiered environmental activities and costs associated with those activities would occur on an expedited schedule. Under the accelerated construction option, work on tiered documents would occur simultaneously with the development of the program-level documents, allowing Metropolitan to obtain permits sooner and expedite the start of construction. The minimum time to obtain permits is estimated to be 1 year after tiered documents are certified and all necessary engineering design is complete. This assumes that take of federal and state threatened, endangered, or protected species can be avoided. Figure 4 presents the accelerated construction schedule. Tasks shown in blue bars have earlier start dates than those presented in Figure 3. The durations of the tasks remain unchanged from the traditional option. Under the accelerated construction option, initial pipeline construction can be expected to start approximately 18 months earlier than under the traditional option, as shown in Figure 4.

Figure 4: Accelerated Construction Tasks and Durations

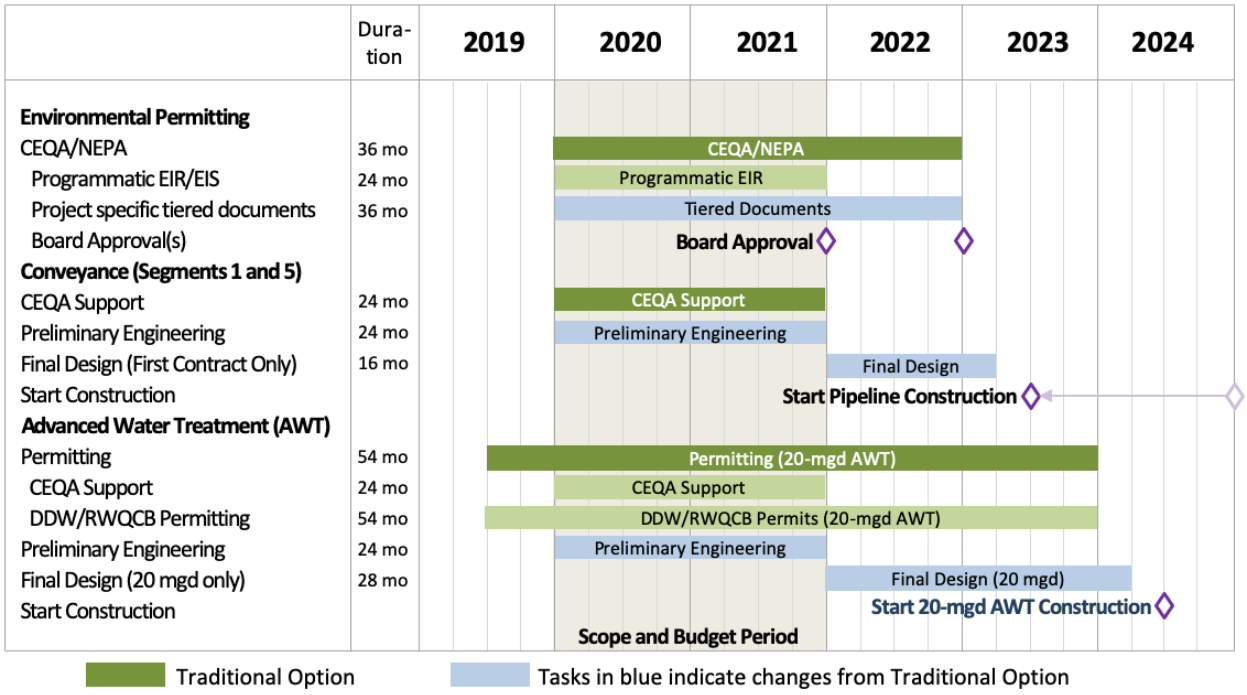


In some cases, the environmental review process will require engineering design to be significantly advanced and additional technical studies completed. Field investigations will be needed to determine the nature and extent of potential soil and water contamination along the pipeline alignment, and how to dispose of construction water and any contaminated soils encountered during construction. Advanced levels of design will also be required in order to apply for key permits needed for some sections of the pipeline alignment. Consequently, in order to achieve an accelerated start to construction, some of the permitting and environmental issues will be targeted as potential areas for early work. Due to these constraints on some of the more complex portions of the pipeline alignments, an approximately 3.5-mile portion of pipeline, originating at the JWPCP, is the planned initial pipeline construction contract.

5.3 Accelerated Water Delivery Option

Figure 5 presents a preliminary estimate of the time to complete the work described in the accelerated construction option (above), as well as the AWT and conveyance facilities needed for accelerated deliveries of purified water to industrial users in the Harbor Area and for replenishment in the West Coast Basin. Preliminary design of the AWT plant is scheduled to begin in close coordination with the regulatory approval process. Preliminary design of the pipeline conveyance facilities would begin during the PEIR process. In the case of the accelerated water delivery option, the initial capacity of the AWT plant will be approximately 20 mgd. This production capacity closely matches the anticipated demands near the JWPCP. Water deliveries from this initial project could reasonably be expected to commence from 48 to 60 months following PEIR certification.

Figure 5: Accelerated Water Delivery Tasks and Durations



6.0 SCOPE OF WORK ESTIMATED BUDGETS

This section presents estimated budget ranges associated with each of the delivery options presented above. As indicated in Figures 3, 4, and 5, the differences between the options reflect alternative sequencing of tasks. The budgetary ranges presented in this section reflect the anticipated costs to complete the identified work for each option during the 24-month period from the beginning of 2020 through the end of 2021. A key assumption is that accelerated options, above and beyond the traditional option, bring work activities and costs forward into the 24-month window (shaded area in the figures).

The budget ranges presented in Table 2 reflect early estimates for the 24-month work efforts for each of the implementation options. The ranges reflect the probable costs for work efforts related to environmental planning for the CEQA process; technical studies; preliminary engineering; real property, external affairs and outreach; operations and water resources planning support; project management

support; and a 20 percent contingency for each option. Once an implementation option is selected by the Board, the range of costs for the selected option will be replaced by a definitive cost estimate for the 24-month work effort. That cost estimate will serve as the basis for a funding request to the Board when appropriate.

Table 2: Preliminary Budget Ranges by Option

Estimated Budget Range (24 Month Duration)		
Option	Low	High
Traditional	**$20,000,000**	**$33,000,000**
Accelerated Construction	**$30,000,000**	**$41,000,000**
Accelerated Water Delivery	**$47,000,000**	**$60,000,000**

6.1 Traditional Option

For the traditional option, emphasis is placed on completion of the PEIR within a 24-month period. Engineering efforts and other technical support during that time are limited to activities needed to support the development and certification of the PEIR, including studies examining the integration of a future City of Los Angeles purified water system with Metropolitan's backbone conveyance system. Table 2 shows the initial budget range of $20 to $33 million to complete the scope of work for this option. This range represents the baseline cost to support the full-scale program through the initial environmental review process. Under this option, preliminary engineering design efforts would not commence until the PEIR is certified by the Board; and preliminary design costs are not included in this cost range.

6.2 Accelerated Construction Option

The accelerated construction option includes the same level of technical and engineering support for the PEIR process described in the traditional option above. In addition, the option includes engineering and technical investigations needed to complete preliminary design of the first 3.5-mile segment of the 84-inch diameter backbone pipeline system from the JWPCP towards Long Beach. This preliminary engineering design will be completed in parallel with preparation of the PEIR and will also be used to support a project-level tiered CEQA review for construction of this first segment of pipeline. The option includes pipeline engineering efforts, geotechnical investigations, substructure investigations, detailed property title research, hydraulic analyses, and development of traffic plans to support construction efforts. As shown in Table 2, the estimated budget range is $30 to $41 million to complete the scope of work.

6.3 Accelerated Water Delivery Option

The accelerated water delivery option includes and adds to the level of technical and engineering activities described in the accelerated construction option above. The additional effort comprises engineering and technical investigations to complete the preliminary design of a pipeline conveying water to the West Coast Basin, as well as preliminary design of an initial 20-mgd AWT module at the JWPCP. The project-level CEQA review will be expanded to cover three initial projects; (1) the 3.5-mile segment of the 84-inch diameter backbone pipeline, (2) the pipeline from the JWPCP to the West Coast Basin, and (3) the 20-mgd treatment module at the JWPCP. All of this work will be conducted in parallel with the preparation of the PEIR.

Engineering and technical support in this option is the most extensive when compared to either the traditional option or the accelerated construction option. Under this approach, preliminary engineering will simultaneously commence on two independent pipeline projects, as well as an advanced water treatment facility. Typical work activities will include pipeline preliminary design; treatment plant process development and preliminary design; geotechnical investigations for both the pipelines and the treatment facility; preliminary design for electrical power supplies/interconnections for the treatment and pumping facilities; substructure investigations; detailed property title research; hydraulic analyses for pipelines/pump station(s)/ treatment plant; and development of traffic plans to support construction efforts. As shown in Table 2, the estimated budget range is $47 to $60 million to complete the scope of work outlined for this option.

6.4 Additional Demonstration Testing and Operations

Phase 1 demonstration facility operations at the JWPCP are anticipated to begin in August 2019. These activities are funded through June 2020. After that date, additional funding will be required to complete Phase 1 testing and to conduct Phase 2 testing. As outlined in Section 4, this testing is needed to determine the optimal treatment process that will be used in the full-scale AWT plant. Secondary MBR demonstration facility testing is anticipated to be complete by the end of 2021, with further testing planned for process optimization and design criteria development. It is estimated that approximately $6 million will be needed to conduct the required testing for the secondary MBR process at the demonstration facility, regardless of which implementation option is pursued. This budgetary amount for additional demonstration facility testing and operations is not included in the budget ranges shown in Table 2. This demonstration facility budget does not include any modifications necessary to conduct research into the DPR options that are discussed in Section 9 of this paper. Additional testing options, including potential modifications to the demonstration facility to conduct studies related to DPR, are discussed in Section 9.

7.0 BENEFITS OF SCHEDULE ACCELERATION

Metropolitan could realize potential benefits as a result of implementing program options to accelerate the overall schedule by (1) starting early construction of the conveyance system, and (2) making early deliveries of purified water to users in close proximity to the AWT plant.

Table 3 summarizes these potential benefits, which fall into three broad categories:

- Reduced exposure to schedule delays and cost increases associated with many large-scale, linear construction projects
- Increased operational understanding and experience in the treatment and delivery of purified water
- Early availability of new water supply and cost recovery

Table 3: Summary of Benefits of Accelerated Implementation Options

Option	Benefits
Accelerated Construction	▪ Minimizes cost increases resulting from inflation ▪ Reduces impacts of unexpected delays on final completion date ▪ Launches preliminary design and risk management as early as possible ▪ Accelerates project team learning curve
Accelerated Water Delivery	▪ All of the accelerated construction benefits listed above ▪ Enables early acquisition of operational experience and knowledge ▪ Accelerates regional benefits of additional water supply ▪ Provides early water sales and cost recovery ▪ Utilizes existing facilities made available by the Sanitation Districts for the program

7.1 Reduced Exposure to Construction Cost Increases

Metropolitan has more experience in delivering large-capacity conveyance systems than most of the world's water utilities. That said, every project is unique, and linear infrastructure by its nature is susceptible to localized "bottle-necks" that delay completion of a fully-functional system and drive up costs. This reality has been documented not only by Metropolitan's own experience, but also by extensive literature in the construction industry regarding the risks associated with large-scale, linear projects.

Commencement of engineering design and other technical studies and investigations, as well as subsequent construction as early as possible, reduces the potential for unexpected delays and uncertainties to occur. Additionally, accelerated start of preliminary engineering and the associated risk mitigation processes will aid in identifying problematic portions of the program at an early date. Once identified, early actions can be taken to mitigate these risks, which left unaddressed could jeopardize the budget and overall schedule of the program. Finally, increased costs associated with inflation-sensitive components of the program can be reduced by acceleration options that are implemented.

7.2 Early Start on Long Lead Time Activities

The early start of long lead time activities related to conveyance and the AWT plant can help to quickly identify potential issues. Identification and scoping the impact of these issues on long lead time activities is often challenging. By gaining an early understanding of the issues, reasonable mitigation methods can be employed to keep the overall program on schedule. The permit process for river crossings is anticipated to be a complex activity that will dictate the schedule for design and construction of these portions of the pipeline alignment. Early design and investigation activities in this specific area, as well as early engagement with the U. S. Army Corps of Engineers, will streamline subsequent final design and construction scheduling.

7.3 Increased Operational Understanding and Experience

Early delivery of purified water from the program will help Metropolitan's staff gain the experience and knowledge needed to develop the full-capacity AWT plant. There is no substitute for actual operational experience when implementing new and innovative treatment processes, even if that initial increment of production capacity is a relatively small fraction of the full program capacity. Consequently, there are potentially significant benefits to be accrued by not only Metropolitan, but also other program stakeholders by pursuing the option which emphasizes early deliveries of water. The initial AWT capacity of approximately 20 mgd is a desirable size for gaining important knowledge that can be incorporated into subsequent expansions of the initial system. Metropolitan has proven the value of early operational learning experiences in the implementation of its oxidation retrofit program which added ozone disinfection to all five Metropolitan water treatment plants.

7.4 New Water Supply and Cost Recovery

The acceleration of purified water deliveries in close proximity to the AWT plant offers the following additional benefits:

- Early establishment of new water supply and cost recovery
- Actual real-case experiences related to producing and delivering purified water to member agencies for both replenishment and industrial uses

These benefits provide valuable institutional and technical knowledge toward finalizing the full-scale program development.

8.0 RISKS OF SCHEDULE ACCELERATION

There are inherent risks associated with the early start of preliminary design and other technical studies and investigations while the PEIR is being developed. The majority of the risks have to do with the potential for programmatic changes after the PEIR is certified, which may diminish some or all of the preliminary engineering and other technical work completed during the PEIR preparation. Some of these risks can be mitigated by focusing preliminary design and technical studies on smaller discrete aspects of the program. These aspects of the program should be relatively straight forward components that hold little risk of changing even if other more significant components of the program are subsequently revised. Stated simply, the inherent risk to acceleration is there is a chance that preliminary design would have to be redone if final environmental and technology permitting requires significant changes. Changes are likely to result from:

- Measures needed to eliminate or mitigate environmental impacts identified during the environmental review processes. Such mitigation measures could impact pipeline alignments or construction methods associated with pipeline installations.
- Changes to the AWT treatment process resulting from the regulatory technology acceptance process and/or finalization of the nitrogen management strategy. Such changes could cause a redesign of key process components whose design was expedited in advance of full regulatory approval or CEQA clearance.

Table 4 summarizes some of the risks of accelerating the start of the program.

Table 4: Summary of Risks Resulting from Accelerating Design Activities

Option	Event	Outcome
Accelerated Construction	▪ Additional mitigation measures required ▪ Complex pipeline alignments must be revised	▪ Some additional costs to revise preliminary engineering documents are expected ▪ Significant rework could be required if complex pipeline alignments change through the PEIR process
Accelerated Water Delivery	▪ MBR treatment process approval delayed ▪ Decision on the nitrogen management strategy delayed ▪ Timing of WRD need for replenishment water in the West Coast Basin remains uncertain	▪ Expected early water deliveries are delayed (i.e., the goal of acceleration is not fully achieved) ▪ Some rework required ▪ Demands for purified water are delayed

8.1 Redesign Resulting from Environmental Process Outcomes

Under both the accelerated options, preliminary design will occur simultaneously with the environmental review processes under CEQA and NEPA. While additional engineering data may be useful to support these environmental reviews, potential impacts may be identified that may require design changes to reduce or avoid environmental effects. These modifications to the design could require engineering rework, adding costs. Further, if portions of the program require alternative alignments be incorporated to avoid impacts, the additional engineering costs could be significant.

For these reasons, it is recommended that if accelerated construction or delivery options are pursued, preliminary design and technical studies should focus on areas that hold small risks of change resulting from either the environmental review process or the regulatory technology acceptance process.

8.2 Uncertainty Regarding Final AWT Process Train

One of the challenges of accelerating the first deliveries of purified water are uncertainties associated with finalization of the AWT process train. These uncertainties affect the ability to achieve the goal of early deliveries; though they do not necessarily put the investment in preliminary engineering at risk. The following milestones are important to reaching the process train finalization decision:

- Completion of MBR technology acceptance process for regulatory approval
- Completion of evaluation for the treatment process trains identified by the Nitrogen Management Committee
- Evaluation of tertiary and secondary MBR performance at the demonstration facility
- Evaluation of costs, performance, and risk of retrofitting JWPCP basins for future MBR systems

A comprehensive regulatory permitting process, including completion of a Title 22 Engineering Report and receipt of a water recycling permit, will take place prior to any delivery of purified water. For the

accelerated water delivery option, Metropolitan would work with the regulators on an accelerated permitting schedule for the 20 mgd AWT plant and associated water deliveries. The proposed approach to accelerating water deliveries focuses on retrofitting existing HPOAS basins at the JWPCP. This initial retrofit can provide important information regarding secondary MBR options within the JWPCP, while producing purified water for early delivery to users.

8.3 Timing of West Coast Basin Demands

As indicated in the Conceptual Planning Studies Report (Section 3.3), expected replenishment demands in the West Coast Basin rely on additional future pumping in the basin. At present, the timing of those future demands is uncertain. Current planning studies are being undertaken by the Water Replenishment District (WRD) and basin pumpers. Should those demands be delayed, the extent of accelerated delivery potential would be reduced.

9.0 DIRECT POTABLE REUSE CONSIDERATIONS

The current focus of the RRWP is on indirect potable reuse (IPR) through groundwater replenishment, as groundwater basin replenishment constitutes a significant portion of demands on Metropolitan. The Conceptual Planning Studies Report described an additional concept for blending advanced treated water at one or more of Metropolitan's existing water treatment plants, employing DPR through raw water augmentation. Based on the status of DPR regulations, this option may become feasible in the near future for application at the Weymouth or Diemer plants.

DPR would allow significant operational flexibility if used in conjunction with IPR deliveries and could considerably expand the benefits of the program. However, additional work would be needed to fully evaluate this option. Metropolitan Board input and funding would be required to examine opportunities for DPR through raw water augmentation with demonstration facility testing.

If approved by the Board, it is recommended that DPR testing at the demonstration facility begin prior to the State Board's final adoption of raw water augmentation regulations. This timing should enable consideration of industry research outcomes, tertiary and secondary MBR testing results, and draft regulatory criteria during test plan development and design of the DPR treatment process train.

It is also recommended that Metropolitan engage in industry research, collaborating with regulators, other agencies, and stakeholders to help guide development of final raw water augmentation regulations. Collaborative efforts in support of regulatory approval of raw water augmentation could also be beneficial, particularly as Metropolitan and the City of Los Angeles examine the additional flexibility and benefits that could result from integrating their respective purified water reuse programs.

This section provides an overview of the DPR opportunities of the RRWP through raw water augmentation, an overview of the testing approach at the demonstration facility for potential implementation of raw water augmentation, and a brief discussion of DPR through treated drinking water augmentation.

9.1 Background

Both the groundwater recharge and surface water augmentation regulations adopted in 2014 and 2018, respectively, require an environmental buffer, which is a waterbody such as an aquifer or a surface water reservoir, lake, or river, into which purified water is introduced before being withdrawn for potable reuse. Environmental buffers provide a number of benefits, including contaminant removal, dilution and blending, and time to detect and respond in the event the purified water does not meet specifications before final treatment and distribution.

In April 2018, the State Board released its *Proposed Framework for Regulating Direct Potable Reuse in California*, which focused on the regulatory development of raw water augmentation. Raw water augmentation is the placement of advanced treated water into a raw water conveyance system upstream of a drinking water treatment plant. The State Board is required to adopt uniform water recycling criteria for raw water augmentation by the end of 2023; however, that timeline may extend to the end of 2025 based on the state of available scientific and technical research at that time. No timeline has been established for the State Board to develop regulations for DPR through treated drinking water augmentation.

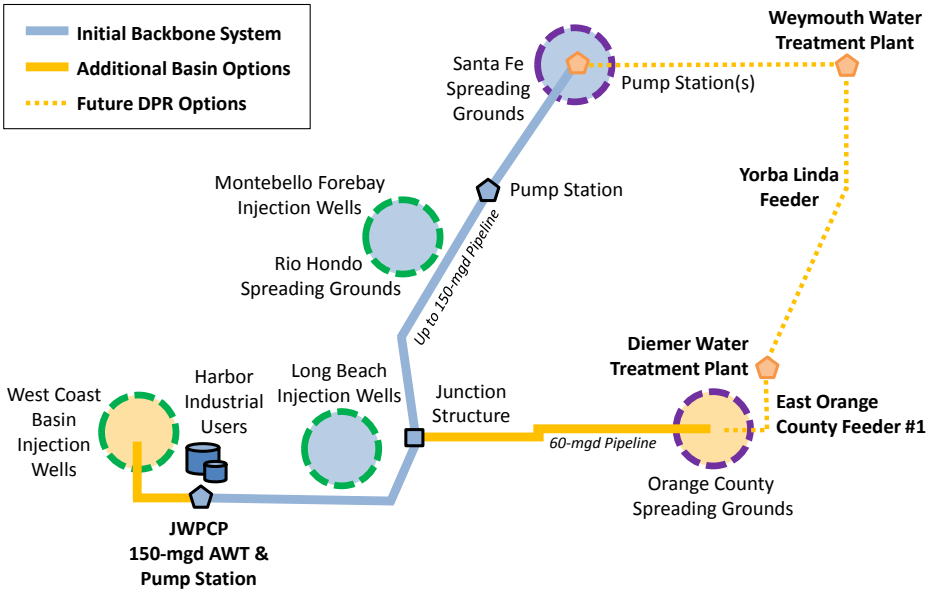
9.2 DPR through Raw Water Augmentation

The Conceptual Planning Studies Report considered the future potential for adapting the program to meet the requirements of forthcoming DPR regulations, including the potential future use of AWT product water for DPR through raw water augmentation at Metropolitan's water treatment plants. Under this scenario, product water from the AWT plant would be conveyed to the Weymouth and/or Diemer plant, blended with raw water from the State Water Project and/or the Colorado River Aqueduct, and undergo additional treatment before entry into Metropolitan's treated drinking water distribution system. As the Weymouth and Diemer plants are two of the three treatment plants that supply treated water to the Central Pool, introduction of the advanced treated water to these two treatment plants would augment a significant portion of Metropolitan's treated water distribution system, further enhancing water supply reliability and system flexibility for Metropolitan's service area.

Implementing raw water augmentation as part of the RRWP would require additional conveyance infrastructure. A system connection from near the Santa Fe Spreading Grounds to the Weymouth plant would require approximately 13 miles of additional pipeline, as well as additional pump stations. From the Weymouth plant, one option would allow purified water to be conveyed from the Weymouth plant to the Diemer plant via Metropolitan's existing Yorba Linda Feeder. This offers a unique opportunity for purified water deliveries to two of Metropolitan's water treatment plants. A second conveyance option, if a pipeline towards the Orange County Spreading Grounds were constructed, would be to repurpose the existing East Orange County Feeder No. 1 to deliver water to the Diemer plant. A schematic of these two potential raw water augmentation options is shown in Figure 6. Additional analyses on pipeline diameters, alignments, and hydraulics, as well as use of existing Metropolitan infrastructure to deliver purified water, would need to be conducted if these DPR options are pursued further.

Several considerations discussed below for DPR through raw water augmentation include enhancements that are anticipated to be required by future regulations to compensate for the loss of the environmental buffer, treatment facility options, blending assumptions, and forecasted available capacities at the treatment plants to accept purified water.

Figure 6: Proposed Regional Recycled Water Program DPR Options



9.2.1 Treatment Process Enhancements

In pursuing DPR options for the RRWP, focus areas include enhanced source control, wastewater treatment optimization, additional advanced water treatment processes, and improved monitoring and response systems.

Source control programs under a DPR application are expected to be more prescriptive than those required for an IPR project. Public outreach would likely be further strengthened, and further optimization of wastewater treatment processes may also be needed. The Sanitation Districts continue to assess opportunities to enhance existing source control programs and wastewater treatment operations as part of the RRWP. These efforts would be of even greater significance for DPR.

Higher levels of advanced treatment and treatment redundancy through multiple independent barriers are expected to be required by future raw water augmentation regulations. The State Board, through its DPR framework, indicated the downstream drinking water treatment plant would be considered redundant treatment in a raw water augmentation application; therefore, it may require all pathogen log removal values (LRVs) to be obtained at the AWT plant. An AWT train that has been evaluated by the State Board is ozone and biological activated carbon filtration, upstream of membrane filtration, RO, and UV/AOP.

With the loss of the environmental buffer, responding to treatment failures becomes even more critical in a DPR treatment scheme. More rigorous monitoring and enhanced tools will be required to respond to "off-spec" events. Locations for diverting off-spec water would have to be identified. Engineered storage may be considered to provide additional response time. In addition, as Metropolitan is considering the option to allow purified water input into the RRWP conveyance system by other entities, introduction into the AWT system may be more feasible utilizing a storage tank with hydraulic buffer capacity, rather than a direct flange-to-flange connection.

9.2.2 Treatment Facility Options

The additional treatment processes needed for raw water augmentation could be included as part of the potential AWT plant at the JWPCP site, or at a potential satellite location downstream. The increased treatment costs for DPR application warrant consideration of satellite treatment only for the portion of flow to be used for DPR; however, further investigation on the feasibility of this concept and its potential to meet anticipated regulatory requirements is needed.

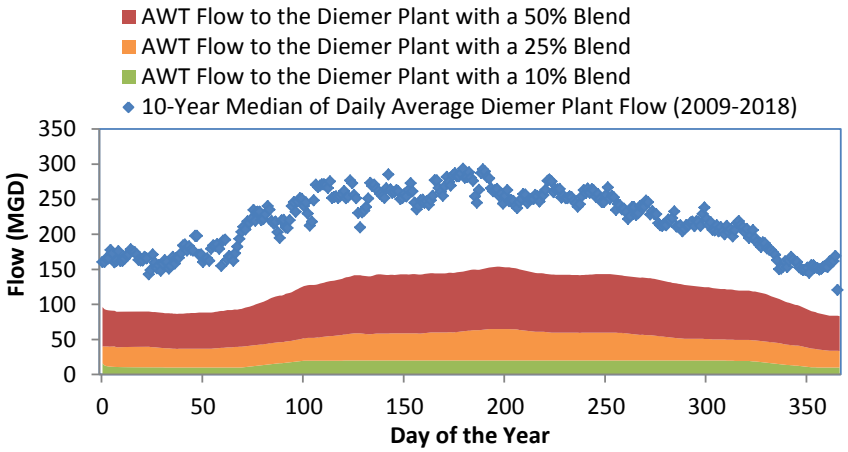
Placement of additional treatment processes at the full-scale AWT plant would require up to a potential 150 mgd to be treated to the higher degree required for DPR, even if most of the treated water would be used for IPR. This could significantly increase the cost per unit of water treated at the AWT plant. It is currently envisioned that only the portion of flow to be used for DPR would be treated to the more stringent requirements, and these additional treatment processes would be placed at a location close to where the advanced treated water would be introduced into the raw water conveyance system.

Further discussion with the State Board is needed to determine whether pathogen reductions from treatment processes at a satellite facility could still be additive to those achieved much further upstream at the full-scale AWT plant, given (1) the potential for water quality changes within the conveyance pipeline, and (2) the sequence of the additional treatment processes being completely downstream of those at the AWT plant.

9.2.3 Blending Assumptions and Forecasted DPR Capacity Scenarios

The State Board has indicated that blending requirements would be incorporated into future raw water augmentation regulations to the degree that it provides a "meaningful public health benefit" (State Board, 2018), and is expected to take a relatively conservative approach until greater DPR project experience is gained. Even without a regulatory-driven blending requirement, Metropolitan may take a conservative approach for introducing advanced treated water to the Weymouth or Diemer plant to ensure operational impacts are minimized, treatment performance is closely monitored, and regulatory compliance is not jeopardized. The median daily average flow at the Diemer and Weymouth plants over a 10-year period (2009 through 2018) ranged from 120 to 293 mgd. Based on these historic flows, if a 10, 25, or 50 percent DPR blend was used, the portion of AWT flows for each treatment plant would range between approximately 15 and 30, 30 and 70, or 60 and 140 mgd, respectively.

Figure 7: Potential AWT Flows to the Diemer Plant under Alternative Blending Scenarios

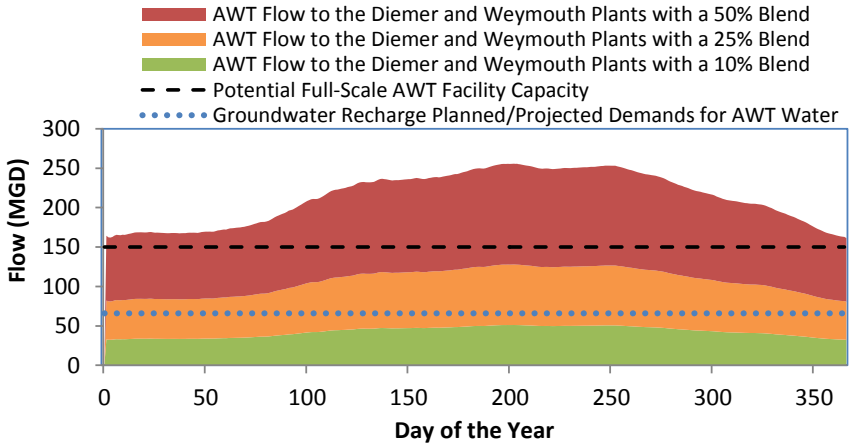


An example of the historic plant flow and projected AWT flows based on alternative blending scenarios for the Diemer plant is shown Figure 7 (above). A similar trend would be observed for the Weymouth plant.

Figure 8 illustrates the total AWT flow that could be delivered simultaneously to both plants at various blends. The Conceptual Planning Studies Report indicated that of the 150 mgd total IPR demand for the RRWP, 84 mgd was existing demand whereas the remaining 66 mgd was either planned or projected.

Figure 8: Potential Total AWT Flows to the Diemer and Weymouth Plants under Alternative Blending Scenarios

(based on historical flows from 2009-2018 at the Diemer and Weymouth plants)



If the targeted raw water augmentation deliveries to the Weymouth and/or Diemer plants were intended to substitute for these planned/projected deliveries of 66 mgd, this could be achieved in a 25 percent DPR blend scenario at both plants and in a 50 percent DPR blend scenario at either plant. Alternatively, if the full-scale AWT plant were to be base loaded at a set capacity, flows in excess of demands up to the total AWT plant capacity of 150 mgd could potentially be sent to the Weymouth and Diemer plants in a 50 percent DPR blend scenario, demonstrating the flexibility that a DPR option could provide to the RRWP.

9.3 Demonstration Facility Testing Roadmap for DPR

As described in Section 4, the first phase of tertiary MBR testing at the demonstration facility focuses on obtaining regulatory acceptance for the MBR process. In the second phase, a secondary MBR will be tested to obtain analogous pathogen removal data. With respect to DPR testing, the equipment needs and costs, research objectives, potential to accelerate testing, and schedule options are discussed in this section.

9.3.1 Equipment Needs and Costs

The State Board's DPR framework highlights the need for multiple barriers that would provide a diverse set of mechanisms to ensure consistent pathogen removal. The treatment mechanisms currently employed at the demonstration facility through the MBR-RO-UV/AOP processes are primarily biological/physical removal, UV light degradation/inactivation, and oxidation. Processes that could be used to provide additional treatment barriers for raw water augmentation include the following:

- Ozone for oxidation/chemical inactivation,
- Biological activated carbon filtration for biological/adsorption/physical removal, and
- Microfiltration for physical removal

These additional processes are currently used for San Diego's Pure Water Program to meet surface water augmentation regulations, and these processes would likely be used if the additional treatment to meet future raw water augmentation regulations were implemented on site at JWPCP. If satellite treatment were to be used, further discussion with the State Board would be needed to identify the additional treatment processes needed.

Modifications could be made at Metropolitan's demonstration facility to test the additional treatment processes for raw water augmentation. It is anticipated that design and construction costs would range from approximately $4 to $13 million depending on the size of facilities. Operational costs are anticipated to be approximately $5.5 to $6.5 million per year for staffing, operations and maintenance, treatment chemicals, and analytical costs. For the satellite treatment option, discussions with the State Board would be required to identify the appropriate treatment train for testing at Metropolitan's demonstration facility.

9.3.2 Research Objectives

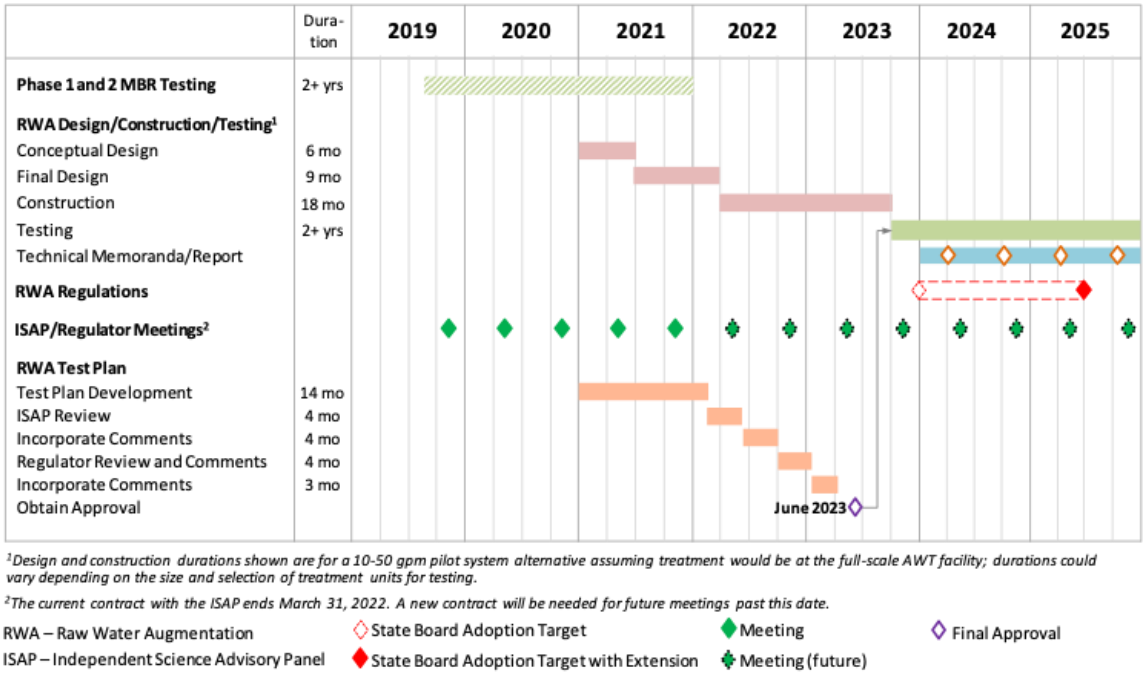
The State Board's expert panel identified various areas of research that should be conducted to ensure the protectiveness of DPR. The objectives of Metropolitan's DPR testing at the demonstration facility would build upon those outcomes and seek to achieve the following:

- Demonstrate the efficacy of additional treatment processes for pathogen and contaminant removal
- Demonstrate the appropriate treatment train that can satisfy basin plan and anticipated regulatory requirements for DPR through raw water augmentation
- Develop water quality acceptance criteria and blending strategies for advanced treated water upstream of drinking water treatment plants
- Develop, evaluate, and optimize analytical methods for detecting microbial and chemical contaminants
- Evaluate impact of blending on distribution system water quality stability

9.3.3 Raw Water Augmentation Testing Schedule

Should the Board direct Metropolitan staff to proceed with developing opportunities for DPR through raw water augmentation, it is recommended that Metropolitan begin test plan development and treatment process design in 2021. It should be noted that this testing schedule would commence prior to State Board adoption of raw water augmentation regulations; however, it allows Metropolitan to work with other stakeholders to help guide regulatory development. The State Board typically leverages actual project experience during the regulatory development process; therefore, it is likely that they would readily engage a potential project sponsor, such as Metropolitan, to help in the development of criteria associated with future raw water augmentation regulations. Similar to the approach taken for the demonstration project, Metropolitan would engage an independent scientific advisory panel on development of raw water augmentation.

Figure 9: Demonstration Facility Testing Roadmap for Direct Potable Reuse through Raw Water Augmentation



Design, construction, and test plan development for DPR development is shown in Figure 9, with test plan development and design beginning in January 2021. Outcomes from research projects currently underway to address topics identified by the State Board to further the science needed to support DPR regulatory development are anticipated near the end of 2020. This timeline would enable consideration of these findings into the design for testing DPR treatment processes. In addition, results from testing tertiary and secondary MBR at the demonstration facility are anticipated to be concluded by early 2022, allowing findings from these first two phases of testing to be incorporated into the DPR test plan. Draft regulatory criteria are likely to be available during test plan development and design of the DPR treatment process train.

9.4 DPR through Treated Water Augmentation

DPR through treated drinking water augmentation is the planned placement of recycled water directly into the water distribution system of a public water system, or commonly referred to as "flange-to-flange" where no buffer is provided between an advanced treated water supply and a treated drinking water distribution system. As noted, while Assembly Bill 574 requires the State Board to develop regulations for DPR through raw water augmentation and mandates the development of raw water augmentation regulations by December 31, 2023, no timeline has been established for the State Board to develop regulations for DPR through treated drinking water augmentation. In addition, the State Board has indicated it will not pursue this regulatory development until raw water augmentation regulations are established.

There have been questions by the Board on the future possibility of DPR at Palos Verdes Reservoir. Palos Verdes Reservoir is a terminal reservoir in the Central Pool low pressure zone, supplied by the Second Lower Feeder and the Palos Verdes Feeder, and located approximately 5 miles from the JWPCP. The

total water demand at the reservoir is approximately 10 to 50 cubic feet per second (cfs) (6.5 to 32 mgd) based on annual average demand. Ninety percent of the time historical demands are less than 14 cfs (9 mgd).

If DPR through treated drinking water augmentation were to be implemented at Palos Verdes Reservoir, the relatively smaller demand at this location would be impractical for utilizing the reservoir as a central distribution source for advanced treated water. A more suitable option to deliver advanced treated water to the Central Pool distribution system would be slightly upstream of Palos Verdes Reservoir, into the Second Lower Feeder, thereby supplying the high-pressure zone of the Central Pool where annual average demand is approximately 400 cfs (258 mgd). Since the regulatory timeline for DPR through treated drinking water augmentation has yet to be determined and requirements would be highly speculative, the delivery of advanced treated water to Palos Verdes Reservoir will not be further evaluated at this time.

9.5 Conclusions

The current focus of the RRWP is IPR through groundwater replenishment, as groundwater basin replenishment constitutes a significant portion of demands on Metropolitan. Raw water augmentation may be a viable additional opportunity for the RRWP; however, further work is needed to fully evaluate this option to deliver advanced treated water to the Weymouth or Diemer plant. DPR would offer significant operational flexibility if used in conjunction with IPR deliveries and could significantly expand the benefits of the program. Metropolitan Board input and funding is required to develop options for raw water augmentation through demonstration facility testing. If approved, testing for DPR requirements at the demonstration facility would likely commence prior to State Board adoption of the regulations. This offers an opportunity for Metropolitan to help develop components that need to be detailed in future raw water augmentation regulations.