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

Chapter III
Project Delivery Methods and Incentive Evaluation

West Basin Municipal Water District

Final Report
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Submitted by

GHD

in association with
RAFTELIS

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1 Introduction

1.1 Scope and Purpose

Chapter III of the *Evaluation of the Costs and Benefits of Implementing Ocean Water Desalination as a Local Drinking Water* (the Study) includes:

- Development of a cash flow model for the Ocean Water Desalination Project (OWDP, 'Project')
- Review, research and confirmation of assumptions underpinning the cash flow model
- Analysis of various grant, rebate and financing options for the project and delivery methods
- Risk analysis, considering risk transfer under different delivery methods

The primary use of this analysis is to assess the most optimal project delivery method/s for the OWDP.

The decision on whether to proceed with the OWDP project (i.e. project vs. no-project decision) will be based on other factors than just the financial and risk profile considerations considered in this report.

The Study commenced in March 2019 and was completed in July 2021. It was undertaken in a five-stage process as covered in five Chapters of this Report (plus an Executive Summary):

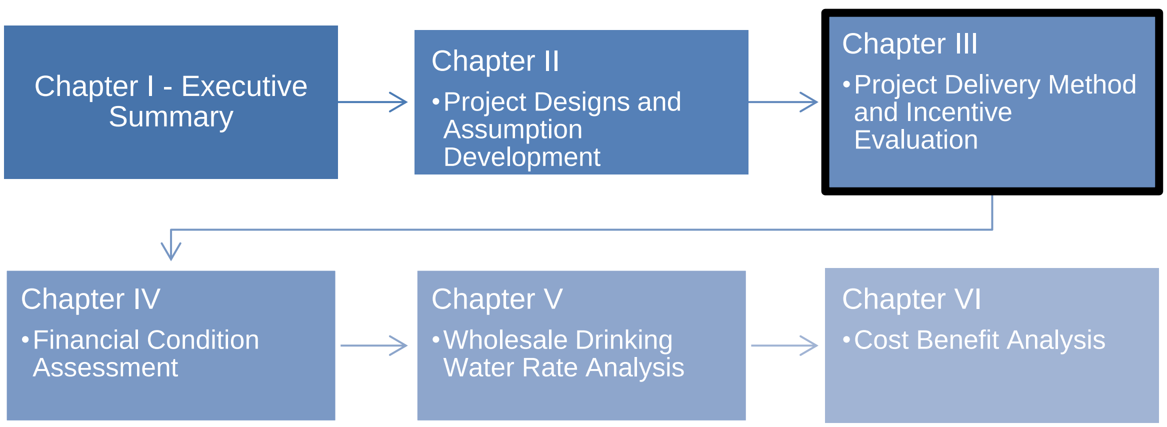


Figure III-1 Structure of this Study: Evaluation of Cost and Benefits of Implementing Ocean Water Desalination as a Local Drinking Water Supply

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 Overview of Delivery Models

The cash flow and risk analysis activities were performed for a number of different project 'delivery models' which represent different contractual mechanisms for delivering the OWDP. These project delivery models are[1]:

1. Design-Bid-Build (DBB) (100% public financing).
2. Design-Build-Operate-Maintain (DBOM) (100% public financing). An additional scenario in which grant funding supports the DBOM.
3. 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.
4. Design-Build-Finance-Operate-Maintain (DBFOM) with 10% private financing.
5. DBFOM with 50% private financing.
6. DBFOM with 100% private financing.
7. Public-Private Partnership (PPP) via a Water Purchase Agreement (WPA).

In this Chapter, the financial and risk-related benefits and costs of the different project delivery options were analyzed and compared. This type of analysis is sometimes termed a value-for-money (VfM) analysis.

1.3 Structure of this Report

This Chapter includes:

- Description of the various project delivery models and the methodology used to evaluate them – Section 2 (Cash Flow and Risk Analysis – Framework and Methodology).
- Discussion of the inputs and assumptions used to model the OWDP's financial outcomes, including project-specific, financing and global inputs – Section 3 (Project Parameters and Assumptions).
- Discussion of the inputs and assumptions used to model future imported water costs from Metropolitan Water District (MWD), which underpin the No-Project alternative – Section 4 (No-Project Parameters and Assumptions).
- Analysis and sensitivity testing of the financial outcomes of the various project designs and delivery models, estimated using the OWDP cash flow model – Section 5 (Results of Cash-Flow Analysis).
- Description of, inputs and assumptions, and results from the risk analysis as it relates to the project delivery methods – Section 6 (Risk Analysis).
- Summary of outcomes and findings – Section 7 (Outcomes and Recommendations)

[1] Delivery models 1,4,5,6 & 7 were identified by the District in the Request for Quotation documentation for this Ocean Water Desalination Project Cost Benefit Analysis project. Delivery models 2 and 3 (DBOM) was added for consideration during delivery of this evaluation.

1.4 Limitations, Exclusions and Assumptions

This Chapter contains analysis, modelling and discussion of the financial outcomes and risk profile of the proposed OWDP, as they relate to the different OWDP technical designs and project delivery models.

- Assumptions used to estimate the cash flow profile of the OWDP are documented in Section 3.
- Assumptions used to estimate the cash flow profile of imported water from MWD are documented in Section 4.
- Assumptions related to the risk profile and allocation of the OWDP risks between the District and various contractual parties through the different delivery methods are documented in Section 6. The primary focus of the risk analysis is on permitting, construction and operation of the OWDP.
- The estimates, findings and conclusions presented in this report are a function of these assumptions, and should be viewed as such.

Limitations and Exclusions pertaining to the Study overall are included in Chapter I and apply here.

1.5 Reference Documents

In addition to the Reference Documents listed in Chapter I of this Study, the following documents are foundational to the discussion in this Chapter. Other references are noted using footnotes throughout the rest of this document.

- Seabed Infiltration Gallery Construction and Life-Cycle costs for a proposed 20 million gallons per day (MGD) Ocean Water Desalination Facility El Segundo, California, Geosyntec, December 2017.
- 4/14/2020 Board Meeting, Board of Directors Finance and Insurance Committee, Metropolitan Water District of Southern California, 14 April 2020.
- Ten–Year Financial Forecast - 2018/19 and 2019/20 Proposed Biennial Budget, Metropolitan Water District of Southern California, 2017.
- Overview of Metropolitan's Efforts to Encourage Local Resources Development, Metropolitan Water District of Southern California, 13 December 2016.
- West Basin Municipal Water District Ocean Water Desalination Program Delivery Analysis - Final Report, CH2M, January 8, 2018 and supporting documents – *see Section 1.5.1 for brief discussion.*

1.5.1 CH2M Project Delivery Analysis

Between 2016-18, consulting firm CH2M was engaged by the District to complete a Program Delivery Analysis and VfM analysis. The following reports were produced by CH2M:

1. West Basin Municipal Water District Ocean Water Desalination Program Delivery Analysis – Final Report (January 8, 2018).
2. Value for Money Analysis: Comparison of Traditional Public Delivery with Collaborative Delivery Options for West Basin's Ocean Water Desalination Program (January 9, 2018). *Attachment to Report 1.*
3. Technical Memorandum – Municipal Funding Options (Draft). *Attachment to Report 2.*
4. West Basin Municipal Water District Ocean Water Desalination Program Progressive Design-Build-Operate with Proponent-Provided Preconstruction Period Financing (June 23, 2017). *Attachment to Report 1.*

The CH2M reports considered five project delivery models: DBB (100% public financing), DBFOM with 10% private financing, DBFOM with 50% private financing, DBFOM with 100% private financing and PPP via a WPA.

The OWDP has developed further since the completion of the CH2M reports, notably the certification of the Final EIR.

The five delivery models considered by CH2M are again considered in this report (with the addition of another delivery model not considered by CH2M, the DBOM model). However, where GHD and CH2M have analyzed the 'same' delivery models, the description and assumptions related to contractual structure, procurement approach and financing are not necessarily the same. GHD has documented its assumptions related to contractual structure, procurement approach and financing within this report.

This GHD report is a standalone analysis and while it builds on elements of CH2M's analysis, it is intended to supersede that earlier work.

2 Cash Flow and Risk Analysis – Framework and Methodology

2.1 Overview

This Chapter evaluates and compares the financial and risk outcomes of the OWDP under different project delivery methods, where project delivery method refers to the contractual and procurement mechanism used to deliver the permitting, planning, construction and operation of the project. The delivery models considered are listed and described in Section 2.3 below.

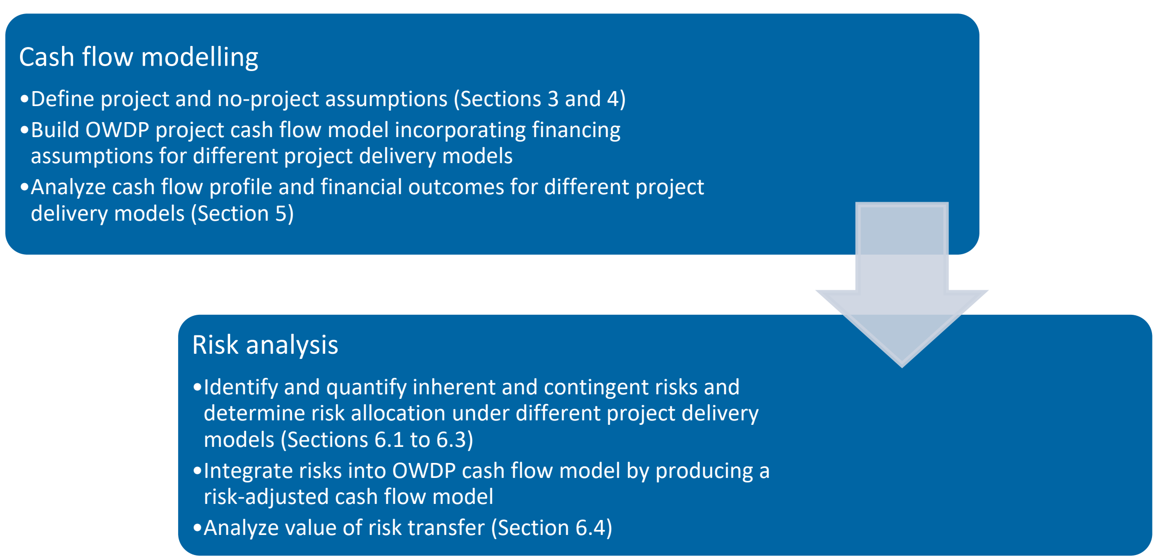
Project delivery methods differ in two key areas: financing costs and risk transfer.

Financing costs – different delivery methods will incur different repayment costs to support the same capital investment due to different terms, conditions and rates of return demanded by different project partners and financial intermediaries. The impact of financing costs is revealed by modelling the annual cash flows of the project over the entire project duration.

Risk transfer – the OWDP is a major capital project with a long duration and exposure to external macroeconomic, technical, political and regulatory conditions. As such, at every stage of the Project there will be risks that cannot be fully mitigated (i.e. residual risks). Through different project delivery methods, some of these risks can be 'passed' to the private sector whereby the District's cost exposure is reduced or eliminated.

However, from the perspective of the District, it should be noted that *maximum risk transfer* (i.e. transferring all possible risks) is not always the same as *optimal risk transfer* (i.e. minimizing total cost while appropriately mitigating risk exposure). That is, the upfront premium charged by the private sector for accepting a certain risk may outweigh the benefits of transferring the risk – this is due to the different positioning of private and public parties with respect to managing different types of risk, how contingency is managed, and who is better equipped and experienced to manage the risk. The bottom line being that it is more beneficial to the District to maintain certain risks.

The framework to assess these two aspects involved:



This type of analysis is often called a VfM analysis. Assessing the balance between cost premium and risk transfer to the private sector is the core objective of this type of analysis.

2.2 Methodology

2.2.1 Development of Cash Flow Model and Financial Performance Metrics

A cash flow model was developed in Microsoft Excel to estimate the yearly cash flows incurred by the District to construct and operate the OWDP over the project timeframe. The model was designed to be flexible, such that the different project delivery options and designs could be analyzed efficiently.

Most likely values, or 'base estimates', of input parameters to the cash flow model were developed based on available information. Sections 3 and 4 includes discussion of the input parameters and the underlying assumptions used to develop the base estimates.

The financial performance of the project under different delivery options and designs were calculated using the cash flow model.

2.2.2 Identification and Quantification of Project Risks

As with all infrastructure projects, there are a number of risks associated with development, delivery and operation that, if they were to eventuate, affect the outcomes of the Project both financially and non-financially. A key distinction between project delivery methods is the risk allocation framework, which contractually designates which party is ultimately liable for the consequences of the project risks. In this analysis:

Major project risks were identified, tabulated in a risk register, and quantified by estimating likelihood and consequence distributions.

- Materiality thresholds of $5 million (i.e. risks with an expected consequence of at least $5 million) for capital costs and $0.2 million/year for operating costs were adopted to focus the analysis on the significant risks affecting the project (the focus is not to generate an exhaustive list of potential risks).

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.

Additional discussion on the risk identification and quantification process is included in Section 6.2.

2.2.3 Risk-Adjusted Cash Flow Analysis

Project risks were incorporated into the MS Excel project cash flow model using the statistical software package @RISK Professional 7.0 (developed by Palisade Corporation).

Then, for different project delivery methods and configurations, Monte-Carlo modelling was used to generate the set of potential risk-adjusted project financial outcomes.

Additional discussion on the risk-adjusted cash flow modelling is included in Section 6.2.

2.3 Description of Project Delivery Methods

Several project delivery frameworks were compared in this VfM analysis: DBB, DBOM, DBFOM and PPP. Three different levels of private sector financing were analyzed within the DBFOM framework resulting in a total of seven project delivery methods:

1. DBB (100% public financing)
2. DBOM (100% public financing)

3. 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
4. DBFOM with 10% private financing
5. DBFOM with 50% private financing
6. DBFOM with 100% private financing
7. PPP via a WPA

Note that the description of the delivery methods below focuses on the substantive and desalination-specific components of the OWDP, namely the ocean water desalination treatment facility, ocean water intake system and brine discharge system. These components make up the majority of the capital cost and operating cost of the project.

Delivery method considerations for the other component of the OWDP, the desalinated water conveyance system is described in Section 2.4.

2.3.1 DBB

In a DBB delivery method the District develops the project concept, obtains project permits, and owns and finances the construction of new assets. The District separately engages private-sector contractors for the design and construction of the assets, as per Figure III-3. This could involve separate contracts for separate components of the project construction (e.g. one contract for the desalination facility, another for the conveyance pipeline).

In this delivery method, the District takes ownership and responsibility for operating the plant at the completion of construction. This may involve District's own staff acting as the main plant operators, or establishing a long-term Operations and Maintenance (O&M) contract with a separate provider (typically a third-party unrelated to the designer or builder) after construction.

The private-sector construction contractor(s) take no or minimal financing risk on the capital and are typically paid a sum for the build of the plant, payable in installments on completion of construction milestones.

An indicative delivery pathway for a DBB is shown in the Figure below, highlighting the linear approach and multiple procurement steps involved:

The DBB approach is often considered the 'typical' procurement approach for municipal infrastructure such as roads and traditional water supply infrastructure. For example, the District adopted this model for the expansion of the Edward C. Little Water Recycling Facility. However, this delivery approach is not usually adopted and is not recommended for major seawater desalination projects for two main reasons:

1. The desalination process technology provider is an integral part of the design process, and detailed designs of the treatment process cannot typically be performed by consulting engineers (especially for seawater reverse-osmosis plants of this size).
2. The major global desalination process technology providers are experienced operators of seawater desalination facilities, and it is almost always beneficial to have the same provider design as well as operate the plant. The process technology provider is best-placed to accept the risks of operating costs and equipment durability for their specific design. Therefore, it is highly recommended to 'bundle' O&M of the facility with the design and construction, as is done by the DBOM, DBFOM and PPP delivery models discussed below.

The District's legal counsel advised[2] in 2014, the Californian legislature revamped design-build authority for public agencies through SB 785, which went into effect January 1, 2015, codified at Public Contract Code (PCC) sections 22160 et seq. This legislation repealed most of the existing design build statutes applicable to different types of agencies, and replaced them with a single statute applicable to "local agencies." The statutes allow design-build for the design and construction of wastewater facilities, or water recycling facilities in excess of $1,000,000. (PCC 22161, 22162.) The District can award such a contract on a best-value basis. (PCC 22162(a)). Note these provisions automatically repeal on January 1, 2025. On this basis, the DBB model entails very little legal ambiguity or risk.

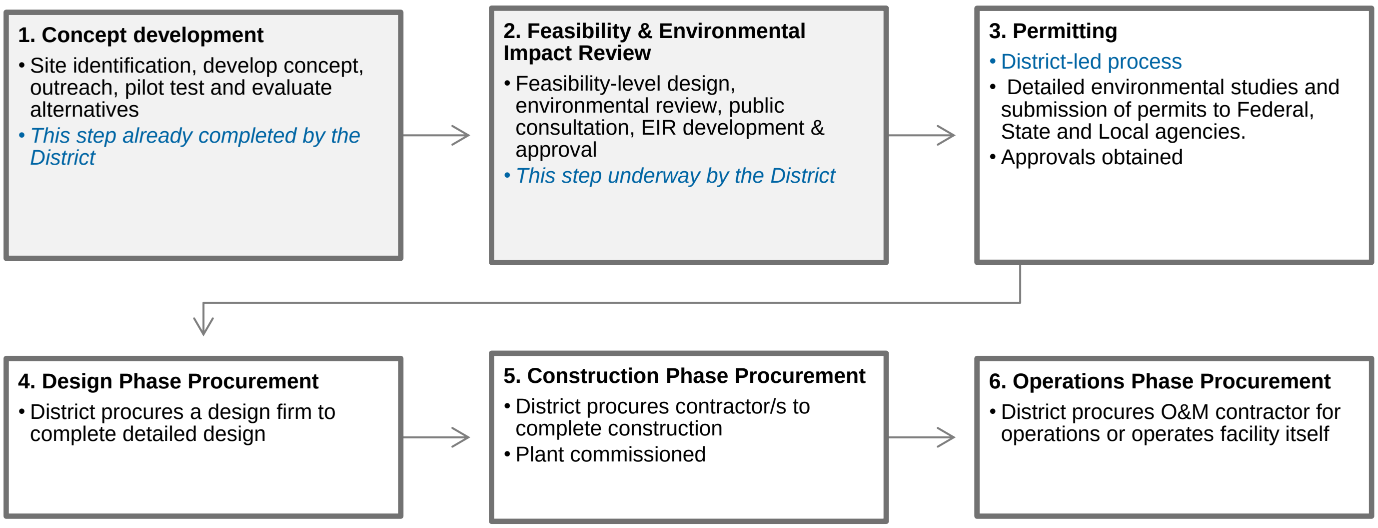


Figure III-2 Delivery Pathway for DBB Model

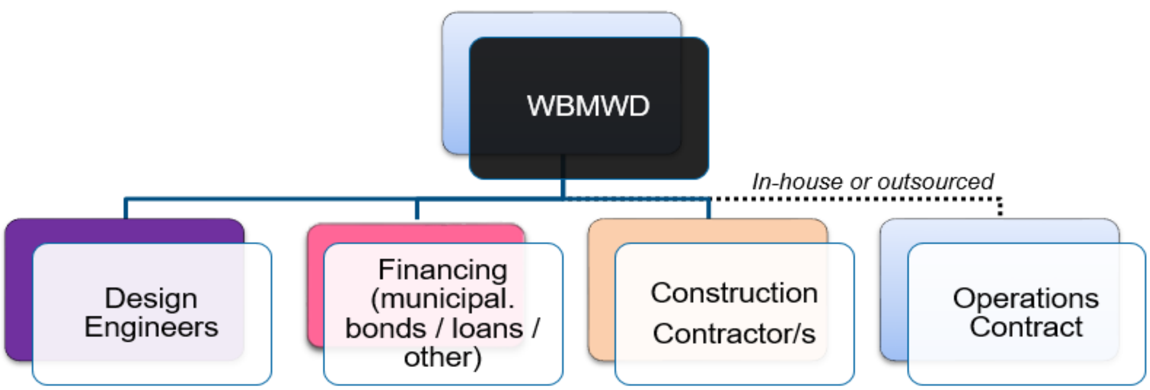


Figure III-3 DBB Contractual Structure Overview

2.3.2 DBOM

The DBOM model involves the District contracting with a single private sector consortium to manage design, construction and also O&M of the OWDP.

[2] Personal communications, Steve O'Neill, Olivarez Madruga Lemieux O'Neill, LLP, 3/12/20

The District owns the assets and finances the project itself. The private-sector contractor(s) take no or minimal financing risk on the capital and are typically paid:

- A sum for the design-build of the plant, payable in instalments on completion of design and construction milestones; and,
- An operating fee for the operating period which is typically a short term (e.g. five years with options to extend). Often-times extensions are favorable to both the operator and the owner.

The DBOM approach has the advantage of a single-point of accountability for the District, reducing the number of contractual interfaces requiring management. It also leverages the expertise of the process technology provider through design, construction and operation and maximizes transfer of operational risk away from the District. Figure III-4 illustrates the typical contractual structure of a DBOM project delivery method.

Charles E. Meyer Desalination Facility (Santa Barbara)

An example of a Californian desalination facility delivered using a DBOM is the Charles E. Meyer Desalination Facility. The facility was built in 1991 but was placed in standby in 1992 when improved rainfall reduced the requirement for desalinated water supply. The facility was retained as an emergency supply source and in 2016 the City of Santa Barbara elected to reactivate the 3 MGD facility in response to the current drought conditions. The $60 million reactivation project was delivered through a DBOM contract, awarded to IDE Americas Inc. and funded through a DWSRF loan. The facility began operating in 2017.

1. Concept development
- Site identification, develop concept, outreach, pilot test and evaluate alternatives
- *This step already completed by the District*

→

2. Feasibility & Environmental Impact Review
- Feasibility-level design, environmental review, public consultation, EIR development & approval
- *This step underway by the District*

→

3. Permitting
- District-led process
- Detailed environmental studies and submission of permits to Federal, State and Local agencies.
- Approvals obtained

↓

4. Design, Construction and Operations Phase Procurement
- District procures a private sector consortia to complete detailed design, build and O&M

Figure III-4 Delivery Pathway for DBOM Models

DBOM approach appears to be legally enabled under the 2014 revamping of design-build authority for public agencies through SB 785, which went into effect January 1, 2015, codified at Public Contract Code sections 22160 et seq. The District's legal counsel advised they do not see any legal restrictions to the District using public financing to fund all the aspects (design, build, operate, and maintain) of the OWDP[3]: The proposed Doheny Desalination Project intends to utilize this approach.

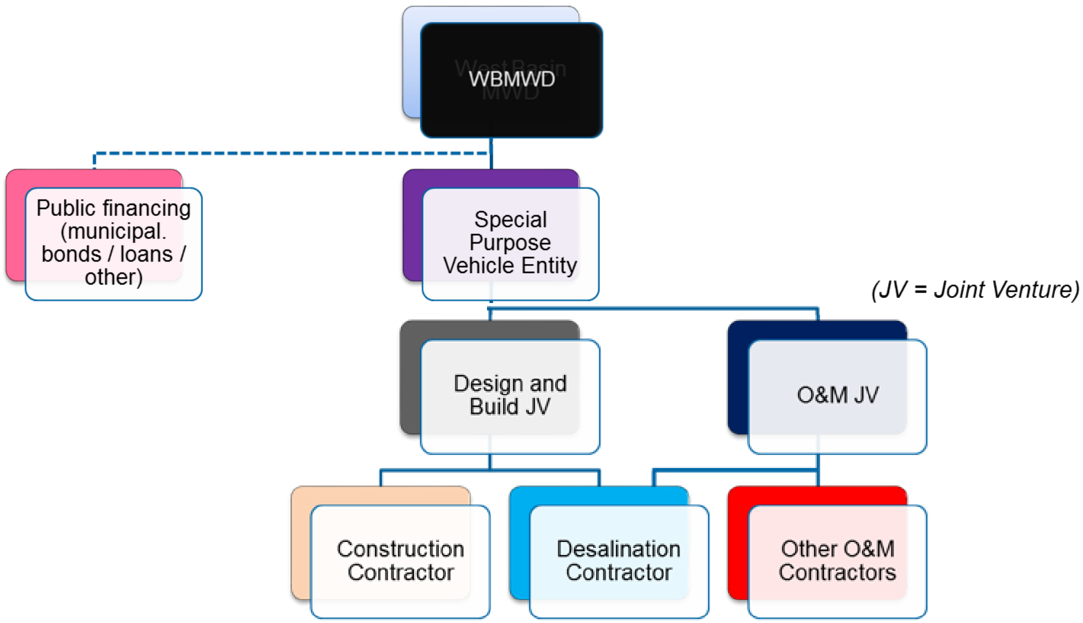


Figure III-5 DBOM Contractual Structure Overview

2.3.3 DBFOM

Similar to the DBOM delivery model, the DBFOM model involves the District contracting with a single private sector consortium (typically a special purpose vehicle, SPV) to manage design and construction and also long-term (i.e. 20 to 30 year) O&M of the facility. Furthermore, the finance element of the DBFOM involves full or partial financing by the private-sector SPV using their own combinations of debt and equity.

The District retains ownership of all facilities in this model (unlike a PPP).

Like a DBOM, this approach reduces the number of contractual interfaces requiring management and maximizes transfer of operational risk away from the District (see Figure III-6). In a DBFOM model, the private-sector SPV is typically paid:

- An ongoing availability fee for the right to provide water from the desalination facility, no matter how much water is actually taken by the District; AND,
- A usage fee determined on a per volume basis of water ordered.

The amount of financing contributed by the private sector consortium is flexible. This analysis contemplates three levels of private sector financing – 10%, 50% and 100%, where the percentages are the proportion of the total final installed cost of the project funded by private finance.

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[3] Personal communications, Steve O'Neill, Olivarez Madruga Lemieux O'Neill, LLP, 3/12/20 and Margaret Moggia, South Coast Water District 5/27/2020

The DBFOM model allows the District to transfer some or all of the financing burden to the private sector. However, it is critical to note that the private sector consortium recoups its own financing costs through the availability fee and usage fee it charges the District. Therefore, financing costs do not disappear, they are just seen by the District in a different way. This is important as private financing costs are generally higher than municipal financing options and therefore this approach can increase the effective cost of water paid by the District.

It is assumed that the District would obtain all necessary permits before procuring its DBFOM partner, to ensure DBFOM bidders can provide maximum price guarantees with reasonable certainty[4]. Therefore, the project development pathway is essentially the same as that shown for the DBOM model (reference Figure III-4).

The previously proposed Rosarito Desalination Plant in Baja, Mexico and the Victorian Desalination Plant in Australia are examples of such an approach.

The DBFOM-10% and DBFOM-50% approach entail some legal risk[5], stemming from the California statutory requirements surrounding the use of private-sector finance in public projects. Specifically, Government Code (GC) sections 5956 et seq. provides authority for a public corporation to utilize private-sector investment capital in all stages of developing, although the intent of GC 5956 is to facilitate projects that could not be otherwise delivered without substantial use of private financing, and the DBFOM-10% and DBFOM-50% seems only minimally to satisfy that goal.

Furthermore, blended public and private financing models such as these can lead to additional complexity around ownership and related tax implications for both the District and the private sector contractor. This includes tax treatment of profits and losses incurred by the contractor, and the District's access to tax-exempt municipal financing. The additional complexity can be difficult to estimate and resolve, as has been experienced with the Carlsbad Desalination Project. The Carlsbad Project specifically evaluated and rejected a blended ownership model due to complexity. The Carlsbad conveyance pipeline was made a separate facility from the treatment plant with 100% SDCWA ownership.

Further legal and tax review will be needed if these DBFOM delivery models emerge as preferred models for the OWDP. In any case, the level of complexity is greatly increased.

Rosarito Desalination Plant

The Rosarito Desalination Project is located in the State of Baja, Mexico, and with an ultimate size of 100 MGD, will be the largest desalination facility in the Western Hemisphere. An agreement between the State of Baja and NSC Agua, SUEZ, NuWater and Degremont was signed in August 2016 for design, construction, finance and operation of the facility. This project was structured by the State of Baja and subjected to a competitive bidding process. Permitting remained the responsibility of the State.

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[4] Note that this differs from the value-for-money analysis completed by CH2M for the OWDP in 2017-18, which assumed the DBFOM bidder would be procured prior to final permit approvals, with the project developed iteratively before a guaranteed maximum price is provided by the DBFOM consortium.

[5] Personal communications, Steve O'Neill, Olivarez Madruga Lemieux O'Neill, LLP, 3/12/20. Margaret Moggia and South Coast Water District 5/27/2020.

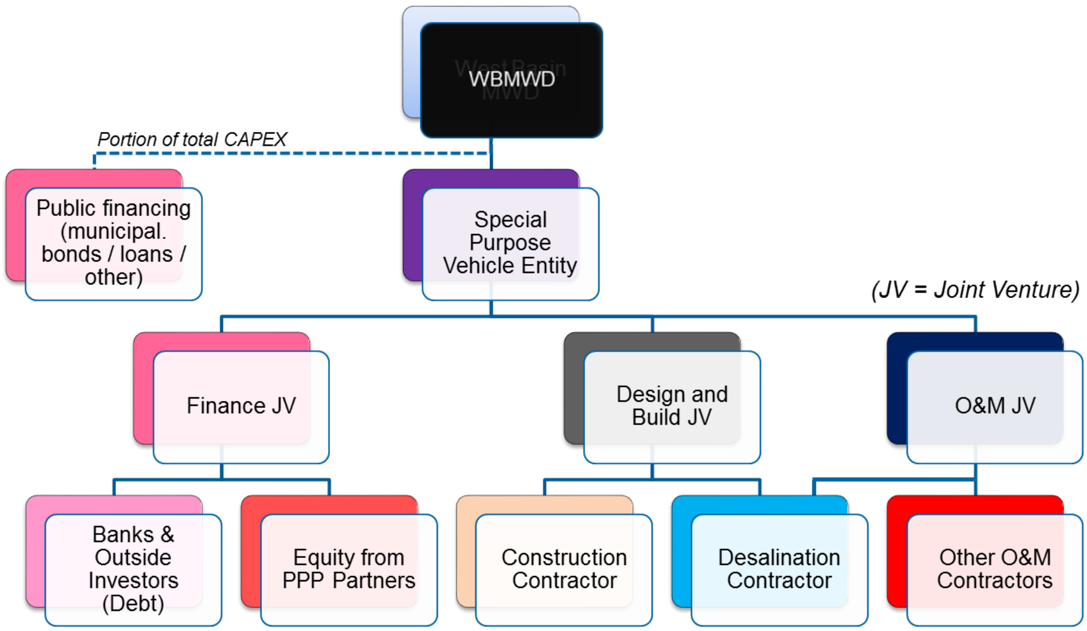


Figure III-6 Key Aspects of DBFOM Delivery Method

2.3.4 PPP

The PPP (also written as ‘P3’) approach is very similar to the DBFOM model described above with some subtle differences related to ownership, handback and implications on debt. In a PPP the project is *fully owned and developed and 100% financed* by a private sector SPV and the District signs a WPA contract with that entity.

The WPA obligates the District to purchase agreed volumes of desalinated water at agreed prices over the contract period. This guarantees revenue to the private sector SPV and is a critical component for the SPV to secure its financing. The details of the WPA are finalized during contractual negotiations, but in desalination projects such agreements typically take a ‘take-or-pay’ structure where the District pays:

- An availability fee for the right to water supply from the desalination facility, no matter how much water is actually taken by the District; and
- A usage fee determined on a per volume basis of water ordered.

Through the WPA, the PPP partner is obligated to meet specified water quality, availability, reporting and monitoring requirements (amongst other considerations).

Carlsbad Desalination Plant

An example of a Californian desalination PPP is the 50 MGD Carlsbad Desalination Plant located at the Encina Power Station in Carlsbad, California. Construction was completed in 2015 at a cost of approximately $1 billion, and the plant has delivered water to the SDCWA since December 2015. The project was delivered as a PPP with Poseidon Water. Poseidon owns, financed, built and will operate the facility under a 30-year WPA established with SDCWA. A link to the WPA is provided below[6].

Through a PPP approach the amount of debt on the District's books is minimized during construction and operation, as it does not 'own' the OWDP assets (whereas in DBB, DBOM and DBFOM it retains ownership throughout). Therefore, a PPP enables the District to have more debt capacity and it may be able to secure more attractive interest rates when financing other future capital projects. The District and its customers are also insulated from damages should the PPP party go into default. However, this is a mutually disadvantageous scenario, as a default of the PPP would mean the District also cannot receive desalinated water without some reinvestment and reorganization of the OWDP – which may be significant. The District can partially protect itself from that risk by obtaining step-in rights in the event the PPP or its surety is unable to cure a default event.

Ownership of the assets *after* the operations period is dependent on the final contractual negotiations. It is common for PPP contracts to include a buyback or handback clause at the end of the operating term, in which the assets are transferred from the private sector SPV to the District for no or nominal cost. As an example, San Diego County Water Authority (SDCWA) has the option to purchase the Carlsbad Desalination Plant from the private sector SPV for $1 at the end of the 30-year operating period. Similarly, the Rosarito Desalination Plant under construction in Baja California includes handback of the facility from the SPV to the State after a 37-year operating period.

This point is raised to highlight that it is likely that the District could own all the OWDP assets after the 30-year operating period and as a result the whole-of-life cash flow model is very similar to the DBFOM delivery model.

The contractual structure of a PPP is essentially the same as a DBFOM as shown in Figure III-8. As with a DBFOM, a benefit of the contractual structure is a single-point of accountability for the District reducing the number of contractual interfaces (although in practice, contractual complexity tends to increase).

[6] Memorandum to Special Board Meeting – Carlsbad WPA, San Diego County Water Authority (2012) - http://www.sdcwa.org/sites/default/files/files/water-management/desal/Special%20Board%20Meeting%20Desal%20Board%20Memo%2011-21.pdf

It is often purported that the PPP delivery model enables the District to share or transfer permitting risk to the private sector. In GHD's experience, the reality of this risk transfer is often less than expected because the private sector party can often successfully argue that major cost increases due to permitting conditions were unforeseen or unavoidable at the time of contract signing. In many cases, while the District may believe it has transferred risk away, litigation results do not support this belief. In the Carlsbad example shown, Poseidon Water had pursued permitting since 1998, with final litigation completed and permitting approved in 2012. The WPA was executed between Poseidon and SCDWA only in November 2012. In that case, Poseidon as the project owner and the permit applicant was able to agree to conditions that would ultimately be reflected in the price of water to SDCWA. However, SDCWA was not able to transfer the risk of *future* regulations or changes in law because the private financing bondholders would not accept such an opened ended risk.

It is unlikely the District could obtain a competitive price guarantee from a PPP before final permit conditions were known and would not be able to fully transfer that risk. Under typical commercial terms it would also not be able to transfer the risk of future regulations or permit conditions to a PPP. Because the District has led the permitting effort and has been intimately involved in discussions with regulators it may be able mitigate some of its risk by continuing to take the lead in permitting or closely collaborating with the PPP on condition acceptance. It could also negotiate strict price parameters for the cost of water that will mitigate the effect of permitting conditions on the final cost.

Therefore, the PPP model analyzed in this report assumes the District obtains all necessary permits prior to procurement of the PPP private-sector partner.

As will be seen later in the report, there is no difference between the PPP option and the DBFOM-100% delivery model options in terms of financial costs and risk transfer because they both include full private financing and permitting is pursued by the District (so risk allocation is the same). Debt and ownership impacts, as discussed above, are not captured in this type of analysis and can be separately considered.

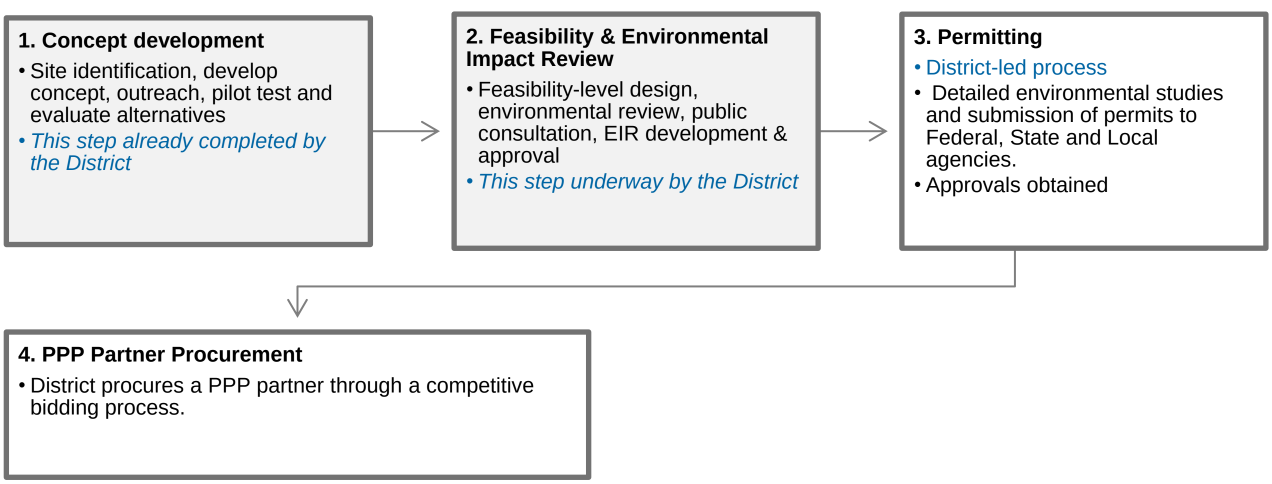


Figure III-7 Delivery pathway for PPP model

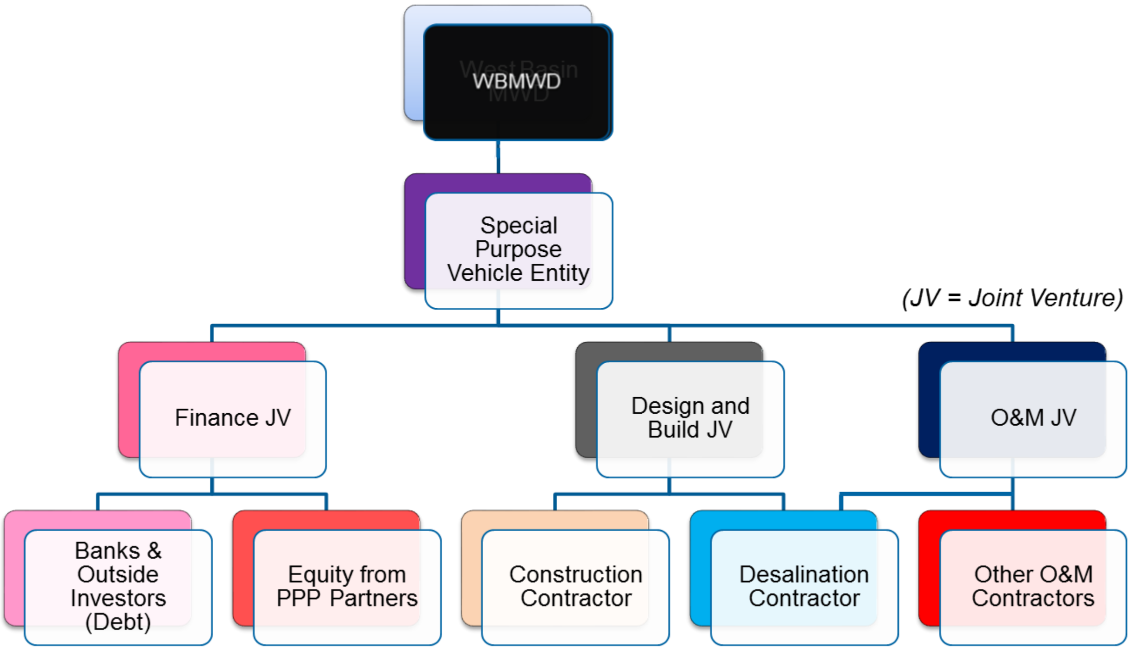


Figure III-8 Key aspects of PPP delivery method

2.4 Procurement Separation for Pipeline

The discussion on delivery models above is focused on the procurement approach for the ocean water desalination treatment facility, ocean water intake system and brine discharge system. These components make up the majority of the capital cost of the OWDP – approximately 90% - and require specialized technologies and contractors with which the District (and most municipal agencies) have limited experience.

The other component of the OWDP is the conveyance system to be constructed inland of the ESGS to deliver potable water produced at the new desalination facility to the local and regional water supply systems. The conveyance system consists of a pumping station and underground buried pipeline. At this early stage of development, the alignment and exact integration points have not been finalized.

The District has more robust experience managing and delivering capital projects similar to the conveyance system and has valuable local knowledge through its experience connecting new customers to its recycled water system. The District is also experienced at operating and maintaining pipelines. However, it is noted that the District does not currently do this for potable water pipelines which fall under a different regulatory regime than recycled water pipelines. This would require some different certifications for staff.

The District could consider procuring the conveyance system using a different delivery model and contract from the rest of the OWDP by, for example, using a separate DBB contract under District management.

The Carlsbad Desalination Project provided a separate contract and financing arrangement for the conveyance pipeline, but both were delivered within the same PPP contract.

For the purpose of the analysis outlined in this report, the assumption is that the conveyance system is delivered through the same model as the rest of the OWDP. This assumption can be refined in later stages of the project development pathway.

2.5 Evaluation Criteria

Many output parameters can be used to compare project configurations / delivery methods. In this analysis, the following parameters were used as the criteria to assess the financial performance of a particular option:

Net present cost, NPC ($ million)

- The discounted annual cash flows over the whole Project timeframe, including the construction and operating phases, including financing.
- Lower NPCs are favorable to Project viability and capture whole-of-project impacts.

Cost of water over time as dollar per acre-feet ($/AF)

- Profile of the unit cost of desalinated water each year over the project life.
- Equivalent to the annual project cash flow divided by annual water production.
- Shows how cost of water changes each year which has implications for equity between current and future water customers.
- Cost of water in each year can be compared to equivalent cost of water from MWD imported supply (the No-Project alternative).

3 Project Parameters and Assumptions

3.1 Introduction

This section summarizes the inputs used in the cash flow model for the OWDP. The inputs fall into three categories:

1. Project-specific assumptions – capital and operating costs and project timing, for each Project Design evaluated.
2. Financing assumptions – includes public and private financing options, debt and equity repayment terms, and the overall weighted average interest rate, which vary depending on the delivery model chosen.
3. Global assumptions – aspects like inflation, power price, rebates, commodities, etc., which apply irrespective of the type of desalination project design (i.e. Current Project Design or Subsurface Intake Design) and delivery model.

These inputs are discussed in detail in the subsequent subsections, with a summary provided in Table III-1. Assumptions related to the cost of imported water from MWD are discussed in Section 4.

Table III-1 Summary of cash flow model base estimates

Parameter	Values		Comment
	Current Project Design	Subsurface Intake Design	
Project-specific assumptions			
Total CAPEX	$514 million	$740 million	2019 dollars
Fixed O&M	$4.3 million/yr	$4.6 million/yr	2019 dollars, escalates with inflation
Variable O&M	$0.18 / 1000 gal		2019 dollars, escalates with inflation
Power consumption	13 kWh/1000 gal	13.2 kWh/1000 gal	
GHG emissions	11,000 $MTCO_2e$/y		Qty of offsets purchased
R&R	$4.3 m/yr		2019 dollars
Construction period	2025-27	2022-24	3-yr period
Operation period	2028-57	2025-54	30-yr period
Financing assumptions (for each of the delivery models)			
DBB	Weighted average interest rate = 4.5% Repayment period = 30 yrs		Fully public debt financed through municipal bonds
DBOM	Weighted average interest rate = 4.5% Repayment period = 30 yrs		Fully public debt financed through municipal bonds
DBFOM-10%	Weighted average interest rate = 4.83% Repayment period = 30 yrs		Combination of public financing (municipal bonds) & private finance (debt and equity)
DBFOM-50%	Weighted average interest rate = 6.15% Repayment period = 30 yrs		Combination of public financing (municipal bonds) & private finance (debt and equity)
DBFOM-100%	Weighted average interest rate = 7.8% Repayment period = 30 yrs		Fully privately financed (debt and equity)
PPP	Weighted average interest rate = 7.8% Repayment period = 30 yrs		Fully privately financed (debt and equity)

Parameter	Values		Comment
	Current Project Design	Subsurface Intake Design	
Global assumptions			
Power price	$0.12 per kWh		Nominal price in 2023
Power escalation	4% (nominal)		
GHG offset price	$20 per $MTCO_2e$		Nominal price in 2023
GHG offset price escalation	4% (nominal)		
MWD rebate	Option A		*$340/AF for first 25 yrs of plant operation*
Public grants	$0		Conservative assumption
Inflation	2.5%		Consumer price index
Capital cost escalation	3% (nominal)		
Residual value	$0		Conservative assumption
Discount rate	3.5%		

Note: Details and discussion on the assumptions contained in this Table are included in the rest of Section 3.

Blue shaded boxes appear throughout the rest of this section which relate the broader discussion points to the specific input values used in the OWDP cash flow model.

3.2 Project-specific Assumptions

Chapter II in the Study shows updated capital and operating cost estimates for the Current Project Design and Subsurface Intake Design . Refer to that Chapter for further information on the basis for the estimates. Below we summarize the key findings.

3.2.1 CAPEX

Table III-2 below shows the capital cost estimate for the Project Designs. The higher capital cost for Subsurface Intake Design is driven by the additional approx. $130 million to build the offshore Subsurface Intake compared to the open-water intake for the Current Project Design.

As discussed in Chapter II, during 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.

Note that this is a Class V estimate with a typical accuracy of L: -20% to -50%, H: +30% to +100%.

Table III-2 Class V Capital Cost Estimates ($ million, 2019 dollars)

Capital Cost Components	Current Project Design	Subsurface Intake Design
Construction Costs		
Total direct costs	$304	$444
Total indirect costs (excl. contingency)	$94	$136
Contingency (25%)	$99	$144
Total (rounded)	$498	$725

Capital Cost Components	Current Project Design	Subsurface Intake Design
Biological Mitigation		
Upfront costs	$11	$11
Permitting costs		
Upfront costs	$6	$4
TOTAL CAPITAL COSTS (rounded)	**$514**	**$740**

Based on the size of the facility and the site constraints at the El Segundo site, GHD expects a construction period of three years. The model assumes a flat capital expenditure (CAPEX) cash flows during the three years of construction. It is assumed interest is charged each year on the CAPEX to date. The financial modelling assumes the first year of loan repayment is the first year of plant operation.

3.2.2 Operating Costs

Operating costs were discussed in detail in Chapter II. For the purpose of the cash flow modelling, operating costs are grouped into the categories as described in the Table below. This Chapter III builds upon Chapter II by modelling operating costs in greater detail and assessing the significance of each operating cost item. The Table below presents the underlying baseline assumptions for each item.

Table III-3 Operating Cost Assumptions (2019 dollars)

Item	Description	Current Project Design	Subsurface Intake Design
Fixed O&M	*Includes maintenance costs, operator labor, annualized RO membrane replacement costs, other (e.g. insurance, performance bonds), NPDES monitoring at brine discharge point, and State Lands Lease for intake and discharge facilities.*	$4.3 million/yr Assumed to escalate at inflation rate.	$4.6 million/yr Assumed to escalate at inflation rate.
Variable O&M	*Costs for chemicals and sludge disposal that depend on the volume of water treated. Does not include power costs.*	$0.18/1000 gal ($1.3 million/yr at full production) Assumed to escalate at inflation rate.	
Power costs	*Electricity costs. Modelled as an average annual variable cost ($/kWh) dependent on volume of water treated. In reality, there will be a fixed component to the power cost but will depend on the final contractual arrangements with power supplier.*	13 kWh/1000 gal (90.2 GWh/yr) Refer Section 3.4.1 for discussion of power prices.	13.2 kWh/1000 gal (91.5 GWh/yr) Refer Section 3.4.1 for discussion of power prices.
Greenhouse gas offsets	*Costs to purchase GHG credits to fulfil regulations requiring the project to be net carbon neutral compared to importing water from MWD.*	11,000 MTCO2e/yr to be offset Refer Section 3.4.2 for discussion of GHG offset price scenarios.	
Rehab and replacement (R&R)	*Costs for replacement and other works on assets at their end of life, or to extend their operational life. The R&R allowance described here only applies to main process units in treatment facility onshore. (Differences between the seawater intake infrastructure between Current Project Design and*	~1% of onshore plant CAPEX per yr ~$4.3 million/yr Assumed to escalate at inflation rate.	~1% of onshore plant CAPEX per yr ~$4.3 million/yr Assumed to escalate at inflation rate.

	Subsurface Intake Design are captured in the risk analysis.)		

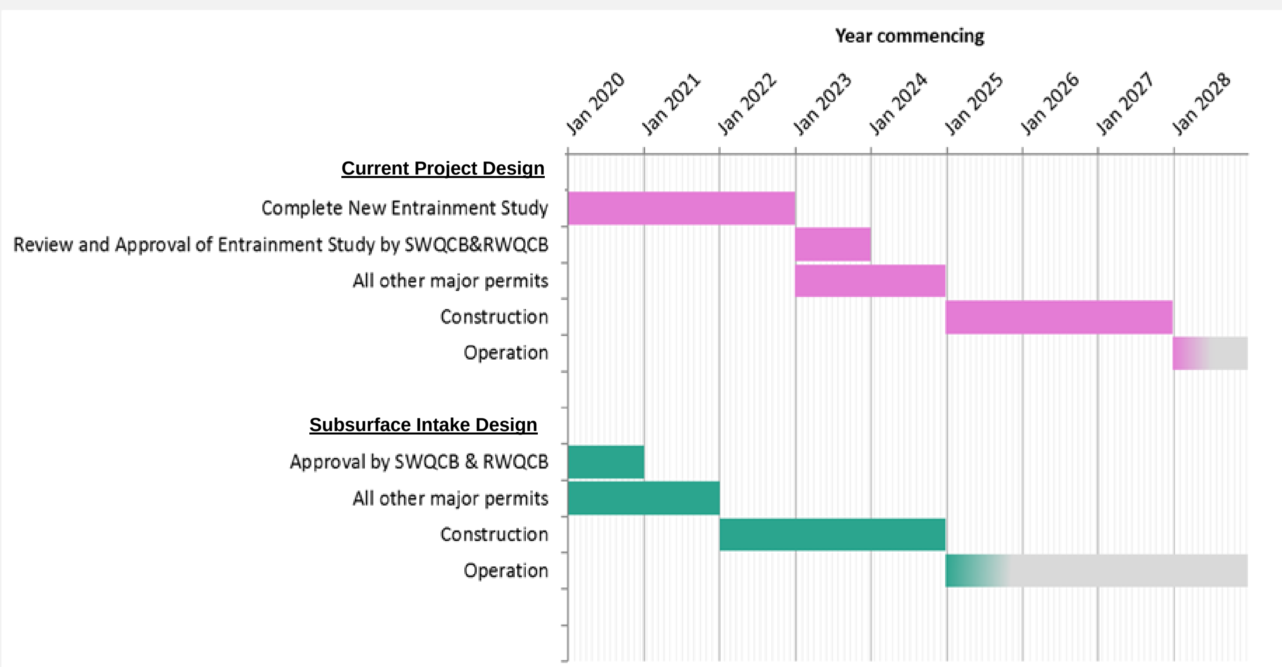
For both Project Designs, a 20 MGD treated water output is assumed with 95% availability. The total output of the plant each year is therefore 6,935 million gallons (21,283 acre-feet per year, AFY). It is assumed full production output is achieved in the first year of production (i.e. no ramp-up period is needed).

3.2.3 Project Timing

Due to differences in the permitting pathway for the two Project Designs, the required time before construction can commence is likely to be significantly longer for the Current Project Design. For this analysis, the modelling includes timing assumptions below in Table III-4.

Table III-4 Timing Assumptions for Each Project Design

Timing Parameter	Current Project Design	Subsurface Intake Design
First year of construction	2025	2022
Construction period	Beginning 2025 – end 2027	Beginning 2022 – end 2024
First year of operation	2028	2025
Final year of operation for 30-yr asset life	2057	2054
Assumed pathways to operation (refer Chapter II for full detail):		



3.3 Financing Assumptions

3.3.1 Public Financing

Overview

There are several possible funding sources available to the District:

- Municipal financing vehicles including combinations of revenue-bonds, short term credit notes, general obligation (GO) bonds and certificates of participation.
- Drinking Water State Revolving Fund (DWSRF).
- Water Infrastructure Finance Innovation Act of 2014 (WIFIA) loan.

These funding sources are discussed further below.

The weighted average interest rate used in the cash flow model for municipal financing is 4.5%, representing an indicative weighted cost of debt through a combination of municipal bond instruments.

A sensitivity scenario is presented showing the favorable impact on the project if a DWSRF loan is received for 50% of the project CAPEX, with an assumed DWSRF interest rate of **1.8%**.

Municipal Bonds

CH2M's work in 2016-17 (refer to Section 1.5.1) included a municipal financing workshop held in conjunction with the District and PFM Financial Advisors LLC, the District's municipal advisor.

The outcome of that work was to adopt a weighted average interest rate of 3.5% for public debt. This interest rate was described as the "average of the several municipal bond market debt options modelled by PFM Financial Advisors LLC at the time of the municipal funding workshop" in July 2016. This could include revenue bonds, short-term credit notes, GO bonds, etc.

Broadly, US long-term fixed-maturity public and municipal bonds saw increases in interest rates from mid-2016 through late 2018 with some reduction in rates during 2019.

GHD understands a long-term municipal bond interest rate in the range of 4 to 4.5% is currently reasonable for financial planning purposes. For conservatism, the base estimate adopted is 4.5% – this has been verified by District staff.

GHD is not a registered Municipal Advisor as defined in Section 975 of the Dodd-Frank Wall Street Reform and Consumer Protection Act and does not provide advice regarding sale or purchase of specific municipal securities. At later stages of project development more accurate and up-to-date information should be obtained from a registered municipal advisor, such as PFM Financial Advisors LLC.

It is also noted that the interest rate adopted for the analysis should represent the interest rate received *when the bonds are issued*, which is expected to be several years away. This introduces extra uncertainty into this assumption.

State Revolving Fund Loans

There are two State Revolving Funds of interest: the Drinking Water State Revolving Fund (DWSRF) and the Clean Water State Revolving Fund (CWSRF).

Both funds are managed by the California State Water Quality Control Board (State Water Boards) and provide loans for capital and start-up costs at a highly competitive interest rate.

The DWSRF *"assists public water systems in financing the cost of drinking water infrastructure projects needed to achieve or maintain compliance with Safe Drinking Water Act (SDWA)"*. The key details of the DWSRF loan are:

Projects can receive DWSRF loans if they meet certain eligibility requirements[7]. In GHD's experience, it is very likely the OWDP will satisfy these eligibility requirements. This is evidenced by the fact DWSRF loans have been provided to other desalination projects in California including full funding of the $60 million reactivation of the Charles E. Meyer desalination facility in Santa Barbara in 2016, and the proposed Doheny Desalination Project in Orange County has been placed on the DWSRF's Comprehensive List after passing eligibility requirements for DWSRF. Therefore, it is likely that the OWDP will meet the DWSRF eligibility requirements, subject to the restriction on ownership discussed below.

DWSRF loans are restricted to public and privately-owned community water systems, municipal agencies and water systems and non-profit mutual water companies. Therefore, the Project is only eligible for the DWSRF loan if delivered through a method in which the District retains ownership of the OWDP.

Therefore, the OWDP would not be eligible for DWSRF funds if a PPP or DBFOM-100% delivery model is adopted. It is certainly eligible under a DBB or DBOM delivery model (with the Charles E. Meyer Desalination Facility in Santa Barbara as a precedent). If the conveyance pipeline was delivered under a separate DBB or DBOM contract, it alone would be eligible. It is unlikely that a DBFOM-50% or DBFOM-10% would be eligible.

If received, the loan is subject to a fixed interest rate, calculated as "*50% of the average interest rate paid by the state on Californian GO Bonds issues in the prior calendar year."* An agency's credit rating does not affect the interest rate offered. Figure III-9 shows historical DWSRF Loan rates offered. In the past decade State Revolving Fund (SRF) interest rates have ranged from 1.4% to 2.6%. The rate in 2020 was the lowest since 2000, set at 1.4%.

A key benefit of the DWSRF is this highly competitive, below-market interest rate, which is well below the financing available to the private sector. In addition, fixing the interest rate reduces exposure of the Project to macroeconomic uncertainty.

The DWSRF loan repayment period has recently been increased to 30 years or up to the commercial life of the asset[8] (it was previously restricted to 20 years), commencing the first year after construction is completed. Two interest-only payments are required per year during the construction phase, starting when payments are disbursed. Once construction is completed, thereafter an annual payment is made on principal and interest.

An indicative interest rate of 1.8% and repayment term of 30 years was adopted for modelling the DWSRF loan sensitivity scenario.

It is important to note that DWSRF eligibility does not guarantee that the loan will necessarily be granted, or, if granted, completely fund the project. DWSRF funding is conditional on fund availability and competition between other projects seeking funding. In GHD's view it is unlikely that the DWSRF fund would provide loans to the full value of the relatively high OWDP capital cost.

For this reason, the DWSRF sensitivity scenario assumes the DWSRF loan will cover 50% of the project capital cost, with the remainder of funding coming from municipal bonds issued by the District.

[7] Further info - *http://www.waterboards.ca.gov/drinking_water/services/funding/dwsrf_basics.shtml*
[8] 2018 DWSRF Intended Use Plan: *https://www.waterboards.ca.gov/drinking_water/services/funding/documents/srf/2019_20_dwsrf_iup_finaldraft.pdf*

The typical period for the loan approval process is 6 – 9 months, once all parts of the application are completed. Having all necessary permits in place (to the extent possible) and having the project "shovel ready" greatly assists the approval process

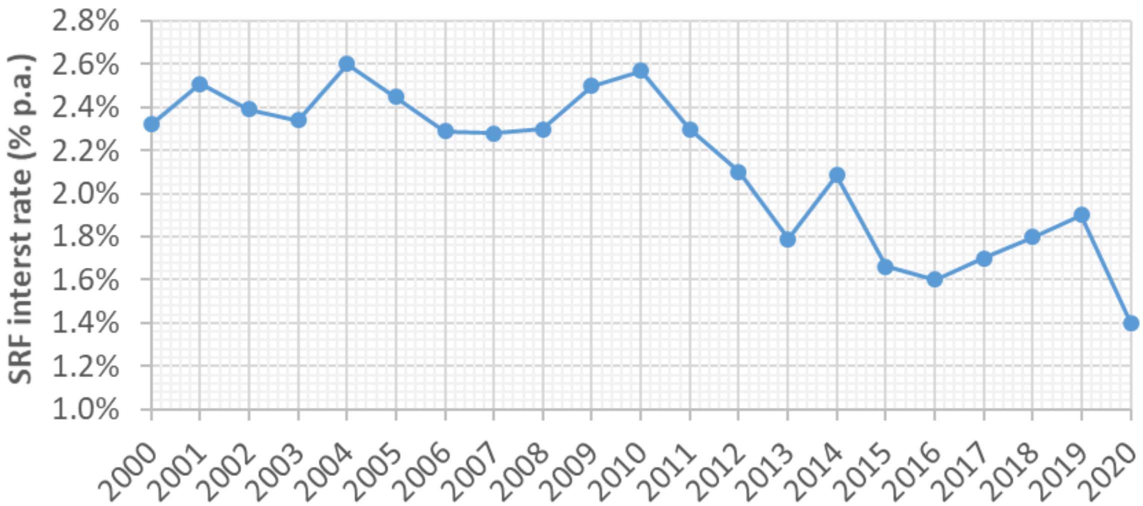


Figure III-9 Historical Interest Rates Offered by the DWSRF and CWSRF Loans

There is also a separate Clean Water SRF managed by the California Water Boards. The CWSRF program provides financial assistance for projects that prevent pollution of State waters. It has different goals and eligibility requirements to the DWSRF, but offers loans at the same interest rates shown in Figure III-9.

Desalination projects generally do not meet the eligibility requirements for the CWSRF program (unless it can be proven that it will somehow benefit the quality of groundwater) and in GHD's experience, the CWSRF will not be an attractive funding target for the OWDP.

WIFIA Loans

WIFIA of 2014 established the WIFIA program[9], a federal credit program administered by the Environmental Protection Agency (EPA) for water and wastewater infrastructure projects. WIFIA financing is available to all Projects eligible for the DWSRF.

From the WIFIA website and FAQs, the following key points are noted:

- WIFIA funding is for projects led by either public or private sector – therefore it could provide some portion of the public financing in any of the delivery methods.
- WIFIA funds can only be provided for a maximum of 49% of the eligible project CAPEX. It appears that most of the CAPEX included in the project cost estimates would be eligible.
- There is a limit on total federal funding involvement if WIFIA loans are utilized. This provision caps total federal funding at 80% of the total CAPEX, and capitalized SRF funds are subject to this limit. For example, for a DBFOM-50%, a potential funding structure may be 40% WIFIA, 10% SRF or municipal bonds, and 50% private funding.

[9] For further information, refer to https://www.epa.gov/wifia/learn-about-wifia-program#overview

- Repayment of the loan can be deferred up to 5 years. Beyond that, the EPA has flexibility to structure repayment to best match the cashflow of the project in question. EPA and prospective borrowers will negotiate the repayment schedule for each project, and it will be included in the credit agreement. Loan repayment is up to 35 years or the useful life of the project.
- The interest rate offered in a WIFIA loan is calculated as "equal to or greater than the yield on U.S. Treasury securities of comparable maturity on the date of execution of the credit agreement. The base interest rate can be identified through use of the daily rate tables published by the Bureau of the Fiscal Service for the State and Local Government Series (SLGS) investments". The current equivalent interest rate is approximately 2.3% p.a and as a rule of thumb has been consistently around 1% higher than DWSRF loan interest [10].

To May 2020, the WIFIA program has provided funding to 19 projects[11], none of which has been a desalination facility, however desalination facilities do meet WIFIA application criteria. Of note:

- In 2018, a $135 million loan was provided by WIFIA to the Orange County Groundwater Replenishment System expansion project.
- In 2019 the Doheny Desalination Project (South Coast Water District) passed the first round of screening by WIFIA.
- In 2018 the Carlsbad Intake Project (Poseidon Water) passed the first round of screening by WIFIA, but chose not to proceed with a loan due to the expedited scheduling for commencement of intake construction that could not be met under WIFIA guidelines. They are considering participation in a later round of WIFIA funding.

Because the interest rate offered by the WIFIA program is within the range of the two public financing options that will be modelled (municipal bonds and DWSRF program), cash flow modelling results have not been explicitly shown for the WIFIA program, but will be in between those two.

Senate Bill 628

Senate Bill 628 was briefly reviewed for applicability as a funding option for the OWDP. Senate Bill 628 was enacted in 2014 and allows:

- Local cities and counties to form Enhanced Infrastructure Financing Districts (EIFD's) to finance infrastructure projects. EIFD's can consist of *multiple* cities and/or counties that do not have to be contiguous as long as they share a common infrastructure goal. The EIFD may be formed for up to 45 years.
- The EIFD to adopt an infrastructure financing plan and issue bonds for which only the EIFD is liable, upon approval by 55% voters (those within the new EIFD). The bonds can be used to finance public capital facilities (including water infrastructure amongst many other examples).
- Allows for the EIFD bonds to be repaid using incremental property tax revenues ('tax increments') – i.e. assumes that the capital facility increases land values and thus generates greater revenues through property taxes.

The EIFD framework is analogous to, but not a replacement for, the now-defunct Redevelopment Agencies (RDA).

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[10] https://www.treasury.gov/resource-center/data-chart-center/interest-rates/Pages/TextView.aspx?data=yield

[11] https://www.epa.gov/newsreleases/epa-receives-record-number-letters-interest-wifia-water-infrastructure-loans-0 & https://www.epa.gov/newsreleases/epa-provides-202-million-loan-modernize-baltimores-wastewater-infrastructure

GHD does not believe that the passage of Senate Bill 628 provides any feasible financing alternatives for the District to fund the OWDP. This is because:

- The District does not collect property taxes and would therefore need to negotiate with all of its member customer city and customer county agencies to form the EIFD, and collect incremental property taxes.
- The OWDP is likely to have neither predictable nor material impacts on property values in the service area, making this a riskier financing mechanism.
- The District would be required to relinquish some control of the project, which among many things, would be detrimental to the current project schedule proposed.

3.3.2 Private Financing

Overview

In DBFOM and PPP project delivery methods, the private sector would contribute to financing the project and a number of factors will influence the effective interest rate charged to the District for their portion of the financing.

The weighted average interest rate for private financing is estimated at **7.8%** based on:

- 70% to 30% private debt-to-equity ratio
- Cost of equity of 15% based on the private sectors expected IRR
- Cost of private debt at 6%

30-year repayment term is assumed.

Debt to equity ratio

The percentage of debt and equity financing for a project can vary depending on the strength of the credit structure of the project and its participants. A reasonable range for debt to equity would be 60% / 40% for conservatively leveraged projects, to 80% / 20% for more highly leveraged projects. The North America Development Bank ("NAD Bank") uses a standard structure of 75% / 25%.

A ratio of 70% / 30% is reasonable for the proposed OWDP project depending on the strength of the fixed price and project completion obligations under the construction contract. The Carlsbad project used 18% equity to 82% debt in its capital structure.

Internal rate of return on equity

Private equity financing involves the contribution of funds by an investor in exchange for partial ownership of the special purpose company formed to build, own and operate the desalination plant. The internal rate of return (IRR) sought by equity participants in the PPP will vary depending on the strength of the project's participants, its contractual structure and perceived risk of the project's contractual and financial structure.

These equity investments are generally made by private equity firms, venture capital firms, or, in certain early stages of a project's development, an angel investor. Also prominent in the equity pool of funds are companies that have a strategic interest in the success of the project. These may include a range of design-build contractors, contract operators, large equipment suppliers, and in certain circumstances, companies that rely on the product off-take from the project. Private equity investments in infrastructure have grown considerably since the late 1990's.

In the case of the Carlsbad project, for example, Stonepeak Infrastructure Partners provided approximately $167 million in equity for the project (approx. 18% of the project's capital cost).

Generally, the IRR demanded for equity contribution ranges from 9%-15%. Poseidon Water's target IRR for the Carlsbad project was at the lower end of this range, at 9.45% - it is understood that this IRR was low compared to market conditions and was due to a set of circumstances unique to Poseidon and the project, and was noticeably below industry standard. Therefore, the Carlsbad IRR is not taken as a 'benchmark' for future projects such as the OWDP.

Debt interest rate

The SPV set up to finance the project can secure debt from the market (i.e. banking sector and project private or public bond placements) to leverage its equity stake in the Project. Alternatively, financing may be secured through 'private-activity bonds (PABs)', which are a type of municipal bond issued by a public agency on behalf of a private entity. Unlike with a traditional municipal bond, payment of the principal and interest on these PABs is the responsibility of the private entity, not the public agency that issued the bond.

Generally, the interest on PABs can be taxed whereas other municipal bond interest is tax-exempt. However, certain "qualified" PABs are afforded special status in the tax code and are tax-exempt if the projects they support meet public-interest criteria. The Carlsbad Desalination Project was financed with $734 million in tax-exempt bonds issued by the California Pollution Control Financing Authority on behalf of Poseidon and the San Diego County Water Authority.

Tax-exempt PABs typically have a lower interest rate than the market rate for comparable taxable bonds, and therefore reduce financing costs. The interest rate for tax-exempt PAB's received would be comparable (say 0.05% more) than municipal bonds.

Tax-exempt PABs are a useful vehicle for private-sector finance to achieve attractive financing terms that are competitive with funding sources available to municipal agencies. However, the availability of PABs is limited. California has an annual cap of PABs for statewide projects, and these are normally allocated towards social infrastructure, particularly public housing projects. It is viewed that Poseidon's ability to obtain PABs to finance the Carlsbad Desalination Project was a unique convergence of circumstance and PAB availability made possible because of the 2008 recession-induced collapse of housing construction at the time of that project.

PABs should not be considered as a definite source of private-sector debt for the OWDP. Their availability is uncertain at best.

Projects that are structured with private debt financing that is *not* tax-advantaged will require interest rates in the 6%-8% range for debt terms of 25-30 years.

3.3.3 Funding Mix for each Delivery Model

The five delivery models investigated in this analysis each have a different mix of public and private financing, resulting in a different weighted average interest rate for each model as summarized in Table III-5.

Table III-5 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)	Intere st 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 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.

3.4 Global Assumptions

3.4.1 Power Costs

Overview

Electricity costs are a large component of the total operating costs of desalination projects and are dependent on the electricity price and the electricity consumption of the plant.

The electricity price is difficult to predict into the future. It is a function of the base price (i.e. the price negotiated with an electricity supplier at the start of the project) and its escalation over time.

In practice, electricity supply agreements usually include a fixed supply charge and variable charge based on electricity consumption. This analysis does not distinguish between the two and instead models the electricity price as a combined cost per amount of electricity consumed in Kilowatt hours ($/kWh). This simplification is consistent with the expectation that, when built, the OWDP facility will be operated as a base load facility with an anticipated 95% on line time at full capacity (equates to ~ 19 days per year that the Plant is offline). Note that higher fixed charges result in higher financial consequences if the facility is built but not operated (e.g. demand risk, maintenance downtime).

As shown in Figure III-10, higher electricity prices will have a negative impact on all Southern California potable water supply options, especially MWD imported water deliveries via the State Water Project (which is relatively energy intensive). However, desalination is the most energy intensive supply option and will suffer the most from rising electricity prices per unit of water.

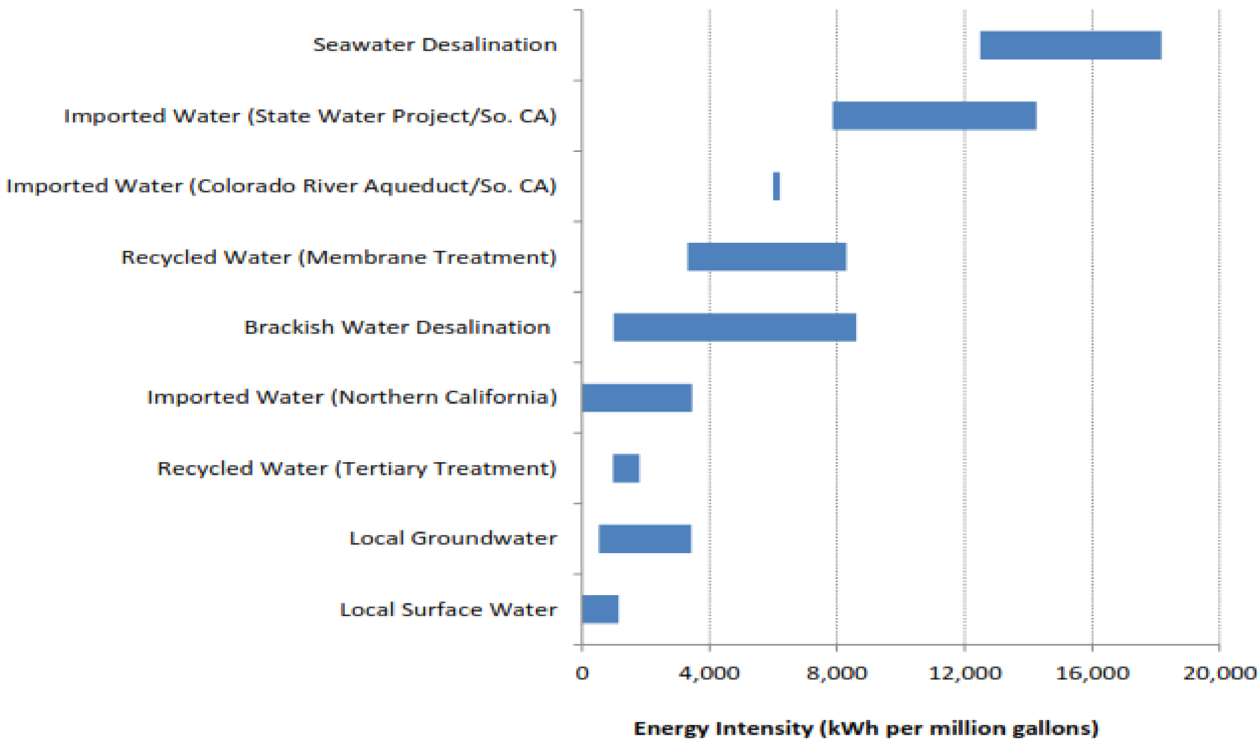


Figure III-10 Comparison of energy intensity of water supply sources for California [12]

Price and Escalation Estimation

GHD estimated the average cost of electricity for the OWDP based on 2019 tariff schedules from Southern California Edison (SCE), the electricity provider in the area. Using the Large Customer Real Time Pricing tariff schedule (TOU-8-D-RTP, above 50 kV) and assuming a simplified flat energy consumption profile over each hour throughout the year, the calculated average cost of energy is $0.097 per kWh. Full calculation procedure is shown in Appendix D.

US Energy Information Administration data shows that residential electricity prices in California are consistently above the US average and have increased at a rate three times more than the US average between 2011 and 2017. See Figure III-11 for a comparison on 2018 data.

The key driver of price and growth has been the high penetration of renewable energy sources in line with the California Renewables Portfolio Standard (RPS) which now mandates 60% renewable portfolio for the State by 2030 and 100% renewables by 2045.

[12] Source: *Key Issues for Seawater Desalination in California - Energy and Greenhouse Gas Emissions* (Pacific Institute, 2013): http://www2.pacinst.org/wp-content/uploads/2013/05/desal-energy-ghg-full-report.pdf

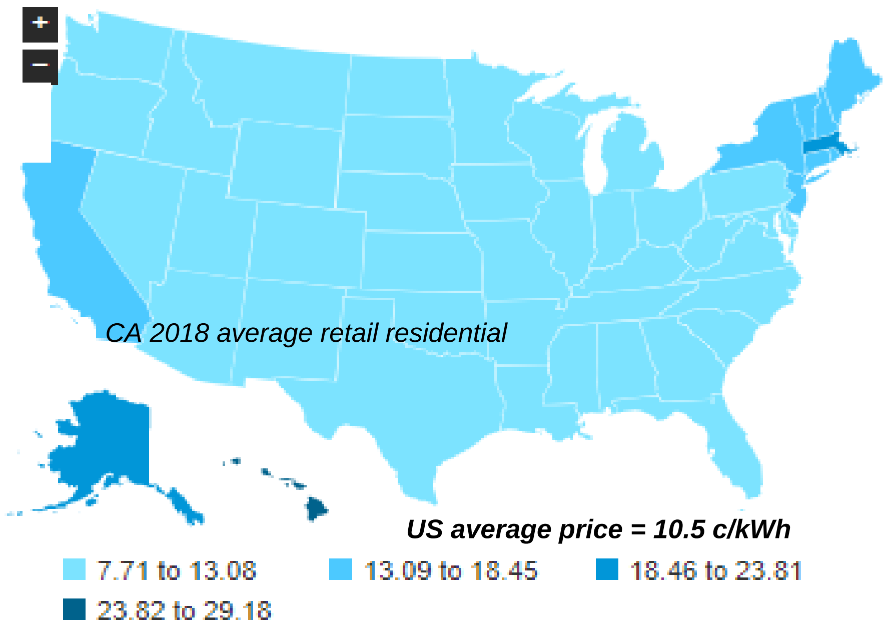


Figure III-11 California residential electricity prices 2018 relative to US average[13]

Industrial rates in SCE's service area and California have escalated at around 2 to 3% between 2014 and 2019. However, there is continued uncertainty as to future escalation rates with most market views pointing to higher escalation rates than the past few years. The forecast for the imported water cost, published by MWD, assumes 4% escalation.

Based on the discussion above, an average annual power cost escalation of **4% (nominal)** has been included in the OWDP cash flow model. The starting power cost estimate is $0.10 per kWh, applicable in 2019. Applying the escalation rate, this yields an estimate of **$0.12 per kWh in 2023**.

3.4.2 GHG Offset Prices

In Chapter II, it was estimated that the OWDP project will result in a net GHG emissions increase of 11,000 metric tonnes of CO2 equivalent per year (MT/yr) – that is relative to the 'No-Project' scenario which includes the emissions associated with pumping the same quantity of imported water through the MWD imported water system.

The cash flow modelling assumes the entire net emissions increase will be offset through purchase of carbon credits through the California Cap-and-Trade Program. In December 2018, the California Air Resources Board (CARB) approved a set of reforms for the post-2020 period. Key reforms include an addition of a price ceiling, the two allowance price containment reserve tiers below the price ceiling, no sustained free allocation, and reduced use of offsets. These reforms came into force in April 2019. These changes were the result of legislative direction for AB 398 which clarified the role of the program in achieving the state's 2030 GHG emissions reductions goals.

The historical market cost of carbon-offset credits is shown in the figure below and demonstrates relatively flat pricing since 2013 when the program was officially launched. The most recent auction in February 2020 saw similar prices to 2013, at around $17-18 per MT (refer Figure III-12).

[13] Energy Information Administration, State Electricity profiles - https://www.eia.gov/electricity/state/

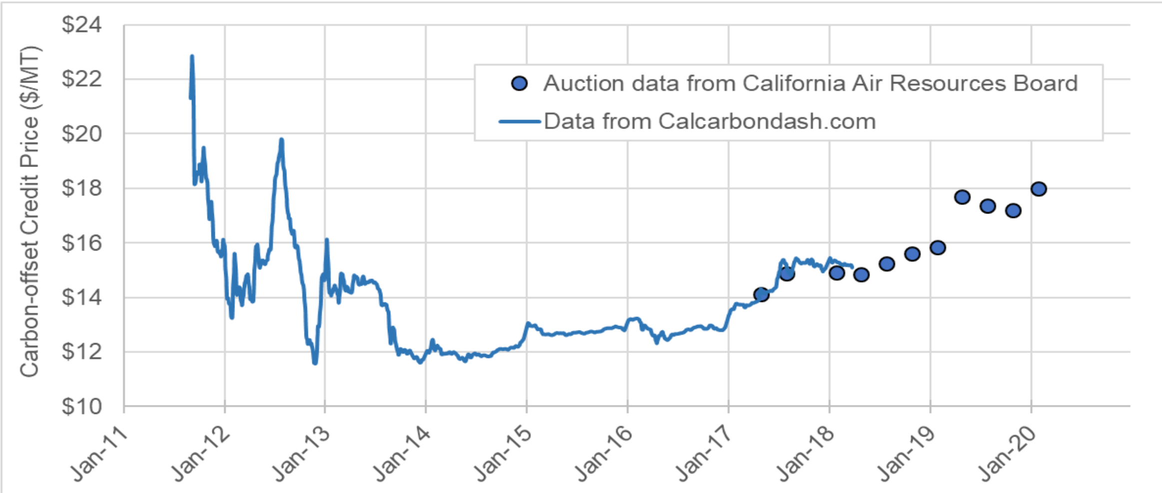
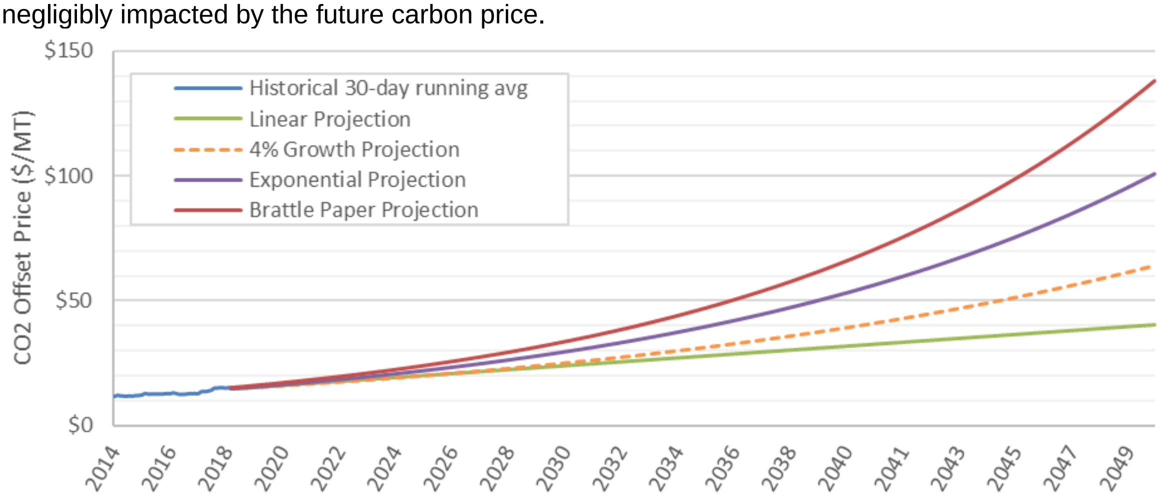


Figure III-12 Historical Daily Carbon-offset Credit Price - California

It is difficult to forecast future offset prices given their sensitivity to regulatory drivers and demand and supply factors, such as political and societal pressure, oil prices and proposed renewable energy projects in the state. Simple linear, exponential or percent growth extrapolations result in different GHG offset prices to 2050.

An analysis by the Brattle Group in Dec 2017[14] developed a range of projections for California's GHG offset prices, and their estimate based on 'current trends' is shown in Figure III-13 below, along with other projection types. This 'current trends' scenario estimated a GHG offset price of $130/MT in 2050, and is in the middle of a range of $95 to $190/MT in 2050 based on different scenario types developed by Brattle Group.

GHG projections change markedly between years and scenario assumptions. GHD has adopted a 4% annual growth rate for simplicity. The sensitivity analysis in Section 5.6 shows that the financial outcomes of the project are negligibly impacted by the future carbon price.



[14] The Future of Cap-and-Trade Program in California: Will Low GHG Prices Last Forever?, Brattle Group, 2017 - https://brattlefiles.blob.core.windows.net/files/11768_the_future_of_cap-and-trade_program_in_california_final_12.4.17.pdf

Figure III-13 Projections of offset pricing (Brattle Paper)

For the purpose of this analysis, GHD has adopted an annual escalation rate of **4% (nominal)**, illustrated by the orange dotted line in the figure, which includes a starting price of **$20/MT in 2023**.

3.4.3 MWD Rebate

Through its Local Resources Program (LRP), MWD offers a water production rebate to water districts for undertaking local water recycling, desalination and groundwater recovery projects that offset a demand for water on MWD and increase water supply capacity and reliability of the MWD service area. In 2019 MWD's Board established a local supply target under the LRP of 170,000 AF of new supplies. More than 50% of that target is currently available to eligible projects. This analysis assumes the LRP Program will have available funds for the OWDP Project at the time of project execution.

There are three rebate options offered by MWD:

1. **Option A** – Sliding scale $340/AF of water produced from the OWDP facility, for the first 25 years of plant operation.
2. **Option B** - Sliding scale $475/AF of water produced from the OWDP facility, for the first 15 years of plant operation but the District is obligated to operate and produce water for the full 25-year term of the agreement.
3. **Option C** – Fixed $305/AF of water produced from the OWDP facility, for the first 25 years of plant operation.

For Options A and B, the 'sliding-scale' refers to the mechanism whereby MWD will only pay an amount each year such that the cost of water from the desalination plant (on a per acre-foot basis) is above or equal to the cost of water from MWD.

For example, if the Option B $475/AF rebate option is chosen, and:

- In Year 2027 the projected MWD water price is $1,456/AF (as discussed later in Section 4); and,
- The cost of desalinated water (i.e. operating costs + capital repayments) from the OWDP in that year is $1800/AF; then,
- MWD will not pay the full rebate amount of $475/AF to the District in 2027. Instead, they will pay a maximum of $344/AF of water produced ($1800 subtracting $1456/AF).

For Option C, the full rebate amount is provided irrespective of the cost of water from the OWDP. So different timing of costs and different choices of MWD rebate lead to different outcomes.

The financial analysis shows Option A provides the most value to the District on a net present cost basis for all scenarios (refer to Section 5.3 for the analysis).

The MWD rebate (LRP) Option A has been included in the base estimate for the cash flow model.

3.4.4 Grants

There are a number of grants available through various bodies that contribute funds upfront to the project – i.e. they do not require repayment and essentially reduce the total amount of money needed to finance the project.

Some promising grant prospects are discussed below but it must be noted that they tend to be selective in nature and application requirements, criteria for selection, and amount of funding are subject to change.

No grant funding has been included in the cash flow model, but funding opportunities should be monitored and pursued as the OWDP project develops further. It should be noted that due to eligibility requirements, grant funds tend to be more accessible when the project is owned by a public agency rather than the private sector. Therefore, the PPP delivery model will limit access to grant funding compared to DBB, DBOM and DBFOM models.

Department of Water Resources

A grant is available from California Department of Water Resources for water supply projects. The Desalination Grant Program specifically funds desalination projects. This grant is administered through the SRF body and now utilizes Proposition 1 (2014) funds potentially available funds from Proposition 50. Grant amounts of up to $10 million may be offered for construction phase projects.

It is understood that the grant is only accessible to municipally-owned Projects[15].

In March 2018, DWR introduced a continuous application program (CAP) for project proponents to apply for funding, on a first ready, first served basis.

The District has successfully received funding through the CAP, for the OWDP Pilot System and OWDP Demonstration Facility. The District also received approval for funds for construction of the OWDP however this was rescinded as construction did not start at the nominated time.

To date, DWR has granted full $10 million grants to several ocean desalination facilities similar in nature to the OWDP and therefore it is an attractive funding source that should be pursued. These include the Doheny Desalination Project and Santa Barbara Charles E. Meyer Desalination Facility Reactivation.

Therefore, the OWDP is likely to be a strong candidate for receipt of Proposition 50 Grant to assist with construction costs, as long as the project is owned by the District (i.e. any delivery model except PPP).

In April 2019 DWR advised it anticipates that the Proposition 1 Water Desalination Grant Program funds under the Continuous Application Process may be exhausted if all the completed applications that have already been submitted to DWR are recommended for grant award. It therefore suspended further applications[16].

The OWDP requires further development prior to applying for the DWR Desalination Grant Program but the availability of funding should be monitored and if available, pursued at a later stage.

Bureau of Reclamation

The US Bureau of Reclamation administers funding under the Water Infrastructure Improvements for the Nation Act (WIIN Act), namely the Desalination Construction Projects program[17].

The program is for sponsors of ocean and brackish water desalination projects to request cost-shared funding for the planning, design, and/or construction of those projects. The recipient must provide at least 75% of the total project costs. Eligible applicants include states, departments of a state, subdivisions of a state, or a public agency organized pursuant to state law – it is unclear if a DBFOM with an element of private finance would be eligible.

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[15] Refer to Slide 6 at http://www.waterboards.ca.gov/water_issues/programs/grants_loans/dwsrf/docs/prop1/dwsrf_prop1_%20presentation.pdf for further info.

[16] https://water.ca.gov/News/Public-Notices/April-19/Water-Desal-Grant-Program-Suspension-Announcement

[17] https://www.usbr.gov/watersmart/desalination/index.html

To be eligible, sponsors must have completed a feasibility study and submitted it to US Bureau of Reclamation for review. The funding is part of WaterSMART, Department of the Interior initiative.

In April 2019, US Bureau of Reclamation made available $12 million with the expectation that two to six awards would be made. As of April 2020 no further updates had been issued.

3.4.5 Inflation

Inflation impacts on all project delivery methods and technical Project Designs. It will also impact the MWD imported supply cost.

Project operating costs are likely to be linked to a localized measure of inflation in the final operating contract. For example, the Carlsbad WPA between San Diego County Water Authority and Poseidon indexed increases in fixed operating charges, variable operating charges and management fees to the San Diego Area CPI.

A constant annual inflation rate of **2.5%** has been included in the cash flow model. This is consistent with the assumption underlying MWD's 10-year forecasts for imported water costs.

3.4.6 Capital Cost Escalation

Capital price escalation reflects increasing construction prices between this analysis and the proposed start of construction, as well as increasing prices during the multi-year construction period of the project. Typically, contractors will provide construction cost estimates in "real" terms and then apply an escalation factor to estimate the delivered cost of the project.

Capital price escalation is distinct from general inflation indicators as it assesses price increases for construction and production inputs rather than consumer prices. However, the two are related since higher inflation will drive project construction prices higher, generally requiring more financing and higher product pricing. Specifically, it looks at cost increases for construction-related labor, materials and equipment.

Inflation indices in the US over the past 15 years have reflected only modest increases in producer and construction pricing. This has led to most projects being structured with a modest 2.5% capital cost escalation factor. For example, Poseidon used 2.5% in its capital cost estimates for both the Carlsbad Desalination Project with the San Diego County Water Authority and the Huntington Beach Desalination Project (~0.5% above prevailing inflation at the time). In addition, Oceanus Water and Power is using a 2.5% escalation rate assumption for its development and construction forecasts for desalination projects in California.

In reality, the capital cost escalation will include the agreements enshrined in the District's Project Labor Agreement in place at the time of construction.

In the cash flow model, annual capital price escalation has been set at **3%**, which is 0.5% above the prevailing general inflation rate.

3.4.7 Discount Rate

The net present value (NPV) discount rate typically reflects the project sponsor's perceived risk in undertaking the project. For the purposes of comparison in this project, since the costs we are evaluating are the District's costs (either through debt repayments, or to the private sector entity), we have used the same discount rate for both approaches.

Discount rates for major Californian water infrastructure projects were generally around 6% before the global financial crisis in 2008[18]. Macroeconomic conditions are significantly different now with discount rates generally lower. The District have advised it typically appraises projects using a discount rate in the range 3 to 5%.

A discount rate of **3.5%** has been adopted to assess the project outcomes.

It should be noted that small differences in the discount rate does not significantly affect the decision between different delivery methods – they all have similar, flat cash flow profiles over the project timeframe.

3.4.8 Treatment of Residual Value

The Project has outgoing costs which occur for 30 years, either to repay debt and operational costs, or to the private sector operators. At the end of the 30 years, the plant and various related assets will still be functional, well maintained and operational, and therefore have an intrinsic value. This analysis assumes that in all delivery methods, the ownership of the assets transfers to the District at the end of the 30-year operational period. Based on that assumption, the residual value of the facility in both project delivery options is the same. Therefore, the assets developed in this project have not been assigned a residual value in the VfM analysis.

However, if the District wishes to compare the desalination project to the MWD rate over an extended time-period (e.g. 40 or 50 years), this residual value should be taken into account. Any such analysis would be challenging given the many uncertainties 30 years into the future and longer.

Residual value has not been included in the financial analysis.

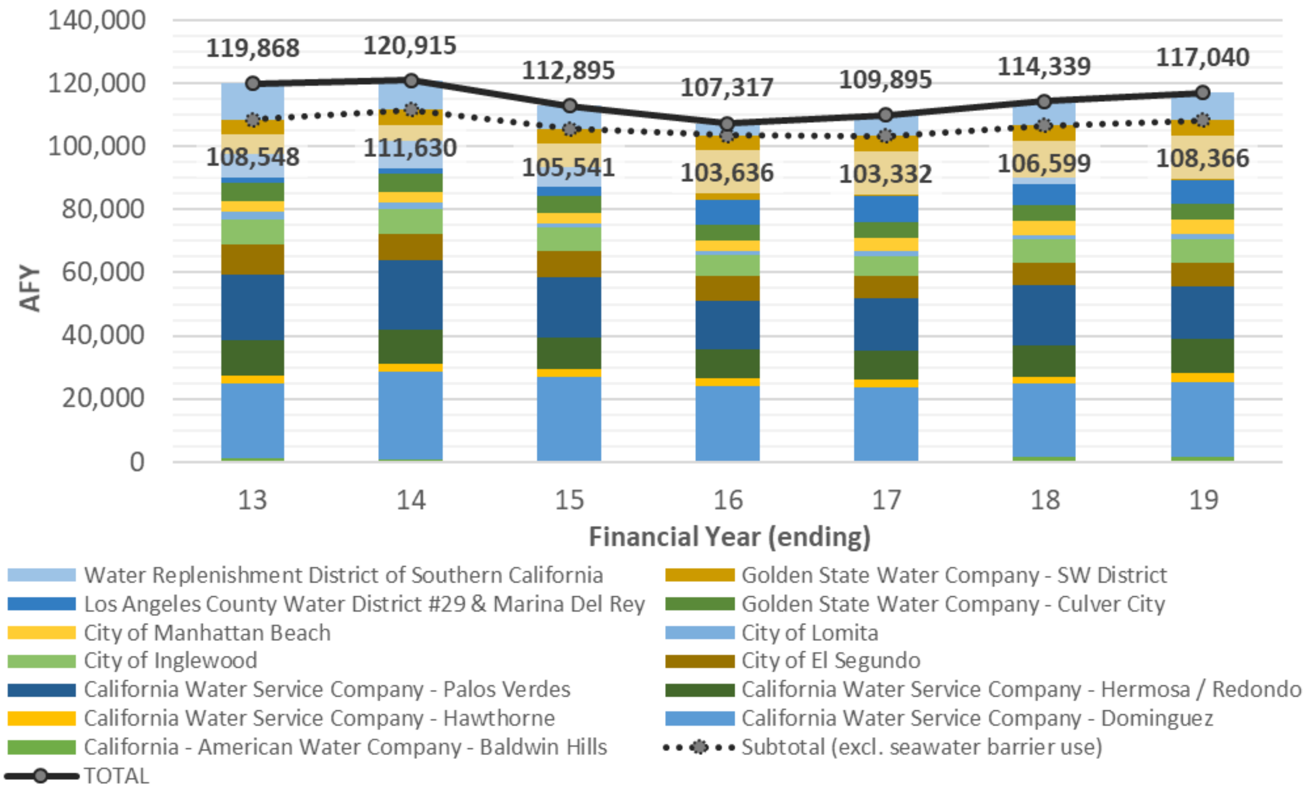
[18] Californian Department of Water Resources *'Economic Analysis Guidebook'* (Jan 2008) - http://www.water.ca.gov/economics/downloads/Guidebook_June_08/EconGuidebook.pdf

4 No-Project Parameters and Assumptions

4.1 Overview

The No-Project alternative involves a status-quo approach in which the District continues to fully import water from the MWD for its potable water needs rather than building the OWDP. Implementation of this alternative assumes that the District would continue to receive potable water supply from the existing sources which make up the District's water supply portfolio.

As described in Section 3, the OWDP facility, if built, would produce 20 MGD (equivalent to 21,283 acre-feet per year (AFY)) of drinking water directly for the District and would reduce the amount of imported water purchased each year by the same amount. With total imported water demand historically in the order of 105,000-120,000 AFY (refer Figure III-14), OWDP production would represent a reduction in the District's imported water purchases of around 18-20%.



Source: West Basin Water Use Report 2018-19; GHD analysis

Figure III-14 Historic District Annual Imported Water Quantities by Customer

The cost of the No-Project alternative is the marginal cost, to the District, of the 21,283 AFY of imported water that will be purchased if the OWDP is not built. The cost components of imported water and future projections are discussed further in the following sections.

4.2 MWD Imported Water Cost Components

The District purchases imported water from MWD and passes on the imported water costs to its customer Retail Agencies. The District also levies its own service charges to the Retail Agencies. Table III-6 below summarizes the components included in the cost of imported water charged by the District, with values shown for FY2019.

The marginal cost of the 21,283 AFY of imported water from MWD is made up of the following two cost components, both levied on a per acre-foot basis:

- MWD Full Service Treated Volumetric Rate
- MWD Readiness-to-Serve Charge

In FY2019, these charges totaled to $1148 per AF.

As shown in Table III-6 there are other charges the District incurs from MWD (e.g. Reliability Service Charge), as well as some charges levied by the District to its Retail Agencies on top of what it pays to MWD (e.g. West Basin Reliability Service Charge). These charges would be levied whether or not the OWDP is built and are not included in the marginal cost of the No-Project alternative.

Table III-6 Breakdown of imported water cost components levied by District (FY19)

Cost component	Description	Charge in FY19 ($/AF)
1. MWD Full Service Treated Volumetric Rate		
Supply (Tier 1)	Cost of securing and maintaining water from State Water Project. *The District uses Tier 1 supply and is not anticipated to use Tier 2.*	$209 / AF
System Access	Costs to support water conveyance and distribution system.	$326 / AF
Power	Cost of energy to transfer water including via relatively energy-intensive State Water Project.	$127 / AF
Stewardship	Costs for programs including water use efficiency and environmental conservation.	$69 / AF
Treatment	Cost of producing potable water at MWD's treatment plants.	$319 / AF
Total MWD Full Service Treated Volumetric Rate	***Tier 1 Full Service Treated Volumetric Rate; sum of the above.***	**$1050 / AF**
2. MWD Readiness-to-serve	Cost of 'reliability' of MWD's imported water system e.g. emergency storage capacity, standby services etc. *Fixed fee is converted to per acre-foot rate by the District.*	$98 / AF
Total Avoided Cost	*Marginal cost of 'No-Project' alternative; sum of 1 & 2.*	$1148 / AF
OTHER CHARGES – Charges levied by MWD or District whether or not OWDP is built.		

Cost component	Description	Charge in FY19 ($/AF)
3. West Basin Reliability Service Charge	Variable charge levied by the District for continued supply of drinking water.	$237/AF
4. Fixed Service Charge	Fixed charge levied by the District for continued supply of drinking water. *Allocated based on agency's 3-yr historical average of imported water purchases.*	Per customer
5. MWD Capacity Charge*	MWD's cost of infrastructure required to meet peak demands for imported water*.	$7,200 / cfs

** MWD capacity charge is calculated as a multiple of each customer Retail Agency's `non-concurrent peak demand week (per cfs) from the past three summer periods. The District passes this cost to its customer Retail Agencies. Impacts to this charge have been excluded from the analysis at this stage as the OWDP's effects on peak demands have not been determined. The capacity charge represents <1% of the total cost of imported water so the impact is not significant.*

4.3 Projections of Future MWD Charges

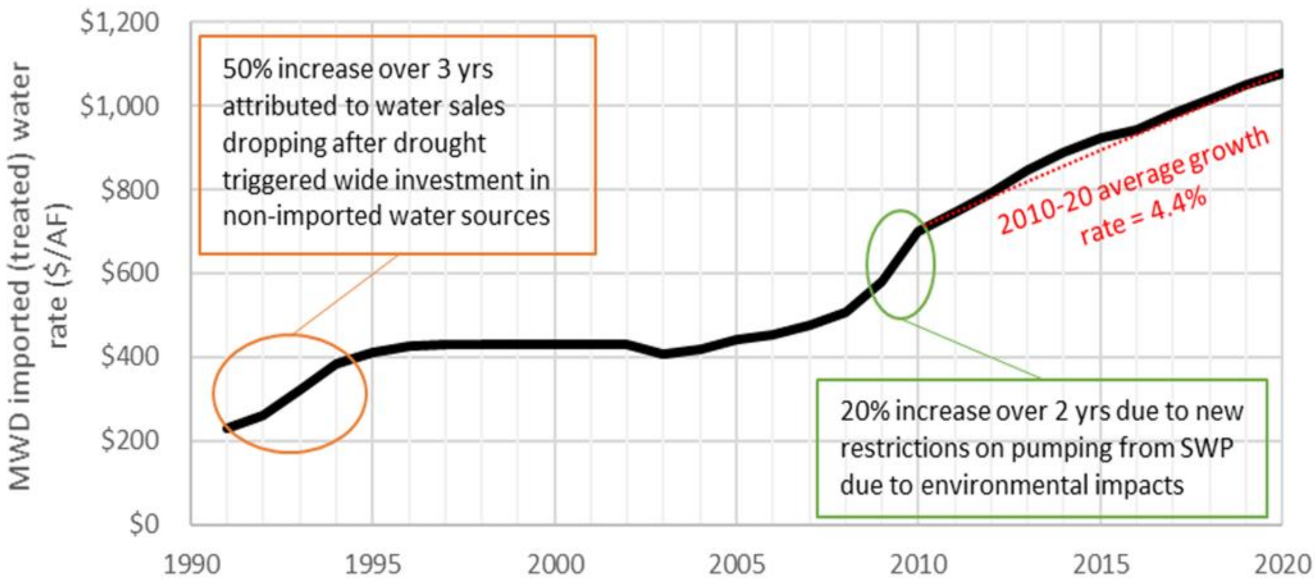
MWD have published projected imported water charges between 2020 and 2030[19]. These projections include MWD's approved water charges for FY2021 and 22 which were recently revised due to the impact of the COVID-19 epidemic.

MWD's projections have been used as the basis of the future imported water cost used in this financial analysis for 2020 to 2030. However, it is noted that these are projections only, and not guaranteed rates – MWD have the discretion to alter these as needed.

To 2030 and beyond, the MWD imported water rate will be sensitive to a number of factors: inflation, power costs, regulatory changes, etc. Critically, the MWD rate may have significant step-change increases related to large-scale capital projects implemented by MWD. Such step changes have occurred 2 times since 1990, related to environmental or regulatory changes which have necessitated large-scale investment by the MWD and recouping of its investment by increasing imported water costs to its customers such as the District (see Figure III-15).

- Post-1990 MWD rates increased because of imported water investments in Colorado River and SWP improvements (MWD storage program on Colorado River and SWP and construction of Diamond Valley Lake reservoir) and greater reliance on more expensive SWP supply to meet increased demand. MWD also experienced reductions in cheaper Colorado River supplies to comply with 4.4 MAF California allocation.
- Much of the rate increases from 2010 and onwards were because of significant demand reduction from two droughts and state conservation legislation and regulation. Pumping restrictions were secondary effects to causes of drought and behavioral changes to water use.

[19] http://www.mwdh2o.com/PDF_Who_We_Are/April%2014,%202020%20Board%20Letter%208-1.pdf



Source: MWD published rates and GHD analysis

Figure III-15 Historic MWD rate increases including step changes

To account for potential step-change increases in the MWD rate in the future, GHD has generated a low, mid, and high scenarios for the MWD rate, described below and shown on Figure III-16:

- Low Scenario – MWD official forecast to 2028, constant annual escalation at 2.7% (nominal) beyond 2028. No step-change included.
- Mid Scenario – MWD official forecast to 2028, constant annual escalation at 3.5% (nominal) beyond 2028. Step-change of $50/AF included at year 2028.
- High 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 Escalation Scenario – MWD official forecast to 2022, constant annual escalation at 5% (nominal) beyond 2028. No step change included.

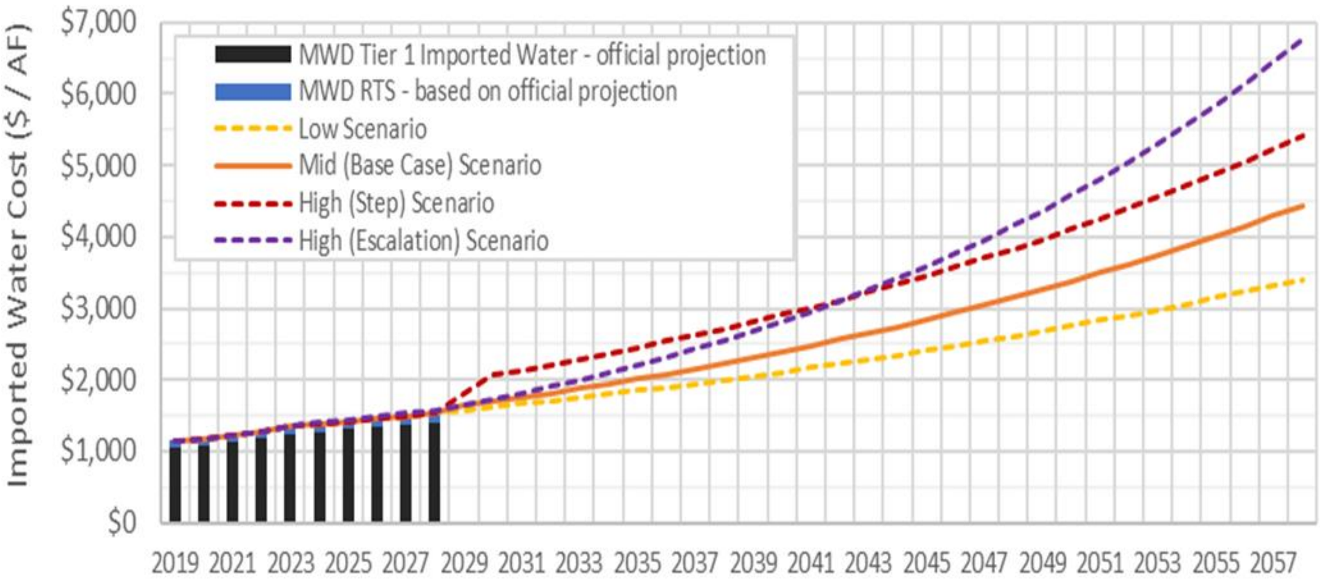


Figure III-16 MWD imported water charges - projection scenarios

These scenarios are consistent with previous detailed modelling work completed by CDMSmith for the *Orange County Water Reliability Study (2016)* on behalf of MWDOC.

GHD has used the Mid Scenario as the base assumption in the cash flow model.

5 Results of Cash-Flow Analysis

5.1 Cost of Water over Time and Whole-Of-Life Assessment

Using the cash flow model and base assumptions summarized in Sections 2 and 3, the financial performance of the different project design and delivery methods are shown in the figures below.

The whole-of-life assessment is captured by the net present cost (NPC) results shown in Figure III-17, also showing the equivalent NPC of importing water from MWD (the 'No-Project' option). The results for the i) DBFOM-100% and PPP, and; ii) DBB and DBOM delivery model options are the same and have been shown together.

Note that these results do not include any consideration of inherent and contingent risks. Furthermore, the primary use of this analysis is to compare project delivery model options to each other on a cost basis.

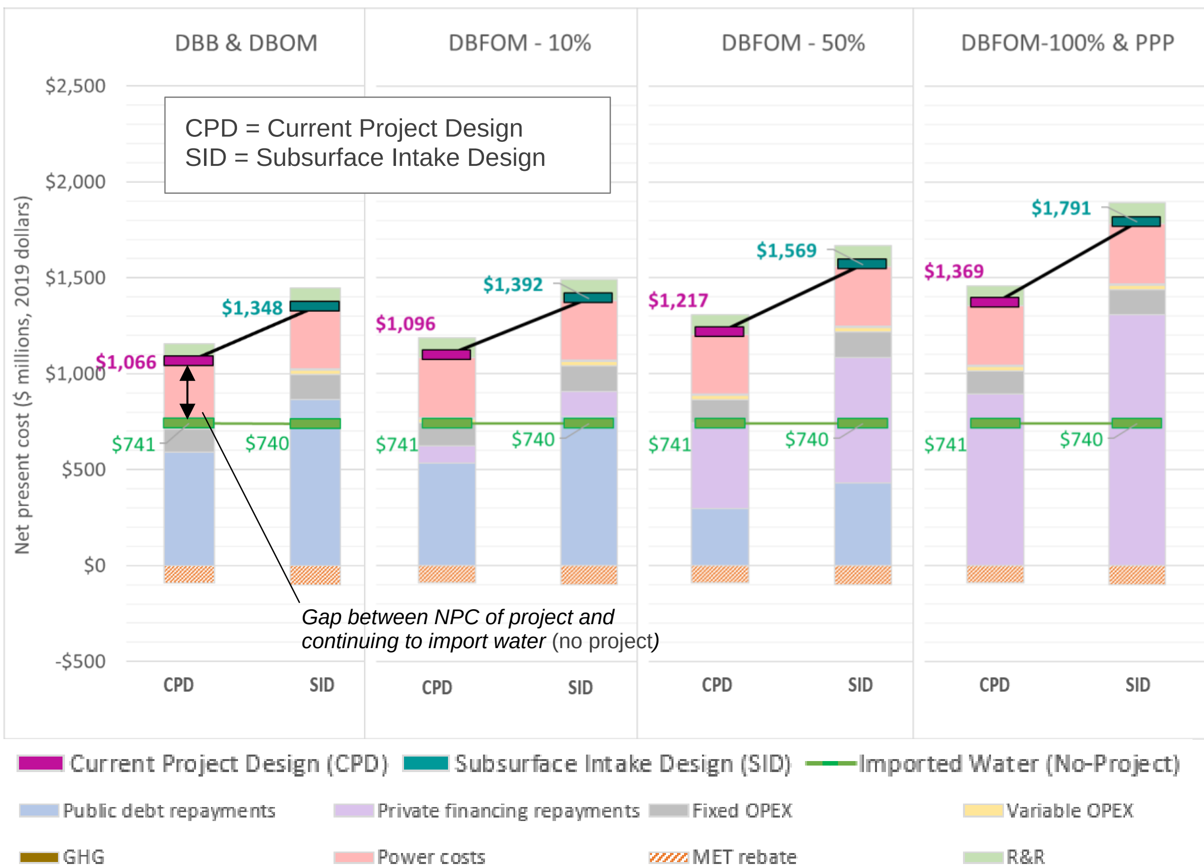


Figure III-17 Calculated NPC for project designs and delivery models

Evidently the Subsurface Intake Design entails significantly higher whole-of-life cost than the Current Project Design, in the order of $300 to $450 million more expensive on a net present cost basis depending on the delivery model.

The level of private financing has a notable impact on whole-of-life cost, with an increased cost of ~$300 million to $350 million on an NPC basis for wholly public-funded versus wholly private-funded delivery models, for the Current Project Design and Subsurface Intake Design respectively.

The significance of financing choice is evident by the large contribution of capital repayments (whether public or privately financed) to the total whole-of-life cost. Power costs are the next biggest contributor to whole-of-life cost, in the order of ~$300 million on an NPC basis.

The cost of greenhouse gas (GHG) offsets is a negligible contributor to the whole-of-life cost. Figure III-18 shows the cost of desalinated water in $/AF over time, compared to the projected MWD imported water cost.

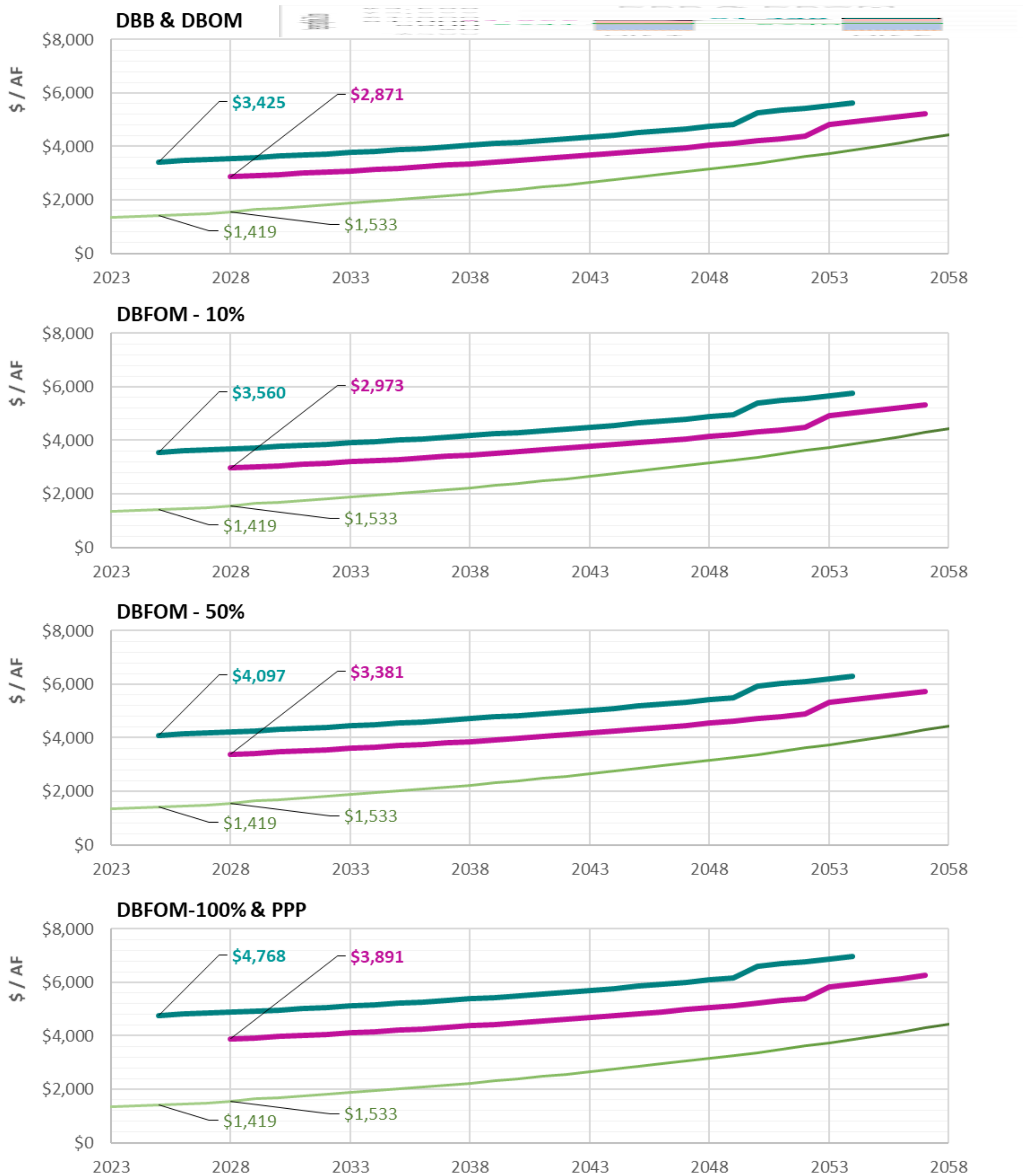
The cost of water curve reflects the costs during the 30-year OWDP facility operating period, and has some notable features:

- Different starting points for the Current Project Design and Subsurface Intake Design, which reflect the longer time for the Current Project Design to become operational.
- A ‘bump’ in the cost of water after 25 years of operation, which reflects the expiration of the MWD LRP rebate. The rebate provides a reduction of $340/AF in the cost of water for the first 25 years of operation. As shown in Figure III-17, the whole-of-life cost reduction provided by the MWD LRP rebate is significant, at approximately $100 million on an NPC basis.

The key findings of the NPC analysis are:

- There is no combination of delivery model or project design that delivers desalinated water at a lower cost than MWD imported water. This is an unsurprising outcome of the analysis.
- As the level of private financing increases, the NPC and cost of water of the OWDP increases significantly. Delivery models that are publicly funded (e.g. DBB) will see lower costs due to lower interest rates offered through public financing methods.
- Current Project Design outperforms the Subsurface Intake Design, driven by the lower capital expenditure.

Detailed outputs from the cashflow model are provided in Appendix A.



Values are expressed in nominal dollars. Values shown for Current Project Design and Subsurface Intake Design represent estimated average annual cost of desalinated water from OWDP during the 30-year operating period. Values shown for Imported Water represent estimated cost of importing water from MWD. Refer to assumptions throughout this report for further detail.

Figure III-18 Cost of water over time ($/AF) for different OWDP project designs and delivery models

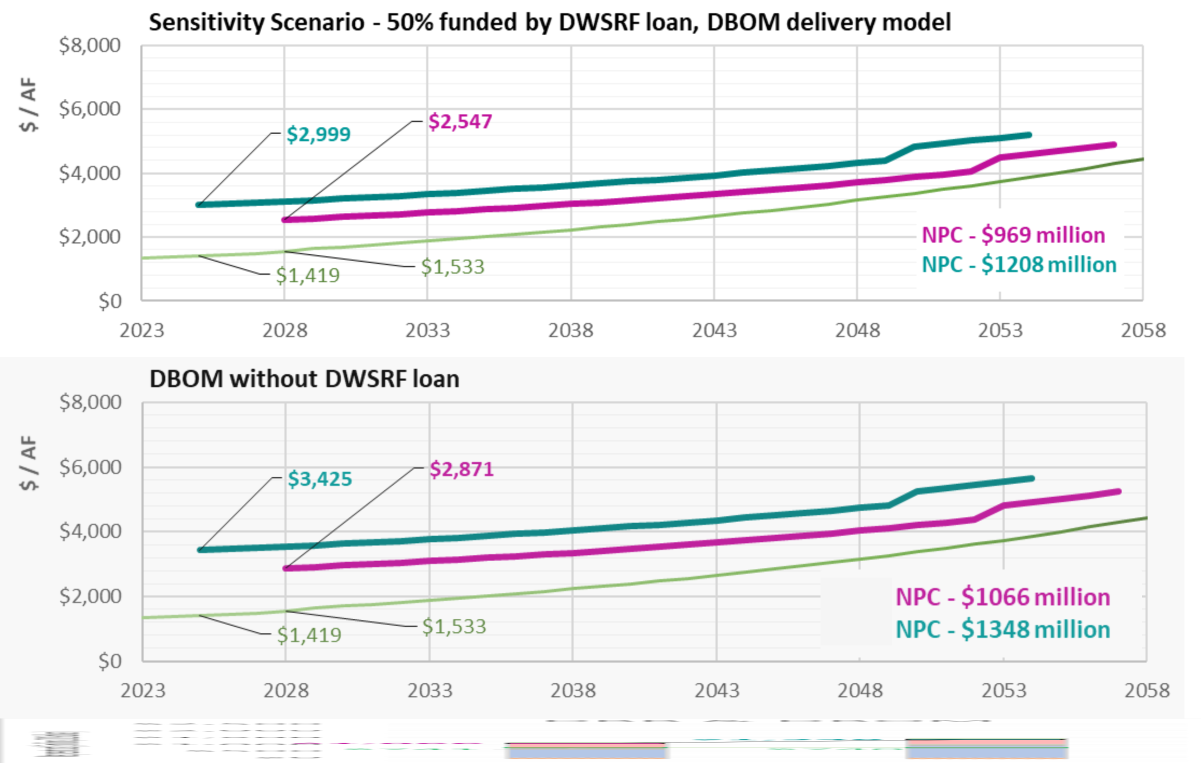
5.2 Sensitivity Analysis - Low Interest Financing Scenario

As discussed in Section 3.3.1, a feasible source of funding for publicly-owned project delivery models is the California State Water Board DWSRF loan, which offers highly competitive interest rates (estimated at 1.8% in this analysis) and 30-year repayment term.

Figure III-19 demonstrates that the DWSRF loan significantly reduces the cost of water and NPC of the project. The results shown in the figure assume the DWSRF loan would cover half of the project cost, with the remainder being funded with municipal bonds, and the project is delivered through a DBOM delivery method.

Evidently, obtaining DWSRF financing can offer significant cost savings to the project – and confirms the importance of pursuing and securing low-interest financing options as far as reasonably practicable.

DWSRF loans are restricted to public and privately-owned community water systems, municipal agencies and water systems and non-profit mutual water companies. Therefore, the Project is only eligible for the DWSRF loan if delivered through a method in which the District retains ownership of the OWDP – it is unclear whether a DBFOM-50% or DBFOM-10% would be eligible, but it would **not** be eligible under a DBFOM-100% or PPP delivery method. This restriction should be weighed against the possible risk transfer benefits of those delivery models.



Values are expressed in nominal dollars. Values shown for Current Project Design and Subsurface Intake Design represent estimated average annual cost of desalinated water from OWDP during the 30-year operating period. Values shown for Imported Water represent estimated cost of importing water from MWD. Refer to assumptions throughout this report for further detail.

Figure III-19 Cost of water over time for 50% DWSRF-funded project

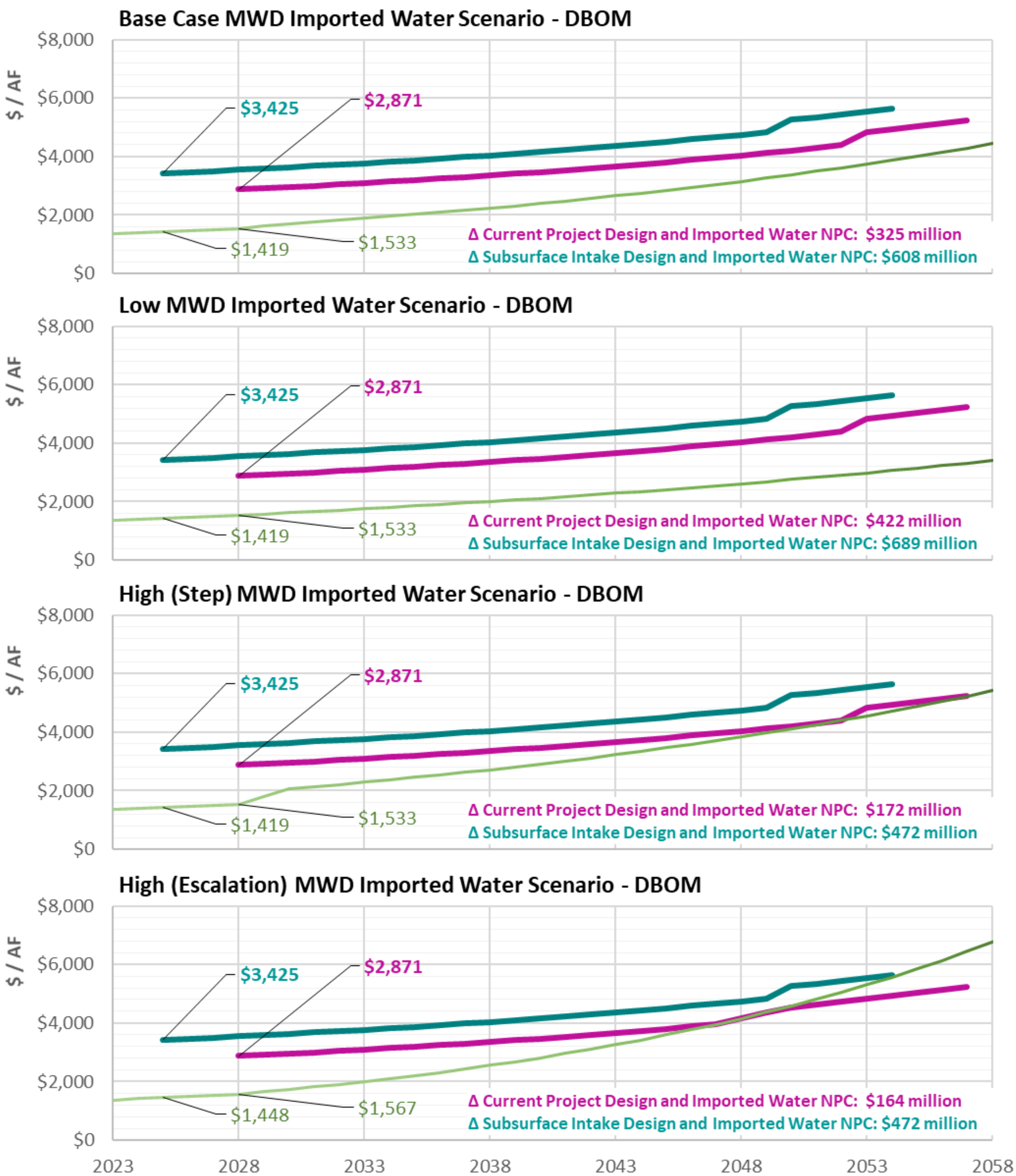
5.3 Sensitivity Analysis – MWD Imported Water Cost

The future cost of MWD imported water is a critical factor and uncertainty in assessing the financial performance of the OWDP. If the imported water cost is higher, the OWDP project appears more attractive.

As discussed in Section 4.3, four projection scenarios were generated for MWD imported water – low, mid base estimate, high with step change, and high with escalation. The figures below present the project financial outcomes for the different imported water scenarios. Figure III-20 shows the outcomes for DBOM project delivery model, and Figure III-21 shows the outcomes for PPP project delivery model. The difference (delta, Δ) between the project and imported water NPC is shown – positive values demonstrate the whole-of-life cost for the OWDP is higher than imported water. The figures demonstrate:

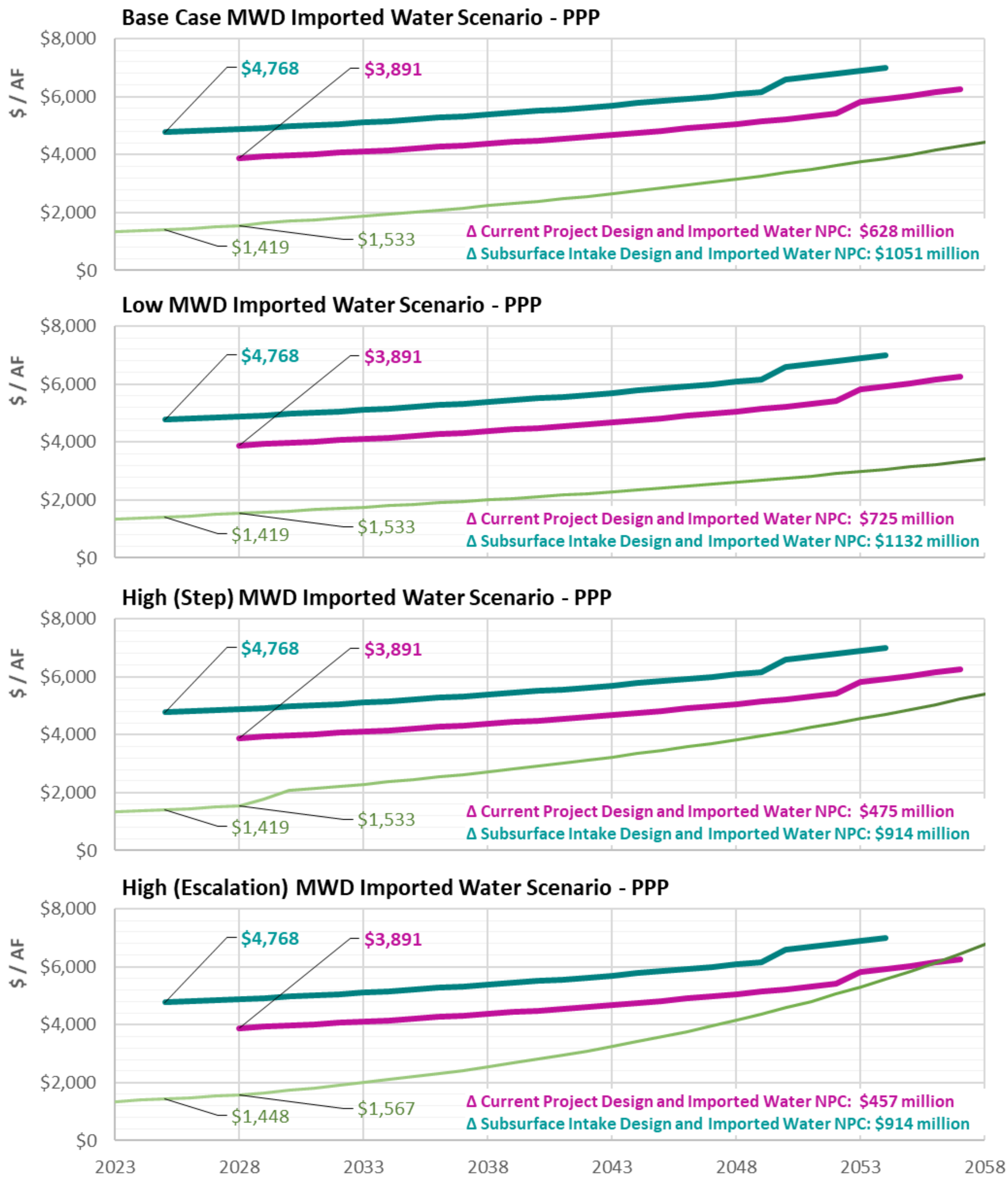
- For the High MWD imported water cost scenarios, the gap between the cost of water (and NPC) of the OWDP is significantly reduced, however the model estimates the OWDP remains more expensive on a whole-of-life basis. In the later years of operation, desalinated water from the Current Project Design may even be cheaper than imported water.
- The difference between the MWD imported water cost and cost of water from the OWDP in each year also impacts the amount of MWD rebate received by the District – when the difference is small, or desalinated water costs less than imported water, the amount of rebate received is reduced. For the High MWD imported water cost scenarios, there may be situations where amount of MWD LRP rebate is not maximized, as the difference between the OWDP cost of water and imported water is smaller than the sliding-scale rebate offer (in this case $340/AF). For example, for DBB/DBOM and High (Escalation) MWD imported water (Figure III-20) in years 2046-2050 the LRP rebate would not be fully maximized.

The outcomes for DBFOM-10% and DBFOM-50% would lie in between the two figures shown below. DBB would be the same as the DBOM outcomes, and DBFOM-100% the same as PPP since they have the same underlying financing, respectively.



Values are expressed in nominal dollars. Values shown for Current Project Design and Subsurface Intake Design represent estimated average annual cost of desalinated water from OWDP during the 30-year operating period. Values shown for Imported Water represent estimated cost of importing water from MWD. Delta (shown as Δ) refers to difference between OWDP and Imported Water. Refer to assumptions throughout this report for further detail.

Figure III-20 Cost of Water ($/AF) and NPC for DBOM Under Different MWD Imported Water Scenarios



Values are expressed in nominal dollars. Values shown for Current Project Design and Subsurface Intake Design represent estimated average annual cost of desalinated water from OWDP during the 30-year operating period. Values shown for Imported Water represent estimated cost of importing water from MWD. Delta (shown as Δ) refers to difference between OWDP and Imported Water. Refer to assumptions throughout this report for further detail.

Figure III-21 Cost of water ($/AF) and NPC for PPP under different MWD Imported Water scenarios

5.4 Sensitivity Analysis - Power Cost

Power costs are a significant component of the project costs and contribute approx. $300 million of whole-of-life cost (as NPC) to the OWDP. Power cost factors will be extremely important during further project development, including:

- Design decisions to minimize power consumption from the OWDP treatment process and conveyance system.
- Negotiations between project parties (e.g. between the District and the private-sector operator) and between the OWDP and the regional electricity provider to determine the framework for how future power prices will be set, adjusted and borne.
- Design-phase investigations of onsite or facility-specific power supplies to the OWDP to fully or partially reduce the power requirement from the regional electricity provider (while maintaining reliability of supply).

The table below presents some hypothetical scenarios in which the power price and/or escalation rate on the project outcomes have been changed from the base assumptions.

Evidently the risk of high electricity price growth in California could result in significantly higher cost of desalinated water by the end of the 30-year operating period (in the order of +$1,500/AF). Conversely, if power costs increase just with inflation (2.5%) or a cheaper starting source of power can be found, the project costs will be noticeably reduced.

Some rough rules of thumb can be drawn from the analysis *(note that these should be used with caution and decision-making should be informed by financial modelling rather than these rules-of-thumb)*:

- Each $0.01/kWh increase in power price (in 2023) results in an increased whole-of-life cost for the OWDP of ~$25 million (in NPC terms).
- Each $0.01/kWh increase in power price (in 2023) results in an increased cost of water from the OWDP of ~$50/AF in the first year of facility operation, increasing to $150/AF by the final year of operation.

5.5 Sensitivity Analysis – MWD LRP Rebate Options

As discussed in Section 3.4.3, there are three MWD rebate options available through the LRP program:

- **Option A** – Sliding scale $340 per acre-foot of water produced from the OWDP facility, for the first 25 years of plant operation.
- **Option B -** Sliding scale $475 per acre-foot of water produced from the OWDP facility, for the first 15 years of plant operation with commitment to operate the project for 25 years.
- **Option C** – Fixed $305 per acre-foot of water produced from the OWDP facility, for the first 25 years of plant operation.

Table III-7 Power cost sensitivity, shown for DBB/DBOM & DBFOM-100%/PPP

Parameters		Base assumptions		High price growth		Low price growth		Cheap alternative source	
Assumptions									
Power price in 2023		*$0.12/kWh*		*$0.12/kWh*		*$0.12/kWh*		*$0.09/kWh*	
Annual escalation rate		*4%*		*6%*		*2.5%*		*4%*	
Results		**CPD**	**SID**	**CPD**	**SID**	**CPD**	**SID**	**CPD**	**SID**
DBB & DBOM	Project NPC ($ mil)	$1,066	$1,348	$1,214	$1,471	$989	$1,282	$988	$1,270
DBB & DBOM	Cost of water at start of operation ($/AF)	$2,871	$3,425	$2,932	$3,446	$2,827	$3,409	$2,716	$3,285
DBB & DBOM	Cost of water at end of operation ($/AF)	$5,235	$5,641	$6,990	$7,040	$4,481	$5,007	$4,751	$5,203
DBFOM 100% & PPP	Project NPC ($ mil)	$1,369	$1,791	$1,518	$1,914	$1,292	$1,725	$1,291	$1,712
DBFOM 100% & PPP	Cost of water at start of operation ($/AF)	$3,891	$4,768	$3,952	$4,789	$3,847	$4,752	$3,735	$4,628
DBFOM 100% & PPP	Cost of water at end of operation ($/AF)	$6,255	$6,984	$8,010	$8,383	$5,501	$6,350	$5,771	$6,546

CPD = Current Project Design; SID = Subsurface Intake Design
Scenarios shown are hypothetical and reflect different modelling assumption. For example a 'cheap alternative source' has not yet been identified for the OWDP.

Figure III-22 illustrates the impact of the various rebate options on the cost of water and NPC of the project, shown for the Current Project Design delivered using DBFOM-10% model. It can be seen that:

- All rebate options offer significant benefits to the project viability by reducing its NPC and minimizing the cost difference between desalinated water and MWD imported supply at the beginning of operation. Priority should be given to understanding the criteria and application process for the MWD rebate to ensure the Project receives it.
- Rebate Option A achieves the best outcome over the project life (in terms of minimizing NPC and also having a 'smoother' cost of water profile over the 30-year operation period).
- To minimize the cost of water in the first years of operation, Option B ($475/AF) provides the most benefit. However, it does not maximize the whole-of-life benefits and results in a large jump in the price of water after 15 years.

Similar results are generated for Subsurface Intake Design and all of the delivery methods considered.

For this reason, Rebate Option A is the preferred option and has been incorporated in the cash flow model. All results shown in Figure III-17 to Figure III-19 (and the rest of this report unless explicitly stated otherwise) have Rebate Option A 'built-in'. It is noted that the District may prioritize lower costs of desalinated water *early* in OWDP operation to reduce initial rate impacts – if this is the case, Option B would be most attractive.

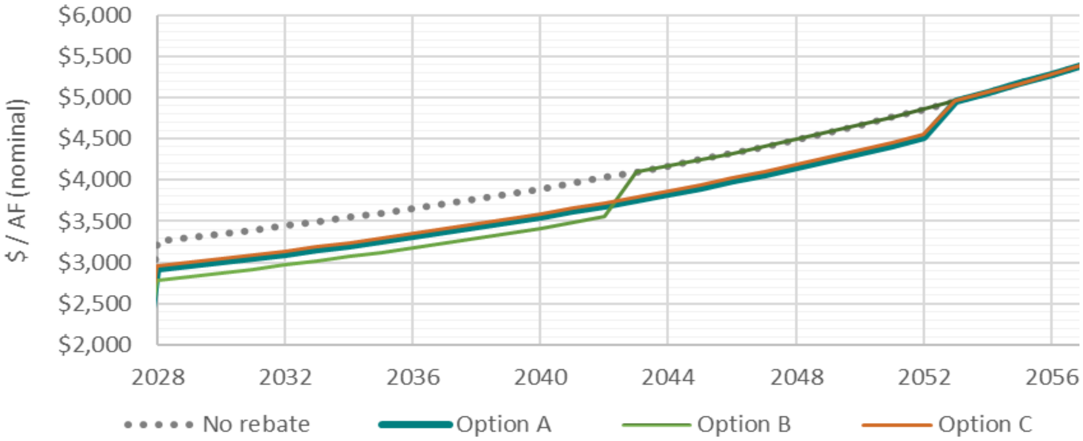


Figure III-22 Impact of different MWD rebate options - shown for Current Project Design, DBFOM-10% scenario

5.6 Sensitivity Analysis - GHG Offset Price

As discussed in Section 3.4.2, the OWDP will purchase GHG offset credits to cover the net increase in GHG emissions generated by its operation. The future price of GHG offset credits under California's Cap-and-Trade system is uncertain and highly sensitive to changes in the political and regulatory framework that underpins the scheme.

The table below summarizes the impacts of adjusting the GHG offset price escalation rate on the project outcomes. Under the base assumption (4% annual escalation rate), the GHG offset price has a very minor contribution to the total project cost, with a net present cost of ~$6 million (<1% of total NPC irrespective of delivery model or design). As the table demonstrates, the NPC and cost of water of the OWDP increases only slightly if the GHG offset price escalation rate is radically increased.

Table III-8 GHG offset price sensitivity, shown for DBB/DBOM & DBFOM-100%/PPP

Parameters		Base assumptions		High price growth		Very high price growth	
Assumptions							
GHG offset price in 2023		*$20/MT*		*$20/MT*		*$20/MT*	
Annual escalation rate		*4%*		*6.5%*		*10%*	
GHG offset price in 2050		*$57/MT*		*$120/MT*		*$326/MT*	
Results		**Current Project Design**	**Subsurface Intake Design**	**Current Project Design**	**Subsurface Intake Design**	**Current Project Design**	**Subsurface Intake Design**
DBB & DBOM	Project NPC ($ mil)	$1,066	$1,348	$1,071	$1,352	$1,086	$1,364
	Cost of water at start of operation ($/AF)	$2,871	$3,425	$2,874	$3,427	$2,879	$3,430
	Cost of water at end of operation ($/AF)	$5,235	$5,641	$5,293	$5,686	$5,525	$5,853
DB FO M-	Project NPC ($ mil)	$1,369	$1,791	$1,374	$1,795	$1,389	$1,807

Parameters		Base assumptions		High price growth		Very high price growth	
	Cost of water at start of operation ($/AF)	$3,891	$4,768	$3,894	$4,770	$3,899	$4,773
	Cost of water at end of operation ($/AF)	$6,255	$6,984	$6,312	$7,029	$6,545	$7,196

5.7 Summary of Findings

The cash flow model results presented in the subsections above provide estimates of the OWDP financial outcomes under different project delivery models, based on the input assumptions described in this report. The OWDP financial outcomes are also considered relative to the No-Project scenario (imported water), although financial considerations will not be the only determinant in the decision to proceed with the project or not.

The cash flow model results do not account for risk transfer under different delivery models, which are dealt with subsequently in this report. Nevertheless, the cash flow model findings demonstrate:

- OWDP Current Project Design is considerably more attractive than Subsurface Intake Design on a financial basis, driven by its significantly lower capital cost (~30% less) and results in whole-of-life cost savings of around $300 to $450 million on an NPC basis, depending on the delivery model.
- The choice of project delivery model has a significant impact on the OWDP financial outcomes through the impact of financing 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 public-funded delivery models (DBB or DBOM).
- The value of securing cheaper lower interest rate financing options is clearly evident. Cheap public funding sources such as the DWSRF or WIFIA should be aggressively pursued during project development. These funding sources will be generally more accessible when the project is owned by the District. The sensitivity scenario where half the project cost is funded by a DWSRF loan estimates whole-of-life cost savings of ~$100 million on NPC basis, and cheaper cost of water by >$300/AF at the start of operation could be achieved.
- 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.
- MWD LRP rebate should be aggressively pursued during project development and offers in the order of $90 million in project savings, 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 OWDP financial outcomes are most sensitive to parameters such as total capital cost and power price/consumption, and less so to GHG offset price and operating cost.

6 Risk Analysis

6.1 Introduction

The OWDP is a major capital project with technical complexity, a long operating timeframe and exposure to external macroeconomic, political and regulatory conditions. The project will be exposed to various cost, delay and scope risks during procurement, pre-construction, construction and operation.

Some of these risks will not be able to be fully mitigated or transferred (i.e. residual risk will remain). In preceding sections of this report, the potential cost impact of these risks was partially captured by the inclusion of contingency in the capital cost of the project.

This section provides a more robust analysis of the potential cost impacts from project risks. It also considers the ability of different project delivery models to reduce the District's risk exposure by transferring risk away to its contractual partners.

The risk analysis was incorporated into the OWDP cash flow model by using the @Risk statistical package (Professional v 7.0 - Palisade Software) in MS Excel. The @Risk software enabled GHD to define probabilistic rather than deterministic inputs to cash flow calculations, and then runs a large number of iterations to generate the probability distribution of cash flow outputs. This is known as the Monte-Carlo method[20]. Figure III-23 is a basic schematic of the probabilistic modelling approach and how it compares to the analysis completed in earlier sections of this report. The deterministic cash flow model inputs and outputs were discussed in Sections 3, 4 and 5 of this report. The risk-adjusted inputs and outputs are described in this Section 6.

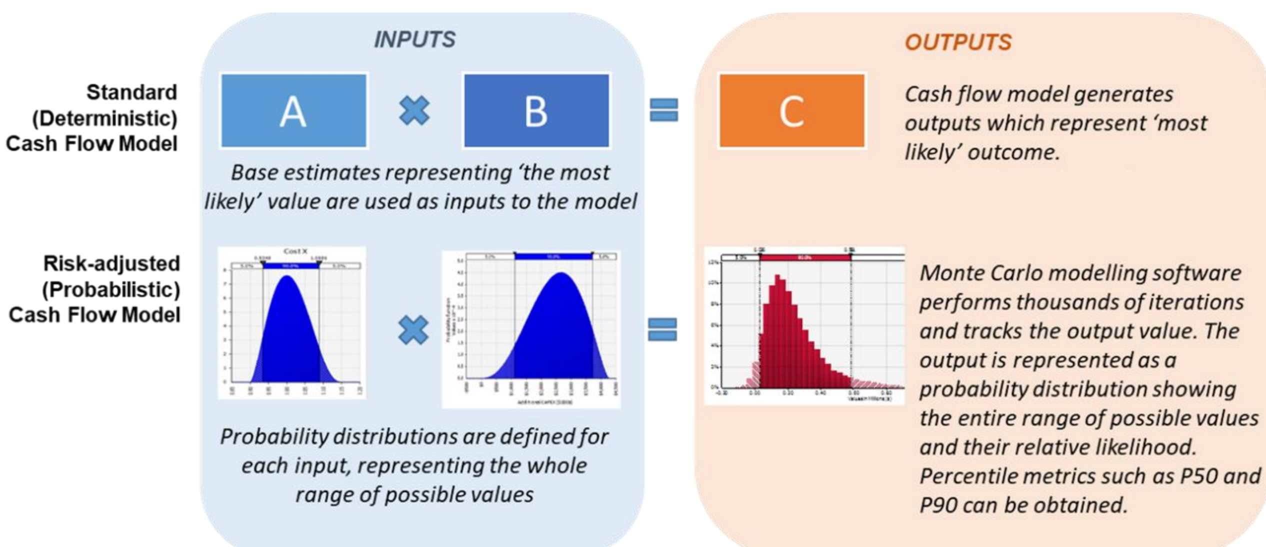


Figure III-23 Schematic of difference in modelling approaches - deterministic and probabilistic

[20] Further background on Monte Carlo modelling and probabilistic modelling can be found on Palisade Software's website - https://www.palisade.com/risk/monte_carlo_simulation.asp

It should be noted that the objective of this risk analysis is to understand the relative benefits of the different project delivery methods from a risk transfer perspective. This exercise is not a substitute for comprehensive capital and operating cost risk assessment for the District's budgeting purposes that will be performed later in the delivery pathway of the OWDP.

6.2 Risk Types and Risk Transfer

6.2.1 Overview

There are two types of risks affecting the OWDP:

- **Inherent risks** – these risks represent uncertainty in the value of project cost items (both CAPEX and operational expenditure, OPEX) and external variables (e.g. inflation, power cost) that are included in the base cost estimate.

  From a quantitative perspective, the likelihood that the cost item will be incurred is 100%. However, the item's consequence (i.e. value) is not perfectly known and is therefore modelled as a probability-weighted range rather than an exact value.

  For example, the OWDP capital cost base estimate includes a value for the Reverse Osmosis System of $84 million. Similarly, the OWDP cash flow model assumed the cost of electricity in 2023 will be $0.12/kWh. In reality, these values may differ from the base estimates and are better modelled as a probability-weighted range (i.e. probability distribution).

- **Contingent risks** – these risks reflect the potential for additional costs above the base cost estimate due to unaccounted items and unpredictable circumstances. Contingent risks result in a *change to the project scope* compared to the scope included in the base cost estimate.

  The likelihood of a contingent risk eventuating is less than 100%. The value of its consequence (i.e. cost) is also modelled as a probability-weighted range rather than an exact value.

  For example, the capital cost estimates for the Current Project Design and Subsurface Intake Design are based on current expectations of onshore geotechnical conditions. There is always a residual risk that onshore geotechnical conditions are significantly worse than planned and will require additional works to stabilize. Therefore, there is a likelihood between 0% and 100% that some additional cost will be incurred, and the exact value of this cost is modelled by a probability weighted-range.

The cost impact of an inherent or contingent risk is given by:

$$Cost\ impact\ (\$\ million) = likelihood\ (\%) \times consequence\ (\$\ million\ \text{or}\ \$\ million/yr)$$

A summary of the inherent and contingent risk modelling assumptions are discussed in Section 6.2.2 and 6.2.2 respectively with supporting detail included in Appendix B.

The ability of different project delivery models to transfer residual risks away from the District and to contractual partners is discussed in Section 6.2.3. This is the key consideration of this exercise.

6.2.2 Inherent Risk Assumptions

Inherent risks affect parameters that are direct inputs to the OWDP cash flow model. These risks were incorporated into the risk analysis using a direct methodology whereby the inputs were redefined as probability distributions and fed directly into the cash-flow calculations.

The spread of the probability distribution (i.e. the range between the lowest potential value and highest potential value) was dependent on GHD's judgement on the level of certainty of each input. Level of certainty depends on the extent of investigation works completed, confidence on pricing estimate and other factors. Each input was classified as High, Medium or Low certainty – the higher uncertainty, the higher the range.

Table III-9 summarizes the assumptions adopted for inherent risks with full detail provided in Appendix B.

Table III-9 Summary of Inherent Risk Assumptions

Parameter Type	High uncertainty	Medium uncertainty	Low uncertainty
Capital cost items	Seawater Intake, Permitting Costs	*All others*	Post Treatment, Chemical Storage, Product Water Storage, Brine Discharge Tank, Spare Parts
Operating cost items	Maintenance, Other/Misc. *Subsurface Intake Design only – NPDES Monitoring, State Lands Lease, Biological Mitigation*	*All others*	Power consumption, Chemicals
External Parameters	Power Escalation, Carbon Price Escalation	CAPEX escalation, Power Cost in 2023	Carbon Price in 2023

Contingent Risk Assumptions

Contingent risks for the project were identified and developed by the project team in a risk register.

Contingent risks were identified based on specifics of the proposed OWDP at the ESGS site, as well as GHD's experience in the delivery of large international public infrastructure projects, including extensive involvement with desalination facilities in North America, Australia and the Middle East.

Identified risks were then quantitatively defined for the risk-adjusted cash flow model using the following parameters:

- **Project Design** – does the risk impact both Current Project Design and Subsurface Intake Design?
- **Likelihood** – what is the probability of the risk eventuating?
- **Consequence –** what will the cost impact be if the risk eventuates?
- **Allocation** – does the risk sit with the District, is it transferred to the private sector, or is it shared?

This information is fully captured in the risk register, attached as Appendix B1. Further detail and an example of the contingent risk modelling approach is included in Appendix B.

6.2.3 Risk Allocation

A key aim of the risk analysis exercise is to understand the extent and value of potential risk transfer enabled by different project delivery models. Risk transfer refers to the ability of the District to contractually allocate risks to its private sector delivery partners.

However, from the perspective of the District, it is critical to understand that *maximum risk transfer* is not always the same as *optimal risk transfer.* That is, the upfront premium charged by the private sector for accepting a certain risk may outweigh the benefits of transferring the risk – this is due to the different positioning of private and public parties with respect to managing different types of risk.

Risk allocation considerations are complex and are influenced by commercial negotiations, market conditions and legal developments. Practically, the level of uncertainty and hence the risk profile to the District will reduce when bids are received from the market, and many risks are eliminated when a final contract is signed. That is, the extent of uncertainty reduces the closer the project gets to execution. However, the arrangement enshrined in a contract may still be open to interpretation and result in lengthy legal proceedings to resolve. That is to say, it is impossible (and not useful) to model all possible risk allocation frameworks or outcomes.

For the purpose of this analysis, general assumptions have been used for the various risk types and contractual frameworks in order to generate meaningful insights regarding the delivery models. The assumptions align with typical outcomes in contractual negotiations of major infrastructure and desalination projects.

To enable this, a set of risk 'groups' were defined, each with a predetermined risk allocation framework (see Table III-10). Then each risk was allocated into the relevant risk group.

6.2.4 A note on interpretation of P values

Note that P values (percentile, e.g. P90 means 90^{th} percentile) represent statistical estimates of uncertainty. They are essentially a way to obtain actionable values from what are inherently probability *distributions*.

- P10 means 10% of modelled costs are less than this value, and 90% are above.
- P90 means 90% of modelled costs are less than this value, and 10% are above.
- The range P10 to P90 covers 80% of the modelled costs.
- P50 is the same as median and means half the costs are less than this value and half are above.

Modelled costs in this context means the costs generated through the @Risk analysis, with its assumptions as discussed.

Table III-10 Risk allocation framework - risk grouping

Risk Group	Description	Risk sub-group	Description (of subgroup)	Allocation under different delivery methods					
				DBB	DBOM	DBFOM-10%	DBFOM-50%	DBFOM-100%	PPP
A	Construction risks accepted by the builder given sufficient information provided by District during procurement (i.e. builder does not need to be designer to accept this risk). These risks are priced into the bid submitted by contractor as 'builder's contingency'.								
B	Construction risk accepted by builders if they are also procured for design.								
C	Construction risk able to be shared with builder or design-builder…	C1	…if procured for design and operation as well. PPP would enable risk to be fully transferred.						
		C2	…if procured for design and operation as well.						
		C3	…only if PPP model established.						
D	Construction risks unlikely to be accepted by builders or design-builders under any circumstances.								
E	Operating risks that can be accepted by the private sector if the operating entity is also the designer.								
F	Operating risk that can be shared with private sector if full PPP approach used.								

Risk Group	Description	Risk sub-group	Description (of subgroup)	Allocation under different delivery methods					
				DBB	DBOM	DBFOM-10%	DBFOM-50%	DBFOM-100%	PPP
G	Operating risks unlikely to be accepted by operators under any circumstances.								
H	Opportunities for cost savings from private sector involvement - passed through to District unless PPP is signed, in which case PPP would receive partial savings.								

Legend:

- Cost risk / opportunity taken by the private sector. The District has transferred the risk exposure.
- Cost risk / opportunity shared 50/50 between the District and private sector.
- Cost risk / opportunity unable to be transferred to the private sector. The District holds the risk exposure.

6.2.5 Discussion of Key Project Risks

Some discussion is given below to the significant risks facing the OWDP project, and their treatment in the risk-adjusted cash flow analysis.

General Design and Construction Risks

The following risks are viewed as 'general' construction risks in that they have impact on all major infrastructure projects:

- Construction delays and errors
- Major exchange rate fluctuations
- Tariff impacts

In practice, construction contractors are adept at managing and mitigating these risks, and pricing in any residual risk to their design or design-build contract bids as part of their 'builders' contingency'. As such, these risks are transferable to the private sector under all project delivery methods (Contingent Risk Group A, as described in Table III-10).

Design error risks – situations where design issues lead to extra costs during construction – can be accepted by the private sector when design and build functions are combined. This occurs in all delivery methods except DBB (Contingent Risk Group B, as described in Table III-10).

The risk likelihoods and consequences are shown in the risk register.

Onshore Geotechnical Risk

The onshore facilities (e.g. the main treatment plant, chemical storage, treated water storage and pump station) of the OWDP will be constructed at North Site of the ESGS owned by NRG Energy.

Preliminary review of available geotechnical information was undertaken for the ESGS as part of EIR development. However additional design-level geotechnical evaluations will be required prior to final design and construction to determine soils remediation and/or foundation systems to reduce seismic and faulting-related hazards risks. These additional investigations are also needed to satisfy regulatory requirements such as the California Building Standards Code and California Building Code, City of El Segundo General Plan, etc.

There is a residual risk that even after additional design-level evaluations, the onshore geotechnical conditions at the North at ESGS could be significantly worse than expected, requiring additional works for foundation systems. GHD has allowed a likelihood of this at 20% and a consequence with a P5 to P95 range of $2-10 million for the Current Project Design. A consequence of $2.5-12.5 million for the Subsurface Intake Design was allowed due to the additional brine pipeline needed to transfer brine to Hyperion, which crosses the ESGS.

With regards to allocation of this risk, it is extremely unlikely that any contractor for design and/or construction of the OWDP will provide a guaranteed maximum price prior completion of the additional design-level geotechnical evaluations, but will accept the risk once provided with the information. As such, this geotechnical information is commonly provided to bidders in the tender documents during procurement. Contractors then typically accept the geotechnical risk as part of their pricing.

In assessing this risk, it is GHD's view that design-level geotechnical evaluations would be completed prior to procurement (by the District) for all delivery models, and accepted by the private sector under all delivery models (Contingent Risk Group A, as described in Table III-10).

Site Access

The ESGS is located in a busy coastal area with limited number of access points. As noted in the Draft EIR, prior to construction a Construction Traffic Control Plan and Parking and Staging Plan will be developed to ensure impacts to the surrounding community are appropriately mitigated.

There is a residual risk that mitigating community impacts will require additional complexity and cost during construction. For example, the potential need to double-handle construction materials, or set up bussing routes to transport construction workers to and from the site.

GHD allowed a risk likelihood of 40% and a consequence with a P5 to P95 range of $2-30 million.

With regards to allocation of this risk, it is likely that the private sector will share this risk with the District if it is involved in both design and construction phases (i.e. DBOM and DBFOM delivery models), and likely to fully accept the risk the project is executed as a PPP. The risk would remain with the District if it chose to pursue a DBB deliver model (Contingent Risk Group C1, as described in Table III-10).

Offshore Geotechnical Risk

Construction of the seawater intake infrastructure (whether open intake in Current Project Design or subsurface infiltration gallery in Subsurface Intake Design) and seawater intake pipeline to the onshore facility is sensitive to the offshore geotechnical conditions. This is a key area of focus for all desalination projects and some significant investigations have been completed to date for the OWDP, including research and site-specific field-testing and analysis between 2015-17 for assessments of various subsurface intake options. Refer to the EIR for further information.

There is a residual risk that even after these and any additional design-level evaluations, the offshore geotechnical conditions are significantly worse than expected, requiring additional works. GHD allowed a risk likelihood of 20% and a consequence with a P5 to P95 range of $5-50 million for the Current Project Design. The consequence of $7.5-75 million for the Subsurface Intake Design was allowed due to the additional complexity of the subsurface intake.

With regards to risk allocation, it is likely that contractors will accept the offshore geotechnical risk under any delivery model given the detailed information already available, and that any identified information gaps would be filled by the District prior to procurement (Contingent Risk Group A, as described in Table III-10).

Regulatory and Permitting – During Construction

As described in Section 2, all the project delivery models assume permitting is completed by the District prior to competitive procurement of private sector contractors. As such, permitting risk sits with the District until key approvals and permits are obtained.

However, there is residual risk that regulatory requirements are amended or community opposition in the time period between obtaining the permits and completion of construction, leads to changes in the scope/costs/timing of the project during design and/or construction phase. Changes in assumptions of permit conditions can result in design breakage if design is out in front.

The likelihood, consequence and allocation of this risk is difficult to quantify, however its potentially significant impact has been seen in cases such as Monterey Desalination Project which has seen unclear permitting requirements from different agencies during the project development.

There is the potential for this risk to be shared with (but not entirely transferred to) the private sector under a DBFOM or PPP delivery model in which the private sector parties share financial incentive to amend the project scope quickly to meet the revised regulatory requirements. Conversely the risk is likely to sit with the District in a DBB or DBOM delivery model. This risk has been grouped in Contingent Risk Group C1, as described in Table III-10.

GHD has allowed a likelihood of occurrence at 20% and a consequence with a P5 to P95 range of $5-70 million.

Site Contamination

Environmental reviews documented in the EIR discuss the possibility for site contamination which could lead to cost and time impacts during construction. Examples include:

- Soils impacted with total petroleum hydrocarbons (TPH) and Volatile Organic Compounds from former onsite fuel storage tanks or chemicals from ESGS operation. Contaminated soils excavated during construction could require additional treatment and management depending on the end use and extent of contamination.
- Groundwater impacts from liquid petroleum hydrocarbons from the offsite Chevron Refinery adjacent to the ESGS. Construction of the OWDP will require excavations which could intercept shallow or perched groundwater and require temporary localized dewatering to create a dry work area and facilitate construction. Dewatering typically involves the extraction of shallow groundwater and subsequent discharge into nearby storm drains or storage ponds. Dewatering effluent may contain pollutants (e.g., sediment, residual petroleum hydrocarbons and elevated heavy metals) that require removal prior to discharge to avoid potential water quality impacts.

The scope and costs of contamination assessment and remediation works prior and during construction are not yet determined. Development of the OWDP to date has assumed that costs for these activities will be borne by the landowner (NRG), however, this has not been confirmed.

Therefore, there is a residual risk that the scope of contamination remediation is significant, and the cost will not be borne by the landowner, in which case it would sit with the project owner. Therefore, the risk allocation sits with the District for DBB, DBOM and DBFOM delivery models. It is likely that this risk could be shared with (but not completely transferred to) a PPP delivery partner under that model. This risk has been grouped in Contingent Risk Group C4, as described in Table III-10.

GHD has allowed a likelihood of occurrence at 30% and a consequence with a P5 to P95 range of $5-50 million.

Site Demolition

Demolition may be required at the ESGS during OWDP construction. The extent of demolition is not yet confirmed (more detailed design is needed), but major demolition works of the existing (but decommissioned) Units 3 and 4 will be needed.

Capital cost estimates for the OWDP (including those developed by GHD and presented in Section 3.2.1) have not allowed for major demolition works associated with Generating Units 3 and 4 (which are idled and disused power generation assets), as they are owned by NRG and it is assumed they will bear those costs. This has not been confirmed, for the same reason, there is a residual risk that the demolition costs would borne by the OWDP owner.

As a result, the risk allocation sits with the District for DBB, DBOM and DBFOM delivery models. It is likely that this risk could be shared with (but not completely transferred to) a PPP delivery partner under that model. This risk has been grouped in Contingent Risk Group C4, as described in Table III-10.

GHD has allowed a likelihood of occurrence at 30% and a consequence with a P5 to P95 range of $5-50 million.

Reuse of Existing Intake Infrastructure

The Current Project Design involves reuse of the northernmost existing ESGS 12-foot concrete intake tunnel to convey the seawater feed to the OWDP facility. OWDP construction would include installation of 42-inch pipes inside the existing ESGS intake. This is viewed as feasible however the condition of the tunnel is unknown. Higher costs may eventuate if the tunnel is not usable.

This risk is unlikely to be accepted by the private sector unless early involvement through a PPP delivery model is adopted, since the condition of the tunnel is entirely out of the control of the contractor. A PPP partner could potentially share the risk. This risk has been grouped in Contingent Risk Group C3, as described in Table III-10.

GHD has allowed a likelihood of occurrence at 20% and a consequence with a P5 to P95 range of $5-100 million.

Design-related Maintenance Risks

Design of the OWDP treatment facility will be conducted by a contractor to the District. Depending on the delivery model chosen, the designer team may also include the entity responsible contractually for O&M of the facility during commercial operation. This is the case in all delivery models considered except for DBB, in which the plant operator will be engaged separately and after design is completed. As discussed in Section 2.3, it is highly recommended for large-scale seawater desalination projects that the design team integrate an operations role. Inclusion of the long-term operator on the design team will ensure that decisions over process technology will reflect that future operating risk is minimized as the design is optimized to mitigate the risk of long-term operating costs and equipment durability. If design and operations roles are separated, it may incentivize behaviors such as designing a process that can be built cheaply but will have a shortened operational life or very high operating costs that a contract operator may not be willing to accept or the District would have responsibility for higher costs of O&M.

This risk captures a potential scenario where the design of the facility results in higher than expected maintenance costs – e.g. additional equipment failures, downtime or additional refurbishments. (Effects on operating costs such as labor and consumables are captured separately in the ‘Labor and Consumables’ risk below.)

This risk will be accepted by the private sector for the DBOM, DBFOM and PPP delivery models since the design and operations functions are bundled. As noted above, it is unlikely to be accepted by the private sector in a DBB. This risk has been grouped in Contingent Risk Group E, as described in Table III-10.

GHD has allowed a likelihood of occurrence at 50% and a consequence with a P5 to P95 range of $1-5 million per year.

Regulatory and Permitting – during Operation

There is an ongoing residual risk that regulatory requirements are amended during operation of the OWDP, which leads to changes in treated water quality, waste disposal processes, brine discharge, monitoring requirements etc. during the project’s 30-year operations phase. This could lead to additional ongoing O&M costs.

The likelihood and consequence of this risk is difficult to quantify as there are wide variety of possible regulatory changes that could occur. Its potentially significant impact has been seen in cases such as Carlsbad Desalination Plant which has had to alter its seawater intake in response to a combination of California Ocean Plan Amendment (OPA) requirements and changes to the co-located power plant operation.

In GHD's experience this risk is unable to be transferred away from the District as the third-party O&M contractor in a DBB, or the operations team in a DBOM, DBFOM or PPP model can reasonably argue the regulatory changes were not foreseen during procurement. In reality, operating contractors and the District work together to develop the most efficient response to a regulatory change, but the higher cost of water is ultimately borne by the District and its customers through amended pricing of the operations contract. This risk has been grouped in Contingent Risk Group G, as described in Table III-10.

GHD has allowed a likelihood of occurrence at 30% and a consequence with a P5 to P95 range of $0.2-1 million per year.

Seawater Quality and Algal Blooms

The design of the OWDP will be based on a defined seawater quality range and a combination of mandated and targeted ranges for treated water quality parameters. There is a residual risk that long-term seawater quality parameters change during the project's 30-year operations phase leading to higher O&M costs to maintain the same treated water quality output. For example, water temperature is an important factor in reverse-osmosis membrane performance and long-term changes in seawater temperature could impact treatment train performance.

Red tide and other algae bloom events could have similar impacts for the Current Project Design of the OWDP which relies on open seawater intake. The subsurface intakes of the Subsurface Intake Design eliminate this risk. In GHD's experience this risk is unable to be transferred away from the District unless a PPP model is used, as an operator can reasonably argue the seawater changes were not foreseen, or constitute an emergency event in the case of algal blooms. In the case of Carlsbad, some costs related to algal blooms were shared with the PPP partner. Therefore, this risk has been grouped in Contingent Risk Group F, as described in Table III-10.

GHD has allowed a likelihood of occurrence at 10% and a consequence with a P5 to P95 range of $0.2-1 million per year for long-term seawater quality risk.

Californian severe red tide events (i.e. those which result in significant additional operational costs or even plant shutdown leading to lost revenue) are being seen in the range of once per three to five years at Carlsbad. GHD has allowed for a likelihood of occurrence of 25% per year in each of the 30 years of plant operation, and has allowed a consequence with a P5 to P95 range of $1-10 million per year of occurrence[21]. The higher end of the consequence allowance reflects situations in which the plant reduces capacity or is shut down and there is lost revenue to the project owner.

Note that this risk applies for the Current Project Design only, due to the use of an open seawater intake. In contrast, Subsurface Intake Design proposes to use SIG as SSI – algae is removed from the seawater feed during the passage of seawater through the seabed and into the subsurface intake.

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[21] Given the intermittent and yearly nature of the red tide risk, a binomial distribution was used to model the likelihood (p=0.25, n=30). This is the only risk in the risk register which did not use a Bernoulli (i.e. yes/no) function to model likelihood.

Labor and Consumables Risk

There is a risk that the cost of operating labor or plant consumables (e.g. chemicals, replacement membranes, spare parts etc.) increase significantly above expected levels during the plant's operating life.

Operating contracts deal with the costs of operating labor and consumables differently. Sometimes the cost is passed directly through to the facility owner. In other cases, the risk can be transferred away from the District through provisions setting price ceilings or limits on price adjustments over time.

For the purpose of this analysis, it is assumed that labor and consumables risk is transferred to the private sector in all cases where the operator is involved in design phase. The risk sits with the District for the DBB model, but is transferred away in the DBOM, DBFOM and PPP models (Contingent Risk Group E, as described in Table III-10).

The labor and consumables risk were modelled in the risk-adjusted cash flow model by including uncertainty (inherent risk) in the labor, chemicals, membrane replacement and maintenance components of OPEX for the DBB, while prescribing it as a fixed value (the base estimate) for the other delivery models.

Offshore Intake Risk

The SSI contemplated in the Subsurface Intake Design has residual risks of clogging or biofouling that could over limit extraction of sufficient seawater to the OWDP treatment facility, over time during the operations phase. This could result in far greater O&M activities to regularly clean the intake.

In GHD's experience this risk is unlikely to be accepted by the private sector partner or operator unless they have significant financing stake in the project. This risk is a key part of the final commercial negotiations which will occur during project delivery and should be considered further by the District.

For this analysis it is assumed that this risk will reside with the District in the DBB, DBOM, DBFOM-10% and DBFOM-50% delivery methods. In the DBFOM-100% and PPP delivery methods, it is assumed the risk can be shared with the private sector (Contingent Risk Group F, as described in Table III-10).

GHD has allowed a likelihood of occurrence at 30% and a consequence with a P5 to P95 range of $2-10 million per year. This applies to the Subsurface Intake Design only. The Current Project Design does not include a SSI so this risk does not apply.

Power Consumption and Power Price Risks

Desalination is an inherently energy intensive process and great effort is needed during design-phase to deliver a system with the lowest and consistent power consumption.

Power costs will be the largest driver of ongoing operational costs of the OWDP and process power consumption is a key factor in assessing bids and selecting a preferred design. Generally, power consumption limits during operation can be guaranteed when the design and operation functions are combined contractually contractor – i.e. the operator does not receive additional compensation if the actual electricity consumption of the facility exceeds previously agreed-upon formulas or benchmarks included in the operating agreement. This is included in the Carlsbad WPA.

Therefore, the District can transfer power consumption risk to the private sector in all delivery models except DBB (Contingent Risk Group E, as described in Table III-10). This was modelled by including uncertainty (inherent risk) in the power consumption parameter for the DBB, while prescribing it as a fixed value (the base estimate) for the other delivery models.

Power for the facility is likely to be provided by the local utility SCE. While the OWDP would be a very large single customer of SCE, the power prices received would be influenced by the macro price drivers in Southern California and the OWDP is unlikely to have overriding bargaining power to fix power prices over a long-term 30-year operational period. (As noted in the EIR, the OWDP power demands represent only 0.15% of the total electricity demand in LA County, supplied by SCE.)

In GHD's experience the power price risk is typically passed through to the District with the contracted cost of water – i.e. when the water is delivered, the estimated cost of water in the operations contract or contracted cost under the WPA in a PPP would include adjustments due to changes to the electricity rate. This was the case in the Carlsbad WPA.

Therefore, it is assumed that the District bears the power price risk in all delivery models (Contingent Risk Group G, as described in Table III-10). This could be a key commercial negotiation point during procurement.

Opportunities – Cost Savings from Private Sector Involvement (Construction and Operation)

It is commonly assumed that the increased levels of private sector involvement in project development can result in improved reduced costs during design, construction and operation. This can be attributed to increased purchasing power of private sector parties who may deliver many different desalination and construction projects, or increased focus on minimizing O&M costs during operation.

GHD has allowed a likelihood of occurrence at 60% and a consequential cost benefit with P5 to P95 range of $2-10 million of capital cost, and $0.2-1 million per year of operating costs. It is assumed potential cost savings would be fully passed on to the District in a DBFOM or DBOM delivery model, or shared under a PPP model (Contingent Risk Group H, as described in Table III-10).

Demand Risk

If built, the OWDP would offer a drought-proof supply of potable water for the District, its customer Retail Agencies and the region. The water security, reliability and other benefits from establishing this supply come at a price, since the cost of desalinated water is higher than the equivalent cost of imported water, as demonstrated by the cash flow model results (see Section 5).

Because of this, desalination facilities are exposed to demand risk – a risk that, after construction, desalinated water from the OWDP would not be financially attractive to produce and purchase in light of competition from cheaper alternative water supply (say due to high rainfall periods leading to large supply of imported water).

The impacts of demand risk have been seen on desalination facilities around the world, e.g.:

- The Charles E. Meyer Desalination Facility in Santa Barbara was developed in the context of the 1987-92 drought but before construction was completed, rainfall returned and water reservoir storage levels recovered. The City elected to use less expensive water and put the desalination plant in standby when construction was completed in 1992.
- The 120 MGD Victorian Desalination Plant was developed from 2008-12 in the context of Australia's Millennium Drought. After its completion in 2012, the plant was immediately put in standby as surface water storage had returned to adequate levels.

In these situations, the capital repayments for the plants need to be serviced even while in standby, resulting in higher costs to customers even though no desalinated water is delivered. There are also costs to maintain the plant in standby mode. In essence, the desalination facility becomes an insurance policy available for future needs.

In the context of the OWDP, it is highly unlikely demand risk will be able to be fully transferred to the private sector. For delivery models using majority private financing (e.g. PPP or DBFOM-50%, DBFOM-100%), guaranteed revenue is necessary to secure financing. It is for this reason that WPAs include the availability fee, which guarantees the operator receives revenue irrespective of the amount of water ordered from the facility (i.e. take-or-pay approach). In this way, WPA is structured such that capital obligations can be paid even if no water is taken and the demand risk must be shifted to the District and its Retail Agencies, to secure private financing.

For example, the Carlsbad WPA obligates SDCWA to purchase 48,000 AFY of water, 85% of the 56,000 AFY maximum plant capacity. Similarly, the water payments from the Victorian Desalination Project includes a minimum 85% contribution for availability, and an even higher proportion when no or low amounts of water are purchased.

Similarly, for the DBB, DBOM and DBFOM-10% demand risk would sit with the District and its customers, because of its obligations to repay the capital loans. Arguably, the demand risk impact is lower for these options since they involve public financing, which results in lower financing costs and capital repayment amounts.

Demand risk is not quantitatively included in this contingent risk analysis as it does not help compare the delivery model options. Nevertheless, it is important to consider it when determining whether to proceed with the OWDP project or not. In addition, demand risk must be considered over the entire project life, not on a year-to-year basis. Both the Charles E. Meyer and Victorian Desalination Plant have been reactivated to full operation after periods of dormancy in response to changed climatic conditions.

As a final note, demand risk does not apply if the facility is used as a 'baseload' facility – i.e. it operates at full capacity throughout its operating phase, without regard to incremental cost from alternative water supplies. The District's UWMP 2015 currently envisages this operating mode.

Financing Risk

Financing risk, also known as borrowing rate risk, refers to the possibility that the actual interest rate received through a given financing method ends up being different to expectations. In this sense, financing risk is an inherent risk.

This analysis has not included financing risk in the risk-adjusted cash flow analysis because the six project delivery methods considered already encompass the wide range of average weighted interest rates that may be received to finance the project. As such, the impact of higher or lower interest rates is already seen through the cash flow analysis outcomes for the different delivery models.

Sea Level Rise

The ESGS site is located on the El Segundo beachfront. Risk of flooding due to long-term sea level rise has been identified as a risk and flood mitigation will be included in the permitting process for the California Coastal Commission. There is a risk that to meet the requirements of flood protection and permitting, additional costs will be incurred to the project.

This risk has been addressed by estimating the additional capital cost to raise the site elevation by 4 ft during construction. The cost of this was estimated in the order of $5 million as per a separate preliminary study completed by GHD for the District in 2020.

For conservatism, GHD has modelled this risk with a likelihood of 75% and a cost range of $2-10 million. This models the scenario in which the sea level rise risk is fully mitigated by incorporating site elevation works during construction. The decision on including site elevation in construction will be made in future stages of the project based on regulatory input. There may be a possibility that additional costs can be avoided by site rearrangement but this is sensitive to the requirements of the regulators.

In GHD's experience this risk is unlikely to be accepted by the private sector partner regardless of delivery method, and any requirements around sea level rise mitigation must be stipulated by the District in its procurement documentation. Therefore, this risk is classified as Contingent Risk Group D, as described in Table III-10.

Integration with existing outfall

The Subsurface Intake Design includes provision to dispose of waste brine from the OWDP by co-disposing it with the existing Hyperion treated wastewater outfall. There is a minor risk that by comingling these waste streams, buoyancy or other properties of the outfall stream will be sufficiently altered that the existing diffusers need to be redesigned and/or replaced to meet environmental standards. This would result in additional cost to the project.

In GHD's experience this risk is unlikely to be accepted by the private sector partner regardless of delivery method, and any requirements related to this must be stipulated by the District in its procurement documentation. This risk is classified as Contingent Risk Group D, as described in Table III-10.

GHD has allowed a likelihood of occurrence at 30% and a consequence with a P5 to P95 range of $5-50 million. This applies to the Subsurface Intake Design only. The Current Project Design does not require any integration with the existing outfall.

Force Majeure Risk

Force majeure risks have not been quantified in this risk analysis. Force majeure risks will inevitably reside with the District.

6.3 MWD Imported Water Risk Adjustments

A risk-adjusted profile of the potential future MWD Imported Water cost was generated within the model. Figure III-24 shows the probabilistic cost range used, with comparison to the low, medium, and high scenarios used in the earlier analysis in Section 5. The risk-adjusted estimates are consistent with those estimates.

The High (Step) scenario aligns roughly with the P80 estimate in the risk-adjusted cost model. Another way of interpreting the output of the cost model is indicated by the percent probability bands shown to the right of the figure:

- There is a 30% probability the cost of water will fall between the P50 (thick green) and High (Step) estimate (dashed red).
- There is a 10% probability the cost of water will fall between the High (Step) estimate (dashed red) and P90 estimate (higher thin green).

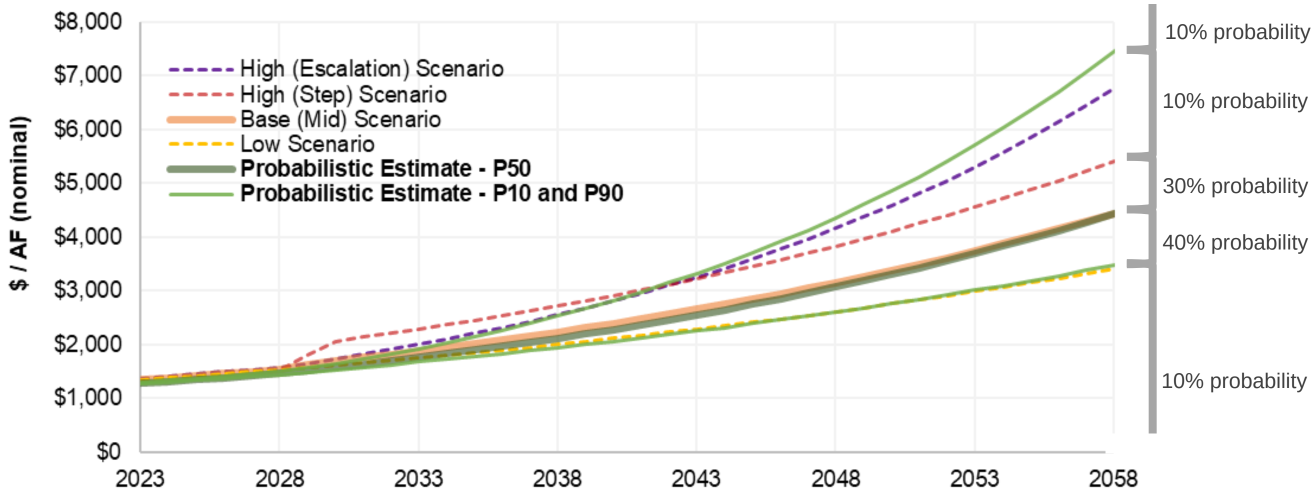

Figure III-24 Probabilistic cost model for MWD Imported Water (with reference to earlier Low, Medium and High scenarios developed for this study)

6.4 Results

6.4.1 Overview

Using the procedure outlined above, the risk-adjusted outcomes were calculated for each of the project delivery models. The model ran five hundred (n=500) Monte Carlo simulations for each delivery model, and four outputs were considered: risk-adjusted capital cost, risk-adjusted whole-of-life NPC, risk-adjusted operating cost, and risk-adjusted yearly cost of water ($/AF).

Table III-11, Figure III-25 and Figure III-26 below present a summary comparison of the risk-adjusted results for the various delivery models.

Table III-11 Comparison summary of risk-adjusted model outputs

	Current Project Design						Subsurface Intake Design					
	Total capital cost ($ mil)		Annualized OPEX ($ mil / yr)		Project NPC ($ millions)		Total capital cost ($ millions)		Annualized OPEX ($ mil / yr)		Project NPC ($ millions)	
	P50	P90	P50	P90	P50	P90	P50	P90	P50	P90	P50	P90
DBB	$469	$537	$21.7	$24.3	$1,102	$1,209	$674	$774	$22.3	$27.9	$1,361	$1,551
DBOM	$464	$525	$20.6	$22.3	$1,067	$1,162	$670	$759	$20.9	$25.9	$1,320	$1,489
DBFOM-10%	*Same as DBOM above*				$1,095	$1,193	*Same as DBOM above*				$1,361	$1,535
DBFOM-50%					$1,205	$1,311					$1,524	$1,707
DBFOM-100%					$1,343	$1,460					$1,725	$1,924
PPP	$453	$496	$20.0	$21.5	$1,688	$1,860	$659	$741	$20.7	$23.3	$1,730	$1,905
Sensitivity - DBOM with 50% DWSRF loan	*Same as DBOM above*				$981	$1,068	*Same as DBOM above*				$1,194	$1,353

Note: all values shown are expressed as 2019 dollars

The results indicate:

- The District can indeed reduce its risk exposure by using a project delivery model with higher levels of private sector involvement. For example, the PPP model reduces the District's capital risk exposure compared to the DBOM model by approximately $10 million for both project designs, using the median (P50) values. The value of this risk transfer is even higher in unlikely but serious project scenarios where multiple risks eventuate – i.e. when using the P90 values, it is estimated the PPP model reduces the District's capital risk exposure by ~$29 million for Current Project Design 1 and ~$11 million for Subsurface Intake Design. Operating risk exposure is also reduced, quite significantly, through a PPP.
- However, 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. This is indicated by the NPC values which include the impact of project financing costs. For example, the NPC of the PPP is 20-28% higher compared to the DBOM model for both Current Project and the Subsurface Intake Designs.

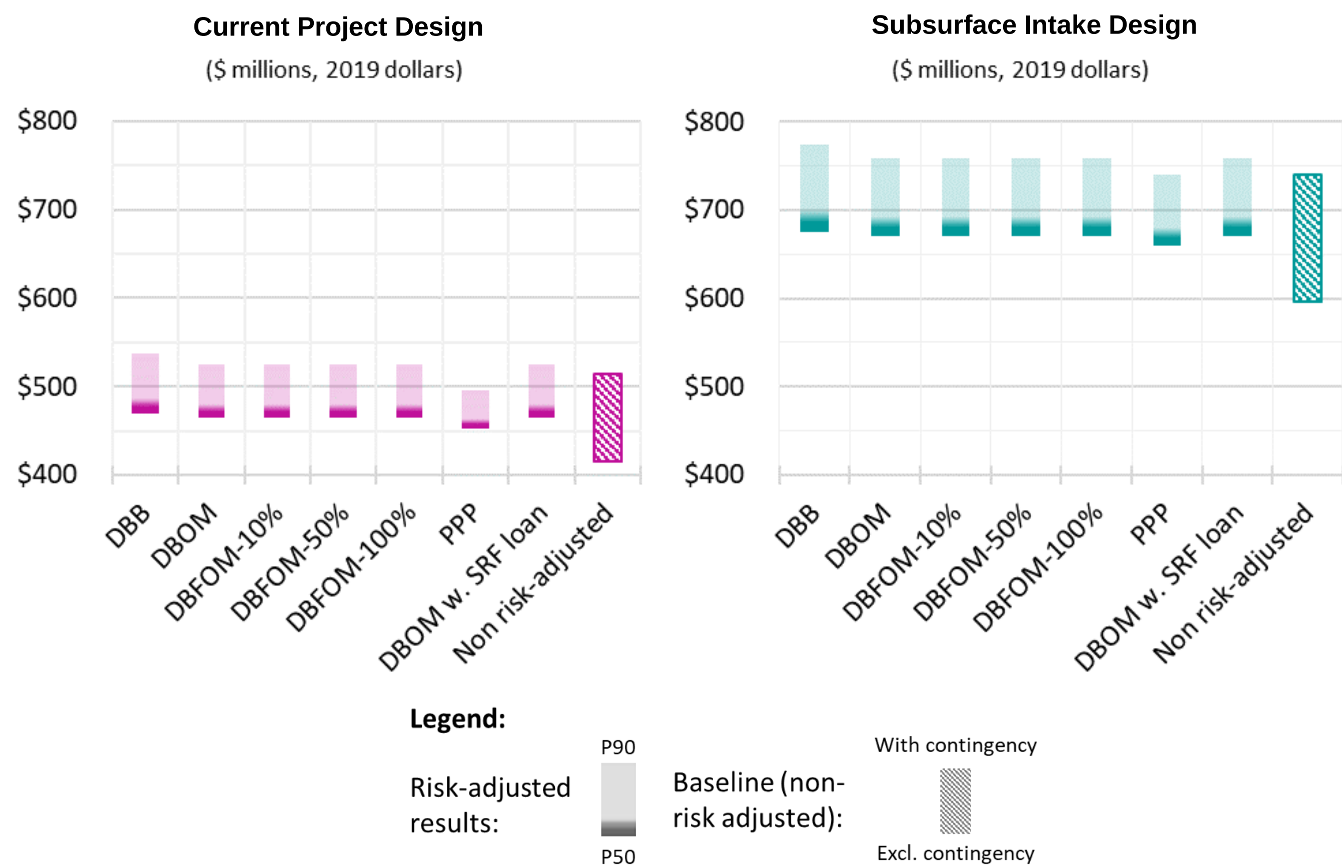

Figure III-25 Graphical summary of risk-adjusted capital cost estimates for project delivery model options

- The DBFOM delivery models (DBFOM-10%, DBFOM-50% and DBFOM-100%) do not appear attractive. This is because all the risk transfer benefits offered by the DBFOM model are also offered by the DBOM model, and the DBOM model has lower financing costs since it does not incorporate any private financing. The

DBFOM-100% model does not appear as attractive as the PPP model which also includes full private financing, but can accommodate more risk transfer.

- The DBB delivery model does not appear attractive. The DBOM delivery model enables transfer of operational risk and some additional capital risk transfer to the private sector, when compared to the DBB model and has the same financing costs. In addition, commentary in Section 2.3.1 noted that the DBB model would be extremely uncommon for a desalination facility of this size as it conflicts with the best practice approach which is to combine the design and operational functions to a single contracted entity. For these reasons, the DBOM model is preferred over the DBB model.
- The risk-adjusted modelling further confirms the value of pursuing low-interest financing options such as the DWSRF loan. These programs are more accessible when the project is owned by the District (not the private sector), providing an advantage to the DBOM model over the PPP model (though this was not explicitly modelled in the risk analysis).

Based on the risk analysis results, GHD recommends the DBB, DBFOM-10%, DBFOM-50% and DBFOM-100% be discarded from further analysis.

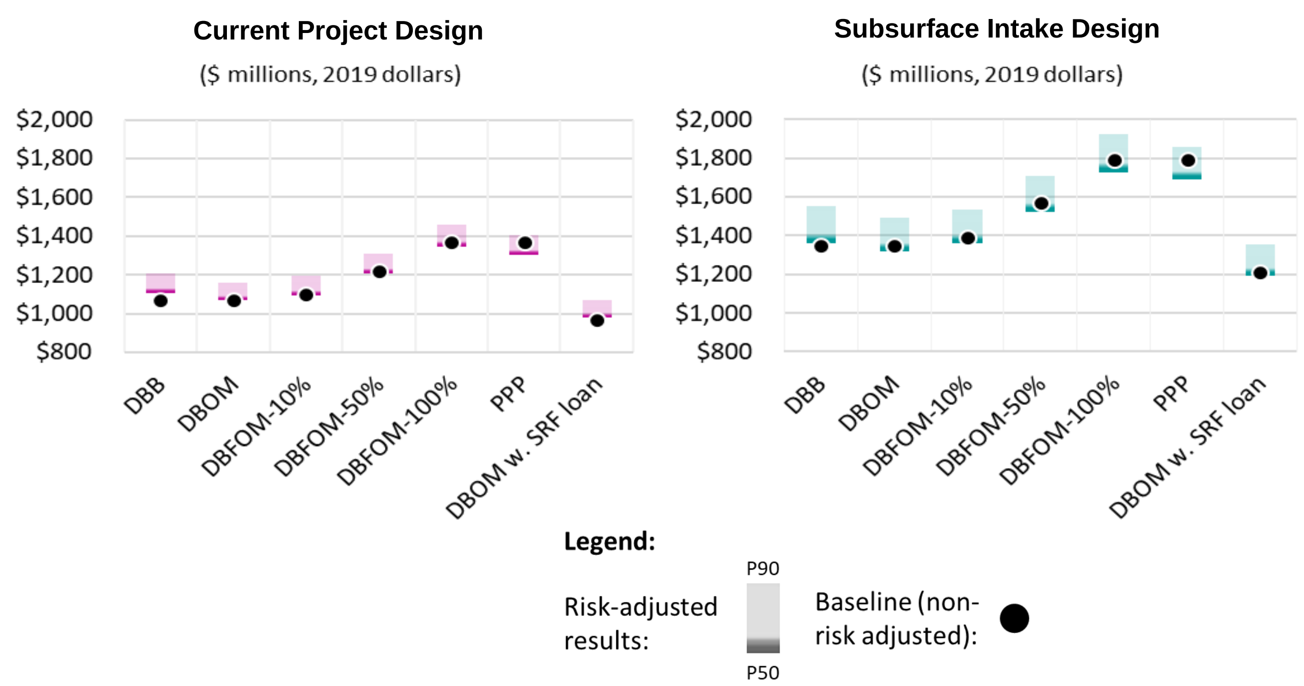

Figure III-26 Graphical summary of risk-adjusted NPC estimates for project delivery model options

6.5 Risk Sensitivity Analysis

The @Risk modelling software used to compute the risk-adjusted cash flow analysis is able to perform multivariate sensitivity analysis which links changes in a single model output to the spread of input values applied from *all* the model inputs. It then ranks the inputs in order of impact.

For the purpose of this analysis, the top five most sensitive risk inputs were identified for the key delivery models, as measured by their impact to the project whole-of-life cost (as NPC).

A summary of the results is provided in Table III-12 below. Evidently, the risks of major importance to the project are:

- Risks related to power price and/or consumption
- Capital risks related to reuse of existing infrastructure – intake infrastructure in the case of the Current Project Design and brine disposal infrastructure for the Subsurface Intake Design
- For the Subsurface Intake Design, the risk of poor performance from the SIG is extremely significant on the project outcome
- Permitting and regulatory risks during construction and operation
- Site contamination and demolition risks that may add additional civil works to the project scope
- The analysis confirms that investing in studies during permitting and design phase to better characterize and mitigate these risks should be prioritized

Table III-12 Ranking of most significant risks – DBB, DBOM and PPP options

Rank	DBB		DBOM		PPP	
	Current Project Design	Subsurface Intake Design	Current Project Design	Subsurface Intake Design	Current Project Design	Subsurface Intake Design
1	Power escalation	Offshore intake performance risk (contingent operating risk)	Power escalation	Offshore intake performance risk (contingent operating risk)	Power escalation	Offshore intake performance risk (contingent operating risk)
2	Design related maintenance risk (contingent operating risk)	Design related maintenance risk - (contingent operating risk)	Power Cost	Power escalation	Power Cost	Power Escalation
3	Power Cost	Power Esc	Reuse of existing intake infrastructure (contingent capital risk)	Power Cost	Reuse of existing intake infrastructure (contingent capital risk)	Power Cost
4	Reuse of existing intake infrastructure (contingent capital risk)	Power Cost	Demolition costs (contingent capital risk)	Demolition costs (contingent capital risk)	Regulatory risks during construction (contingent capital risk)	Demolition costs (contingent capital risk)
5	Regulatory risks during construction (contingent capital risk)	Regulatory risks during construction (contingent capital risk)	Site contamination (contingent capital risk)	Site contamination (contingent capital risk)	Regulatory risks during operation (contingent operating risk)	Site contamination (contingent capital risk)

** As ranked by size of regression coefficients between output (NPC of project) to risk model inputs. Source: @ Risk modelling performed by GHD.*

Detailed outputs are shown for the DBOM, PPP and sensitivity DBOM with 50% SRF funding scenarios.

6.5.1 Detailed Risk-adjusted Results

Detailed risk-adjusted outputs showing the cost of water for each delivery model are included for reference in Appendix C.

7 Outcomes and Recommendations

The combination of financial and risk analysis performed in this Chapter demonstrates:

- OWDP Current Project Design is considerably more attractive than the 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 around $300 to $450 million on an NPC basis, depending on the delivery model (notwithstanding the various technical challenges which make the Subsurface Intake Design infeasible regardless of financial outcomes). The Current Project Design is the technical project description included in the Final EIR. However, it does not use the OPA preferred technologies for seawater intake and brine discharge, and therefore results in a longer permitting timeframe, and a longer time until the facility will become operational.
- The choice of project delivery model to deliver the OWDP has a significant impact on the OWDP financial performance 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).
- Furthermore, the value of securing cheaper lower interest rate financing options through available State and Federal funding sources established to support water infrastructure development is clearly evident and should be a priority for the OWDP. Cheap public funding sources such as the DWSRF or WIFIA should be aggressively pursued during project development. These funding sources will be generally more accessible when the project is owned by the District 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 NPC basis. This equates to a cheaper cost of desalinated water of at least $300/AF at the start of operation.
- Minimizing power price and power consumption is extremely important to reduce the costs of the OWDP. 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. However, 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.
- This analysis demonstrates the DBOM delivery method offers the lowest risk-adjusted cost for the project, on both an NPC basis and cost of water over time. Based on the analysis so far, it is an attractive delivery model.

- The PPP delivery model offers the maximum risk transfer away from the District. This may be advantageous if the District places a high priority on minimizing capital cost risk. However, this risk transfer comes at a significant cost 'premium'. The viability of the PPP model is analyzed further to investigate impacts on the District's overall financial position (Chapter IV), wholesale rates (Chapter V) and affordability impacts to customers (Chapter VI), with comparison to the DBOM model.

Based on the findings from this analysis, GHD recommends the DBB, DBFOM-10%, DBFOM-50% and DBFOM-100% be discarded from further analysis.

This would leave the DBOM and PPP delivery models to be taken forward to the next stages of this project. The DBOM sensitivity scenario which includes 50% SRF funding will also be considered further, as a sensitivity scenario.

8 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		

Appendices

Appendix A – Cash Flow Model Outputs

See attached

Appendix B – Risk Analysis Methodology

Appendix B1 – OWDP Preliminary Risk Register

See attached

Appendix C – Risk-Adjusted Cash Flow Model Outputs

Appendix D – OWDP Power Consumption Calculation

See attached

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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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