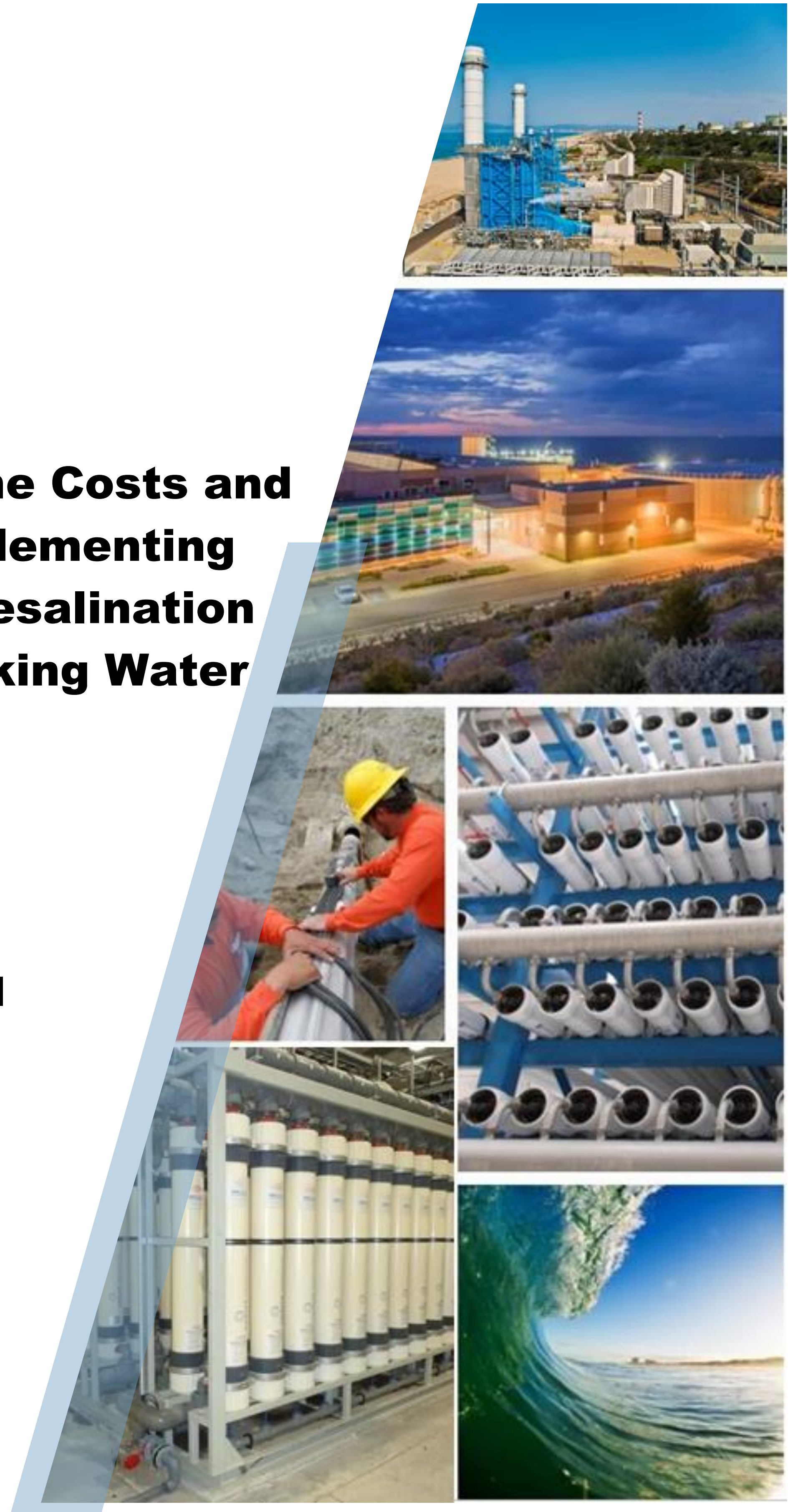

Evaluation of the Costs and Benefits of Implementing Ocean Water Desalination as a Local Drinking Water Supply

Chapter I
Executive Summary

West Basin Municipal
Water District

Final Report
July 30, 2021

Submitted by

GHD

in association with

RAFTELIS

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1. Executive Summary

1.1 Purpose and Structure of the Evaluation

The purpose of this Study is to provide an evaluation of the costs and benefits associated with implementing a 20 million gallons per day (MGD) Ocean Water Desalination Project (OWDP, ‘Project’) as an additional local potable water supply source for the West Basin Municipal Water District (‘the District’). The proposed Project includes the construction of an ocean water intake system, new desalination facility, brine discharge system and desalinated water conveyance.

The Study objectives are to:

- Determine the costs (range) of implementing a potential OWDP;
- Determine the potential impacts on wholesale drinking water rates from a potential OWDP;
- Identify and analyze other impacts leading the tangible and intangible costs and benefits from the potential OWDP.

The Study commenced in March 2019 and was completed in July 2021. It was undertaken in a five-stage process as covered in each of the subsequent five Chapters of this Report. The workflow is summarized in the figure below.

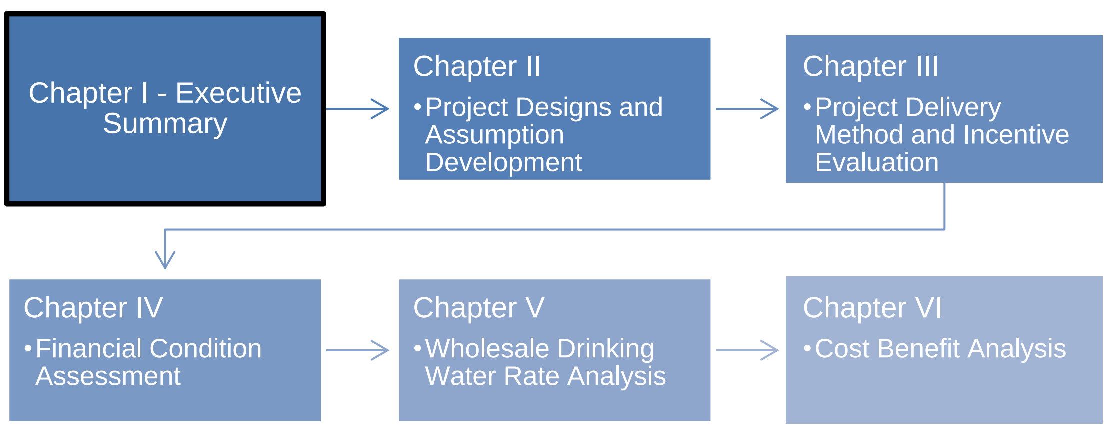


Figure I-1 Structure of this Study: Evaluation of Costs and Benefits of Implementing Ocean Water Desalination as a Local Drinking Water Supply

Chapter I is the Executive Summary and summarizes the key findings and outcomes.

The Chapter should be considered in the context of the detailed discussion included in the supporting Chapters as well as the assumptions, constraints and limitations of this Study.

1.2 Ocean Water Desalination Project Background and Context

As a water wholesaler of the coastal Los Angeles County area, the District supplies potable water to meet demands from its eight retail customers (‘Retail Agencies’) and to meet groundwater replenishment needs. The District currently meets these potable water demands by importing water from Metropolitan Water District of

Southern California (MWD), whose supplies originate from the Colorado River and from Northern California through the State Water Project (SWP).

Maintaining full imported water availability to the Southern California region has been a significant challenge for water suppliers across the region as evidenced by increased frequency and prolonged duration of recent droughts and supply cutbacks in the past 15 years.

In an effort to guarantee future water supply reliability for its service area, the District has considered the proposed OWDP because it would add a **locally produced** and **drought-proof** potable water source to the District's supply portfolio. This is consistent with regional goals for desalinated ocean water supplies identified in MWD's and the District's Urban Water Management Plans (UWMP). Consideration of the proposed OWDP has been pursued in tandem with other successful measures such as an expanded recycled water portfolio, conservation programs and public education.

The proposed 20 MGD OWDP would supply enough potable water to offset approximately 20% of the District's projected long-term annual imported water needs from MWD.

The District has investigated the feasibility of implementing a potential full-scale OWDP since the early 2000s through a step-wise approach. In 2019, the District completed its preparation of an EIR pursuant to the California Environmental Quality Act (CEQA) to evaluate the potential environmental impacts associated with developing and operating the OWDP. The Final EIR was certified by the West Basin Board of Directors in November 2019.

1.3 Current Project Design and Development of Assumptions

1.3.1 Project Design Comparison and Description

The proposed OWDP consists of:

- A new ocean water desalination facility consisting of a pretreatment system and a reverse osmosis (RO) system to be constructed at the existing El Segundo Generating Station (ESGS) site, that would produce 20 MGD of potable drinking water.
- An ocean water intake system with capacity of approximately 40 MGD (in order to supply enough ocean water to produce the final potable volume of 20 MGD).
- A brine discharge system to transfer concentrated seawater back to the ocean, with capacity of approximately 20 MGD.
- A desalinated water conveyance system to be constructed inland of the ESGS to deliver potable water produced at the desalination facility to the local and MWD's regional water supply systems.

The evaluation of the benefits and costs of the OWDP considered two separate technical designs for the OWDP systems, relative to the 'No-Project' alternative (summarized in Figure I-2):

Current Project Design – a facility using similar project design assumptions contained in the Final Environmental Impact Report (EIR), including a screened surface ocean water intake and brine discharge system utilizing the existing intake / discharge tunnels that have supported the cooling system at the ESGS. Reusing the existing ESGS infrastructure results in significant cost savings.

Subsurface Intake Design – a facility using technology preferred under the Desalination Amendment to the California Ocean Plan Amendment (OPA) for ocean water intake and brine discharge. This design includes a subsurface ocean water intake using Seabed Infiltration Galleries (SIGs), and brine discharge by commingling with wastewater discharged at the Hyperion Outfall, which disposes treated wastewater from the Hyperion Water Reclamation Plant. While this concept has significantly higher infrastructure and related development costs, it may offer a streamlined regulatory pathway. However, there is also significant feasibility risk associated with using subsurface ocean intakes for the high capacity needed. Analysis undertaken during EIR development, including research & site-specific analysis, demonstrated this Subsurface Intake Design is not feasible due to technical challenges. It was included in this Study as a cost evaluation and cost comparison to the Current Project Design.

These two technical Project Designs – surface intake and brine discharge using the existing tunnels *versus* subsurface intake using the existing intake tunnel and brine discharge commingling at the Hyperion outfall - are compared to a 'base case' scenario in which the District does not build the OWDP.

No-Project Alternative – the District continues to import from MWD all potable water sold to its Retail Agencies, rather than building the OWDP.

1.3.2 OWDP Cost Estimates and Timeframe Assumptions

Chapter II provides detail on the technical and design assumptions underpinning the capital costs, operating costs and permitting timeframes developed for each of the Project Designs. The outcomes of that analysis are summarized in Table I-1 below:

A key finding is that the Subsurface Intake Design is approximately $220 million more expensive than Current Project Design, driven by the higher direct and indirect costs of constructing the offshore sub-surface intake (compared to the offshore seawater intake piping and screens in the Current Project Design) and the need to build a Brine Discharge Conveyance Pipeline to Hyperion.

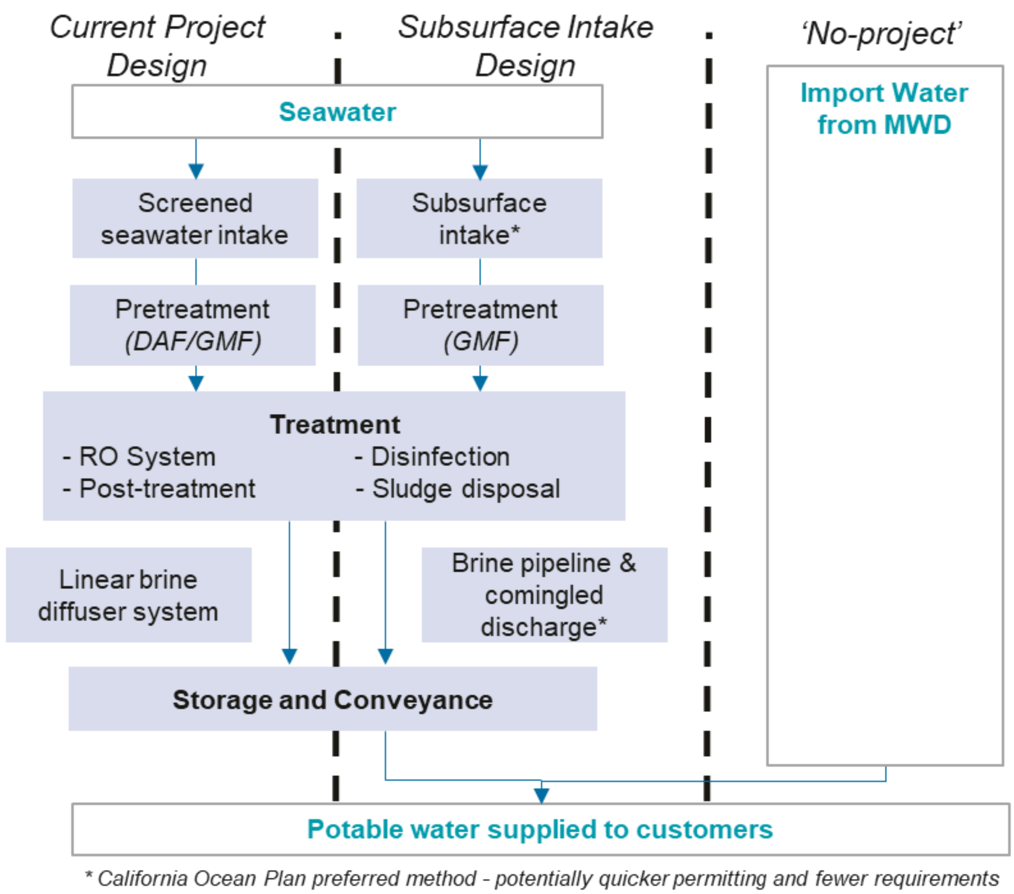


Figure I-2 Overview of Project Designs Considered in This Study

Table I-1 Cost and Timeline Estimates for both OWDP Project Designs

Parameter	Values		Comment
	Current Project Design	Subsurface Intake Design	
Design capacity	20 mgd		Daily maximum treated water capacity
Annual capacity	21,283 AFY 6935 million gallons/yr		Annual treated water output @ 95% availability
Total CAPEX	\$514 million	\$740 million	2019 dollars, Class V Estimate
Fixed O&M	\$4.3 million/yr	\$4.6 million/yr	2019 dollars, escalates with inflation
Variable O&M (excl. power)	\$0.18 / 1000 gal		2019 dollars, escalates with inflation
Power consumption	13 kWh/1000 gal	13.2 kWh/1000 gal	Including treatment and conveyance
Net GHG emissions	11,000 $MTCO_2e$/y		Quantity of offsets purchased, relative to imported water.
Rehabilitation & Refurbishment	\$4.3 million/yr		2019 dollars, escalates with inflation

Parameter	Values		Comment
	Current Project Design	Subsurface Intake Design	
Construction period	2025-27	2022-24	3-year period
Operation period	2028-57	2025-54	30-year period

1.3.3 MWD Imported Water Rate Assumptions

The District will continue to import water from MWD in all project comparisons. If the OWDP proceeds, then the volume of water to be imported will decrease by an amount equivalent to the volume of desalinated water produced (21,283 AFY). Therefore, the cost of the No-Project alternative is the marginal cost to the District of 21,283 AFY of imported water.

Several projections were developed for the future MWD imported water cost (see Figure I-3 below):

- Low-Cost Scenario – MWD official forecast to 2028, constant annual escalation at 2.7% (nominal) beyond 2028. No step-change included.
- Mid-Cost Scenario – MWD official forecast to 2028, constant annual escalation at 3.5% (nominal) beyond 2028. Step-change of $50/AF included at year 2028. **This scenario was adopted as the base assumption in the Study, representing the best estimate at this time.**
- High-Cost Step Scenario – MWD official forecast to 2028, constant annual escalation at 3.5% (nominal) beyond 2028. Step-change of $400/AF included over years 2028-29.
- High-Cost Escalation-Only Scenario – MWD official forecast to 2022, constant annual escalation at 5% (nominal) beyond 2028. No step change included.

The imported water cost projection consists of MWD's Volumetric Tier 1 Imported Water rate and Readiness-to-Serve charge.

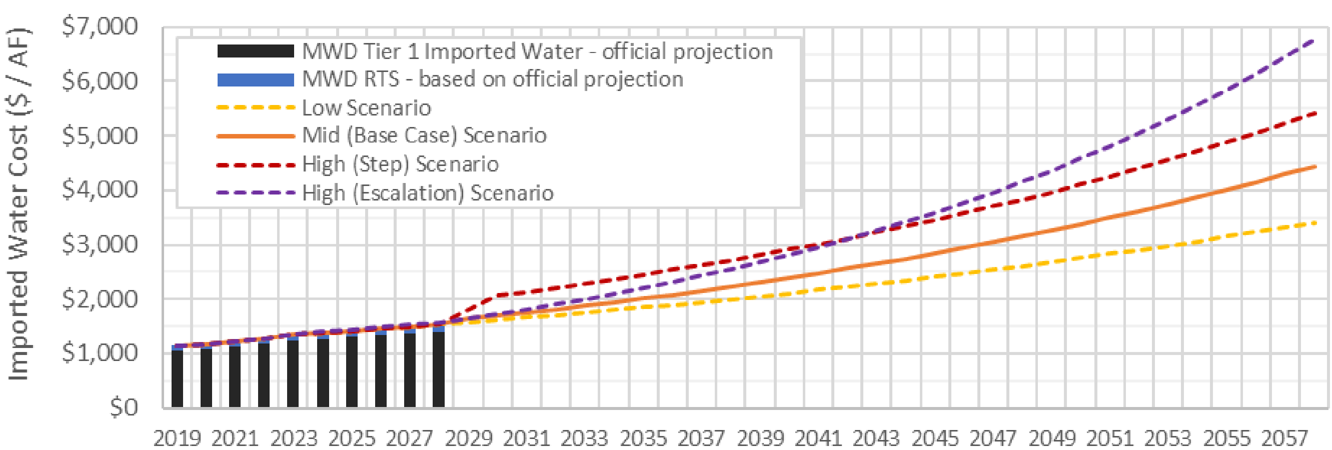


Figure I-3 MWD Imported Water Charges - Projection Scenarios

1.4 Project Delivery Method and Incentive Evaluation

1.4.1 Delivery Models

Several project delivery models were considered in this study, where 'delivery model' refers to the contractual and procurement approach used by the District to deliver the OWDP project. The details are included in Chapter III.

The delivery models considered were: design-bid-build (DBB), design-build-operate-maintain (DBOM), design-bid-finance-operate-maintain (DBFOM) and public-private partnership (PPP). Three different levels of private sector financing were analyzed within the DBFOM framework, and a sensitivity scenario with partial low interest State Revolving Fund (SRF) loan through a DBOM was included, resulting in a total of seven delivery methods and financing rates (Table I-2) that were analyzed:

- **DBB**: Design-bid-build using 100% public municipal financing.
- **DBOM**: Design-build-operate-maintain using 100% public municipal financing.
- **DBOM with SRF**: Sensitivity scenario involving different financing structure - assuming 50% financing through Drinking Water State Revolving Fund (DWSRF) loan, and 50% public municipal financing.
- **DBFOM-10%**: Design-bid-finance-operate-maintain with 10% private financing, and remainder public municipal financing.
- **DBFOM-50%**: DBFOM with 50% private financing, and remainder public municipal financing.
- **DBFOM-100%:** DBFOM with 100% private financing.
- **PPP**: Public-private partnership whereby the District purchases water via a Water Purchase Agreement (WPA).

Table I-2 Summary of Funding Mix and Weighted Average Interest Rate for Delivery Models

Delivery model	Public Financing			Private Financing			Weighted average interest rate
	Repayment period (yrs)	Interest rate	% of funding mix	Repayment period (yrs)	Interest rate	% of funding mix	
DBB	30	4.50%	100%	-	-	-	4.50%
DBOM	30	4.50%	100%	-	-	-	4.50%
DBFOM - 10%	30	4.50%	90%	30	7.80%	10%	4.83%
DBFOM - 50%	30	4.50%	50%	30	7.80%	50%	6.15%
DBFOM - 100%	-	-	-	30	7.80%	100%	7.80%
PPP	-	-	-	30	7.80%	100%	7.80%
DBB with SRF*	30	3.15%*	100%	-	-	-	3.15%

** Includes 50-50 funding of project cost by DWSRF loan at 1.8% and other municipal instruments at 4.5%.*
For all delivery models it is assumed that interest accrues on construction expenditures during the three-year construction period, with no repayments made. It is assumed loan repayments commence during the first year of operation.

1.4.2 Results from Financial and Value-for-Money Analysis

Detailed financial models were developed for each of the delivery models to estimate the yearly cash flows incurred by the District to construct and operate the OWDP over the project timeframe. Figure I-4 below summarizes the estimated cost of water.

In addition, a value-for-money analysis was undertaken to examine impacts of the different delivery models in terms of risk transfer. Generally, an increasing level of private sector involvement results in higher financing costs but is offset by the ability to transfer more risk away from the District. A probabilistic Monte Carlo modelling approach was used to incorporate risk into the financial model, whereby major project risks were identified, tabulated in a risk register, and quantified by estimating likelihood and consequence distributions. Based on typical contractual frameworks and industry experience, risks were allocated to the relevant party (i.e. either the District or the private sector), for each project delivery method. The key findings from the analysis were:

- OWDP Current Project Design is considerably more attractive than Subsurface Intake Design on a financial basis, driven by its significantly lower capital cost (~30% reduction) and results in whole-of-life cost savings of approximately $300 to $450 million on a Net Present Cost (NPC) basis, depending on the delivery model.

- The choice of project delivery model to deliver the OWDP has a significant impact on the overall OWDP financial outcomes. This is due to the impact of different financing methods on the weighted average interest rate applied to capital repayments. As the level of private financing increases, the weighted average interest rate also increases due to additional returns expected by the private equity partners and debt lenders. The analysis estimates that fully privately financed delivery models (DBFOM-100% or PPP) result in an increased whole-of-life cost of ~$300 million to $350 million on an NPC basis compared to wholly municipally-funded delivery models (DBB or DBOM).

- Minimizing power price and power consumption is extremely important to reduce the costs of the OWDP project. Design decisions impacting power consumption, commercial negotiations with the District's contractor and the regional grid power provider, and the potential for alternative power sources should be scrutinized closely.

- The MWD LRP rebate should be aggressively pursued during project development and offers around $90 million in subsidy value, on an NPC basis. Rebate Option A (Sliding scale $340 per acre-foot of water produced from the OWDP facility, for the first 25 years of plant operation) appears to be the best option on a whole-of-life basis. However if the District prioritizes lower costs of desalinated water *early* in OWDP operation, then, Option B (Sliding scale $475 per acre-foot of water produced from the OWDP facility, for the first 15 years of plant operation) would be most attractive.

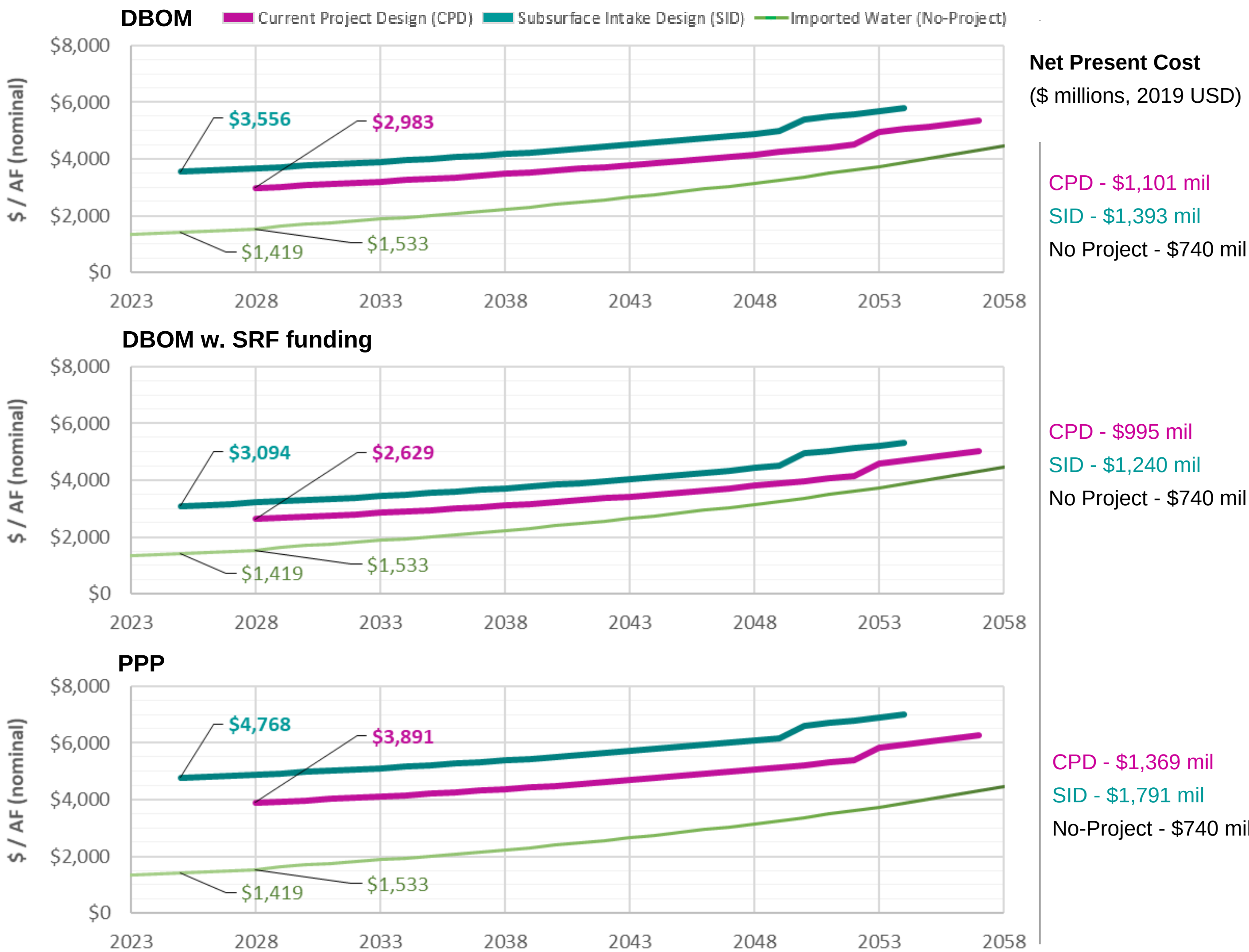
- The District can reduce its risk exposure by using a project delivery model with higher levels of private sector involvement. The risk analysis performed in this work demonstrates the benefits of risk transfer **do not** appear to outweigh the additional costs of private financing. That is, the risk premium charged by the private sector does not appear to be worth the value of the risk transfer to the District.

- The DBOM delivery method offers the lowest risk-adjusted cost for the project, on both NPC and cost-of-water bases over time. The PPP delivery model offers the maximum risk transfer away from the District.

- Below-market interest rate public funding sources such as the DWSRF or Water Infrastructure Finance Innovation Act (WIFIA) should be aggressively pursued during project development to minimize project debt service cost. These funding sources will be generally more accessible when the project is owned by the

District, as a public agency, due to restrictions on availability when the project is owned by a private sector entity. The analysis performed a sensitivity scenario where half the project cost is funded by a DWSRF loan, and estimates whole-of-life cost savings of ~$100 million on an NPC basis. This equates to a substantially lower cost of desalinated water at the start of plant operation.

As a result of this detailed analysis, the **DBOM**, **DBOM with SRF**, and **PPP** delivery models were shortlisted as the preferred delivery models for further consideration. The DBFOM-10%, DBFOM-50%, DBFOM-100% and DBB delivery models were eliminated from further consideration.



Note: the step change in cost of water profile in 2053 (Current Project Design) and 2050 (Subsurface Intake Design) is due to expiration of the MWD LRP rebate. The LRP option included in this analysis offers $340 / AF rebate for the first 25 years of plant operation.

Figure I-4 Cost of Water (nominal $/AF) and Net Present Cost (NPC, $ millions, 2019 dollars) of OWDP for Different Delivery Models

1.5 Financial Condition Assessment

1.5.1 Overview and Assumptions

In developing this study, a Financial Condition Assessment was performed to:

- Summarize current and projected financial obligations.
- Develop a financial condition assessment model for the District.
- Generate a 2030 Plan showing the financial assessment of the District's current revenue plan, and a 2065 Plan looking at the revenue implications needed over 45 years to meet cost requirements. This was developed for the 'No-Project alternative (i.e. before desalination is considered).
- Discuss the various desalination scenarios analyzed, and generate a 2065 Plan looking at the financial implications of desalination scenarios.

The financial plans were developed with staff and included the District's planned rate revenue increases through Fiscal Year (FY) 2030. The District provided various documents including audited statements, budgets, and a financial plan through FY 2030. The financial plans are consistent with the revenue projections, operating budget, sales volume, and assumptions detailed in the District's 10-year plan.

Key assumptions built into the financial condition assessment were:

- All pass-through revenues and costs that the District incurs from MWD are not included in the calculations. As pass-through revenues and expenses, their exclusion does not affect the financial projections of the District. The exclusion of MWD related revenues and expenses allows us to focus on the direct financial implications to the District for both the 2030 and 2065 Plans.
- Assumed interest earnings on invested funds of 2.5% for FY 2021 through FY 2022, and 3% annually starting in FY 2023 throughout the forecast period.
- Water sales projections utilized in the financial model reflect usage information as provided by the District through FY2030. The 2065 Plan assumes the water sale projections established for FY 2030 remain constant through the rest of the projection period.
- Assumed that annual net revenues must be at least 1.15 times the legal debt service requirements in that year. In order to meet the District's debt covenants, a target for minimum debt service coverage ratio of 1.75x was assumed as a benchmark for strong financial management that the District strives to achieve.
- The District's current reserve policy continues into the future and includes the following components:
  - Operating Liquidity Reserve: 50% of annual O&M expenses
  - Operating Contingency Reserve: 5% of Recycled Water Program O&M expenses
  - Capital Contingency Reserve: 10% of three-year average capital expenditures
  - Repair and Replacement (R&R) Reserve: 1% of depreciable assets

1.5.2 Findings without OWDP

The Financial Plan developed to 2030 demonstrates that the District will meet its current and projected cost requirements over the next 10-year projection period based on the revenue adjustments of the District's 10-year plan. Furthermore, with the addition of a projected 5% annual increase in the West Basin Reliability Service Charge from FY 2040 to FY 2065, a financial plan was developed to 2065 which enables the District to continue to meet its projected cost requirements. Figure I-5 shows the District's fund balances through FY 2065 under this baseline plan.

For the majority of the study period, the District is expected to meet or exceed its target reserve balances. The District will generate enough revenues to cover its cost requirements and meet the minimum required debt service coverage ratio in all projected years.

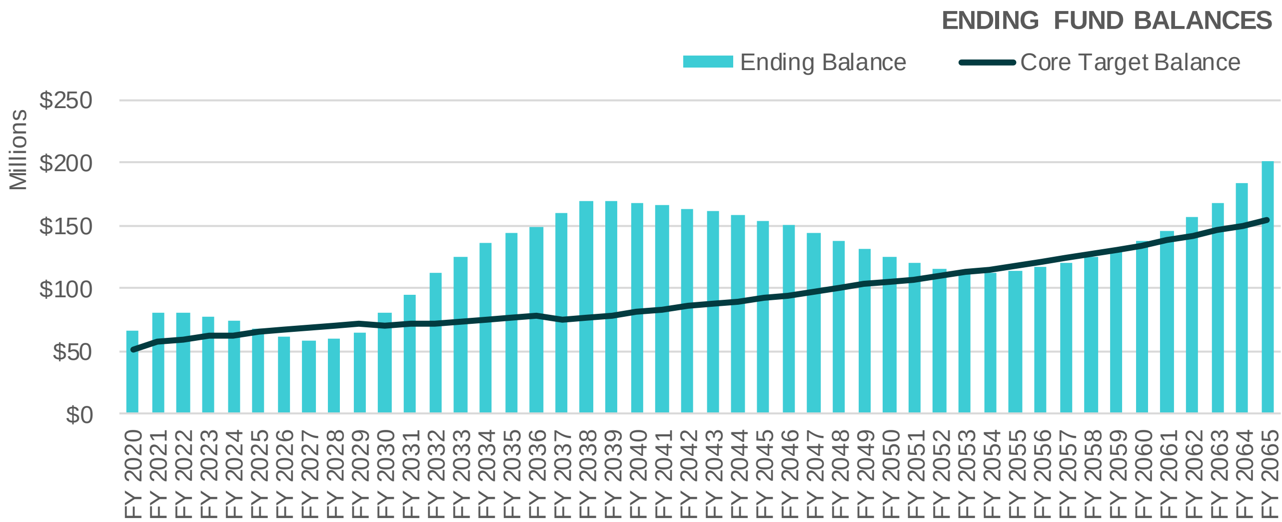


Figure I-5 District Financial Plan to 2065 (Ending Balances) without OWDP

1.5.3 Findings with OWDP

There were six desalination scenarios that were analyzed based on assumptions and cost information provided by District staff and GHD. These were, for each of Current Project Design and Subsurface Intake Design, the DBOM, PPP, and DBOM with SRF scenarios. The costs and assumptions for each scenario were incorporated into the District's financial condition model, and together with the District's other revenues and revenue requirements, generated a financial projection through FY 2065.

Each of the scenarios discussed above will meet the District's revenue requirements should the blended rates be implemented as previously shown. Table I-3 below summarizes these scenarios.

Table I-3 Increase in District Potable Costs in OWDP Scenarios

Desal Scenarios	Desal Premium (%)	Desal Premium ($/AF)
DBOM, Current Project Design	22%	$326
DBOM, Subsurface Intake Design	35%	$473
PPP, Current Project Design	32%	$484
PPP, Subsurface Intake Design	50%	$689
DBOM w. SRF, Current Project Design	15%	$229
DBOM w. SRF, Subsurface Intake Design	26%	$350

Explanatory Notes:

Desal premium ($): approximate increase in District's total cost of potable water in the first year of plant operation, $ per AF, compared to No-Project Alternative.

Desal premium (%): approximate increase in District's total cost of potable water relative to No-Project Alternative, in %.

The key assumption built into this analysis was that every Retail Agency customer of the District will pay for desalinated water and is proposed to be charged an equal blended rate of MWD and desalination costs per AF of water. The section below (and Chapter IV) discusses the policy objectives, rationale, and impact of this blended rate approach in greater detail. In essence, because the District will pass through the costs of desalinated water to its Retail Agencies, it can maintain its own financial condition.

1.6 Wholesale Drinking Water Rate Analysis

1.6.1 Guiding Principles

The purpose of this task was to analyze various pricing options for desalinated ocean water from the OWDP to determine the most appropriate rate option for the District.

The guiding principles outlined below were developed based on discussion with District staff and were used as criteria to determine the appropriate methodology for pricing desalinated water:

- **Ease of Administration**. It is important to District staff that any pricing option be easy to implement and administer. The desired pricing option will minimize the need for additional staff time and costly information technology (IT) implementations. The District's billing system currently has the capacity to bill customers for various types of charges, which include a fixed charge by retailer, a Reliability Service Charge by acre-feet (AF) of water use, and other pass-through charges based on MWD rates. Ideally, the selected pricing option would make the best use of the District's existing resources.

- **Minimizes Impact to Customer Retail Agencies to the Extent Possible**. The ideal pricing option will minimize cost impacts to the District's Retail Agencies. This can be achieved by reducing costs associated with administration and implementation but also as a function of the selected rate option. In addition, the implementation of certain rate changes can cause "rate shock," which can increase cost impacts to all or some retail customer agencies, depending on the rate structure ultimately selected.

- **Evenly Spreads the Cost of Desalinated Ocean Water**. All Customer Retail Agencies would benefit from the additional water supply reliability from construction of the OWDP. District staff expressed interest in spreading the costs of desalinated water evenly and equitably across all agencies so that no single entity is overburdened.

1.6.2 Options and Recommendation

The following options were evaluated:

1. **Blended Rate** – in this approach, the cost of potable water charged by the District to the Retail Agencies is based on the proportionate supply mix between desalinated and imported water for the District as a whole. That is, the District's expected water supply mix once the OWDP is functional is approximately 80% imported water and 20% desalinated ocean water. This results in a blended rate that is equal to 80% of the MWD rate per AF plus 20% of the desalinated ocean water rate per AF. Each Retail Agency would pay the same rate per AF of water use, which recovers the costs related to both desalinated and imported water.
2. **Tiered Approach** – in this approach, a two-tier system would be set up whereby Tier 1 would include costs associated with purchasing imported water from MWD, and Tier 2 would reflect the incremental costs of desalinated ocean water. This option places the costs of producing desalinated ocean water on retail customer agencies that purchase larger amounts of water from the District.
3. **Fixed/Variable Option** – in this hybrid approach, the costs of producing desalinated water must be broken out between fixed and variable costs. The portion of fixed costs would be recovered through a fixed charge to each Retail Agency (similar to the existing fixed service charge, based on each agency's proportion of three years of historical demand), while the portion of variable costs would be recovered through a variable rate based on AF of water use.
4. **Take or Pay** – this final approach involves each Retail Agency paying for a specific share of desalinated ocean water capacity. Customers would be allowed to opt in or out, but once opting in, each agency would be responsible for the costs of desalinated ocean water proportionate to the amount of capacity purchased. Agencies could use water up to the amount of capacity they have purchased. Conversely, agencies will pay for this benefit regardless of whether they use their entire capacity allotment.

The recommendation developed in tandem with District staff is that the option that best reflects the guiding principles is **Option 1**, which involves implementing a blended rate that incorporates both the cost of desalinated ocean water and the costs of imported water from MWD based on their proportion of the water supply mix. This option minimizes the cost impacts of desalinated ocean water, spreads them evenly across Retail Agencies, and is the easiest for District staff to administer. This is the same approach that has been adopted by San Diego County Water Authority for the Carlsbad Desalination Plant.

1.7 Cost Benefit Analysis

This Cost Benefit Analysis exercise has reviewed the potential impacts from implementing the OWDP. This exercise took a broad approach to assessing the Project, by reviewing indirect impacts to a large set of stakeholders.

The key outcomes and findings below are organized around the two project scenarios with the highest and lowest cost of desalinated water, namely:

- Current Project Design delivered using a DBOM delivery model and 50% SRF funding – *lowest cost*
- Subsurface Intake Design delivered using a PPP delivery model – *highest cost*
- The impacts are considered relative to the No-Project alternative where the OWDP is not developed. Chapter VI contains further detail on how these impacts were identified, analyzed and quantified (for some impacts only). The Table below acts as a guide to the findings, and is the summary of outcomes from this Study.

Table I-4 Summary of Cost Benefit Analysis for OWDP

Impacts	Parameter	Current Project Design + DBOM with SRF	Subsurface Intake Design + PPP
Cost of desalinated water Desalinated water is higher cost than MWD imported water. This cost will be passed on to Retail Agencies using a single blended rate that captures the District's average potable water cost from both imported water and desalinated water.	Cost of desalinated water in first year of OWDP operation	$2,629 / AF (approx. + $1,100/AF compared to No-Project) *Current Project Design has significantly lower capital cost due to reuse of existing ocean water intake and brine discharge assets. The SRF loan offers significantly less expensive financing with a large reduction on the cost of water.*	$4,768 / AF (approx. + $3,400/AF compared to No-Project) *Subsurface Intake Design has much higher capital cost but is preferred under California Ocean Plan Amendment regulations. Facility may commence operation ~ 3 years earlier than Current Project Design due to assumed shorter permitting pathway. Note the Subsurface Intake Design was found to be technically infeasible during the EIR development and is presented here as a cost comparison for the Current Project Design.*
	District's overall blended rate of potable water in first year of OWDP operation	$1,729/AF (+ $229/AF compared to No-Project)	$2,057 / AF (approx. + $689/AF compared to No-Project)
	Net present cost, 30-year operating timeframe (as 2019 dollars)	+$0.23 billion relative to No-Project	+$1.05 billion relative to No-Project
Affordability Affordability impacts to households (with a focus on low-income residents) was assessed against two commonly used affordability parameters. Results can be dependent on the size of region chosen for analysis –	Parameter 1 - Water bill as percentage of Median Household Income (<2.5% target)	Affordability definition is met for all Retail Agencies. At census-tract level, additional 2 census tracts will not meet affordability target (all within Golden State Water customer area), relative to No-Project.	Affordability definition is met for all Retail Agencies. At census-tract level, additional 6 census tracts will not meet affordability target (within Golden State Water and Cal American Water Hawthorne customer areas), relative to No-Project.

Impacts	Parameter	Current Project Design + DBOM with SRF	Subsurface Intake Design + PPP
i.e. median household incomes are different for whole retail customer areas or the individual census tracts within. There are ~167 census tracts within the District's service area.	Parameter 2 - Water bill as percentage of Household Income for lowest 20% income quintile (<5% target).	Affordability definition is met for all Retail Agencies. At census-tract level, additional 1 census tracts will not meet affordability target (within Golden State Water, CA Water Hawthorne and City of Inglewood customer areas), relative to No-Project.	Affordability definition is met for all Retail Agencies. At census-tract level, additional 4 census tracts will not meet affordability target (within Golden State Water, CA Water Hawthorne and City of Inglewood customer areas), relative to No-Project.
Risk transfer	Different delivery models enable the District to transfer different levels of risk to the private sector contractor/s. The value-for-money analysis conducted in this study indicated the benefits of risk transfer from greater private sector involvement do not appear to outweigh the additional risk premium costs that will be charged. DBOM delivery model appears to offer the better value for money over PPP, as well as enabling better access to public grants (which will further reduce financing costs).		
Water reliability – long-term drought proofing and avoiding shortages	Desalinated water is drought-proof and partially diversifies the District's supply portfolio away from imported water. If a future multiple dry-year event leads to a Regional Shortage declaration by MWD, the local OWDP supply will reduce the cutbacks the District must enforce on its Retail Agencies. For example, if a Regional Shortage Level 3 were declared (as was in 2015), the District and its customers would have access to an additional ~4,800 AFY of potable water. In addition, the drought proof supply would 'unlock' an extra ~16,500 AFY of potable water available to the MWD imported water region as a whole. Although the economic and social benefits of this additional water supply were not quantified in this study, some relevant data points for consideration are: • The value of avoided penalty rates for exceeding water consumption limits during Regional Shortage cutbacks, as dictated by the MWD Water Shortage Allocation Plan and the District's Water District Drought Rationing Plan (2015). Under the current frameworks, the value of this water is $1,480 to $2,960 per AF. • Willingness-to-pay and consumer surveys in Southern California that provide a basis for understanding household perception of the value of increased reliability. Numerous studies have shown a perceived value in the order of hundreds of dollars per household, per year, for improved reliability, including the District's own Water Issues Survey in 2015. • There is limited California-specific data available on economic losses to urban industry and businesses from water restrictions during historical drought cutbacks, but experience from adverse impacts to California's agricultural sector during 2015 as well as global case studies demonstrates that additional water		

Impacts	Parameter	Current Project Design + DBOM with SRF	Subsurface Intake Design + PPP
	availability can have immense benefits by enabling economic activity to occur when it would not otherwise.		
Water resiliency – seismic risk	Resilient water supply is one that has better ability to absorb and rebound from a supply shock. The proposed OWDP location is far south from the Southern San Andreas fault. The likelihood of a major earthquake at the fault line closest to the OWDP, the Palos Verdes fault, is at least 5 times lower than that for the Southern San Andreas. Therefore, the OWDP is at a lower and differentiated seismic risk than imported water supply, and further diversifies and diminishes the risk because it uses a seawater source that is completely independent of the imported network. The diversification improves the possibility and extent to which partial deliveries can be provided immediately following an emergency event.		
Water Quality – salt and minerals Reduced salt and mineral content in desalinated water can result in avoided maintenance and household costs for appliances and point-of-use treatment systems	Amortized value of benefits to households from reduced salt and mineral content	$90 to $320/AF of desalinated water production – Depends on which estimation approach is used. Value of benefits are higher or lower depending on the baseline water conditions assumed – benefits could be as high $570/AF if blended desalinated water is compared to times of annual maximum salt and mineral content in the District's service area.	
Water Quality – other	The reverse-osmosis treatment process included in the OWDP design is extremely robust at removing contaminants in water. Literature review indicated that there may be potential benefits to customer health, including removal of emerging contaminants which may have regulatory limits in the future (e.g. PFAS/PPCPs). There may also be costs related to cardiovascular disease, algal toxins and horticulture (from boron), though these risks can be adequately mitigated with careful process design.		
Economic stimulus Direct, indirect and induced economic activity will be generated from delivery of a large infrastructure project such as the OWDP, with positive effects on regional employment and supply chain.	Gross Regional Product during construction phase	$249 million within LA County and $767 million within California	$395 million within LA County and $1,224 million within California
	Gross Regional Product during operations phase	$28 million per year within LA County and $38 million per year within California	$29 million per year within LA County and $39 million per year within California
	Employment during construction phase	613 job-years within LA County and 1827 job-years within California	981 job-years within LA County and 2929 job-years within California
	Employment during operations phase	114 jobs within LA County and 150 jobs within California	129 jobs within LA County and 156 jobs within California

Impacts	Parameter	Current Project Design + DBOM with SRF	Subsurface Intake Design + PPP
Management and Overhead Staffing The District will need to add and restructure management and supervision roles internally to effectively manage the OWDP once operational. As a potable water supplier, the District will be subject to more stringent set of reporting requirements (relative to its existing recycled water portfolio).		District will need to perform ongoing contract management and supervision functions. These engineering, operations, legal, finance, and compliance activities may require an additional 7 to 10 FTE.	District will need to perform Water Purchase Agreement compliance monitoring (technical and legal), accounting and invoicing review and O&M interface with plant operators. These activities may require an additional 5 to 7 FTE.
Environmental and Amenity	Environmental and amenity issues were considered extensively during development of the OWDP EIR. The EIR was based on the Current Project Design	The only impacts identified in the EIR as 'significant and unavoidable' were for construction-related air emissions and noise. Both impacts were assessed to be 'less than significant with mitigation' during operation	Land-based works are essentially the same as Current Project Design. Marine works in Subsurface Intake Design include the California Ocean Plan Amendment preferred technology for seawater intake and discharge, so may have similar or less impact over the long term.

2. Limitations, Exclusions and Assumptions

This Chapter I and supporting Chapters in the *Evaluation of the Costs and Benefits of Implementing Ocean Water Desalination as a Local Drinking Water Supply* (the Study) document the analyses and outcomes of efforts to evaluate the potential impacts to the District as well as other public agencies, residents, and businesses from the potential implementation of OWDP.

The intent of this Study is to provide a body of information for District decision-makers as they determine immediate and future next steps for the OWDP.

This Study is subject to the following limitations and exclusions:

- This Study was prepared based on the understanding of the OWDP available at the time of the Study (March 2019 to July 2021). This includes assumptions regarding the OWDP technical design, permitting requirements, delivery models, financing availability and financial condition of the District including projected revenues and revenue requirements into the future. Financial condition is based on the budget assumptions in the District's fiscal year 2020-2021 budget. Assumptions are articulated and defined throughout the Chapters of this Study.

- Several technical and commercial elements of the OWDP remain at concept development stage, some of which will be further clarified by the District before the final decision to proceed with the OWDP (e.g. which delivery model, funding sources, commercial negotiations, tie-in to MWD potable water network, ESGS demolition and site works sequencing, power supply agreements, etc.), and some which will only be confirmed after the decision to proceed, that is during financing, detailed design, construction and operation phase (e.g. exact construction methodology and timing, detailed component design, etc.). Therefore, elements of the OWDP may change subsequent to publication of this Study and could necessitate revisiting the assumptions relied on in the analysis and the outcomes presented herein.
- Furthermore, assumptions are made regarding the approach and status of regional water planning efforts such as those undertaken by MWD, costs of imported water from MWD and the political and regulatory context. It is assumed that regional water planning conditions remain similar to those over the past several years, as articulated in the Chapters of this Study. A change in these conditions could necessitate revisiting the assumptions relied on in the analyses and the outcomes presented herein.
- This Study does not investigate other potable water supply projects for the Southern California region. The scope is restricted to comparing the OWDP to a No-Project alternative.
- Analyses of the type conducted in this Study include trade-offs between the level of detail and precision for impact identification and analysis, and the level of effort required to complete such analysis. GHD has worked within its allocated time, data availability, and effort constraints during the preparation of this Study. Further effort could be expended at subsequent stages of OWDP development to enhance the level of detail and precision of some or all areas of the scope.
- GHD has prepared this Study on the basis of information provided by the District and other third parties. GHD has not independently verified or checked this information beyond the agreed scope of work.
- This Study has been prepared by GHD for the District and may only be used and relied on by the District for the purpose agreed between GHD and the District in its contractual arrangement.

3. Key Reference Documents

The following key documents are foundational to the discussion in this Study. Other references and sources are noted using footnotes throughout the body of this Study and the other Chapters.

- Draft Environmental Impact Report - West Basin Municipal Water District Ocean Water Desalination Project, West Basin Municipal Water District, March 27, 2018
- Final Environmental Impact Report - West Basin Municipal Water District Ocean Water Desalination Project, West Basin Municipal Water District, October 23, 2019.
- 2015 Urban Water Management Plan, West Basin Municipal Water District, June 2016
- 2015 Urban Water Management Plan, Metropolitan Water District, June 2016

- 4/14/2020 Board Meeting, Board of Directors Finance and Insurance Committee, Metropolitan Water District of Southern California, 14 April 2020
- Carlsbad Water Purchase Agreement (WPA), Board Letter November 21 2012, San Diego County Water Authority (SDCWA)

4. Acknowledgements and Contributors

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5. Glossary

Abbreviation	Meaning	Abbreviation	Meaning
@Risk	@Risk modelling software developed by Palisade Corporation	O&M	Operations and Maintenance
AF	Acre foot	OWDP	Ocean Water Desalination Project
AFY	Acre Feet per Year	OPEX	Operations Expenditure
CAP	Continuous Application Program	PAB	Private Activity Bonds
CAPEX	Capital Expenditure	PCC	Public Contract Code
CARB	California Air Resources Board	PFAS	Poly-fluoroalkyl Substances
CBA	Cost Benefit Analysis	PFHxA	Perfluorhexanoic Acid
CDP	Carlsbad Desalination Plant	PFOA	Perfluorooctanoic Acid
CEQA	California Environmental Quality Act	PFOS	Perfluorooctane Sulfonate
CRA	Colorado River Aqueduct	POU	Point-of-use
CRCWSC	Cooperative Research Center for Water Sensitive Cities	PPCPs	Pharmaceuticals and personal care products
CWSRF	Clean Water State Revolving Fund	PPP	Public-Private Partnership (also P3)
DBB	Design-Bid-Build	PPT	Parts per Trillion
DBFOM	Design-Build-Finance-Operate-Maintain	R&R	Rehab and Replacement
DBOM	Design-Build-Operate-Maintain	RDA	Redevelopment Agencies
DDW	Division of Drinking Water	RO	Reverse Osmosis
(the) District	West Basin Municipal Water District	ROW	Right-of-way
DWSRF	Drinking Water State Revolving Fund	RPS	Renewables Portfolio Standard
EIFD	Enhanced Infrastructure Financing Districts	SCAQMD	South Coast Air Quality Management District
EIR	Environmental Impact Report	SCE	Southern California Edison
EPA	Environmental Protection Agency	SDCWA	San Diego County Water Authority
ESGS	El Segundo Generating Site	SPV	Special Purpose Vehicle
FTE	Full-time Equivalents	SRF	(Drinking Water) State Revolving Fund
GHG	Greenhouse Gas	SWP	State Water Project
GO	General Obligation (Bonds)	TDS	Total Dissolved Solids
HAB	Harmful Algal Blooms	TMs	Task Memorandums
INFFEWS	Investment Framework for Economics of Water Sensitive Cities	UWMP	Urban Water Management Plan
IO	Input-Output	VfM	Value-for-Money
IRR	Internal Rate of Return	WBMWD	West Basin Municipal Water District
kWh	Kilowatt Hour	WIFIA	Water Infrastructure Finance Innovation Act
LRP	Local Resources Program (a rebate program by MWD)	WIIN Act	Water Infrastructure Improvements for the Nation Act
MCL	Maximum Contaminant Level	WPA	Water Purchase Agreement
MGD (or mgd)	Million Gallons per Day	WSAP	Water Supply Allocation Plan
MG/L	Milligrams per liter	WTP	Willingness-to-pay
MMRP	Mitigation Monitoring and Reporting Program		
MT/yr	Metric Tonnes per Year		
MWD	Metropolitan Water District of Southern California		
NAD Bank	North American Development Bank		
NDMA	Nitrosodimenthylamine		
NPC	Net Present Cost		
NPV	Net Present Value		
NOA	Notice of Availability		
NOP	Notice of Preparation		

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https://projects-northamerica.ghd.com/sites/uswest1/wbmwddesalcostbenefi/ProjectDocs/FINAL DELIVERABLES/Chapter I - Executive Summary - Evaluation of Costs and Benefits of OWDP.docx

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GHD is one of the world's leading professional services companies operating in the global markets of water, energy and resources, environment, property and buildings, and transportation. We provide engineering, environmental, and construction services to private and public sector clients.

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