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Evaluation of the Deep Water Desalination Project Costs

12 September 2014

Prepared for

Soquel Creek Water District

Monterey Peninsula Water Management District

K/J Project No. 1468018.00

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List of Acronyms

AFY	Acre Feet Per Year
DWD	Deep Water Desal
IRP	Integrated Resources Plan
JPA	Joint Powers Authority
MGD	Million Gallons Per Day
MPWMD	Monterey Peninsula Water Management District
SCADA	Supervisory Controls and Data Acquisition
SqCWD	Soquel Creek Water District

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Section 1: Introduction

The Soquel Creek Water District (SqCWD) has practiced groundwater management for over 25 years and monitors for changes in water quality and groundwater levels in mid-Santa Cruz County. SqCWD is leading a regional effort to find a supplemental water supply that will help reduce pumping from the over-drafted groundwater aquifers and prevent seawater intrusion. As part of developing a groundwater basin sustainability program, SqCWD is evaluating the feasibility, infrastructure components and conceptual level costs for potential alternative water supply projects.

The SqCWD's 2012 Integrated Resources Plan (IRP) Update is a long-term water plan that offers a diversified strategy emphasizing water-use efficiency through demand management (e.g. conservation efforts), groundwater management, and evaluation of recycled water and desalination supplemental supplies. As part of the SqCWD IRP, the supplemental water supply objective is to provide an estimated average of 1,500 acre-feet per year (AFY), or 1.3 million gallons per day (mgd), of additional potable water supply every year for at least 20 years to protect and recover over-drafted aquifers in mid-Santa Cruz County.

The Monterey Peninsula Water Management District (MPWMD) provides oversight, promotes and provides long-term sustainable water supply to the Monterey Peninsula communities. The MPWMD also manages and protects water resources for the benefit of the community and the environment. The Monterey region will be required to reduce its withdrawal of surface water from the Carmel River. The water agencies in the region have been evaluating various supplemental water supply projects. The required additional supplemental water objective in the Monterey region is approximately 9,600 AFY

The Deep Water Desalination (DWD) Project proposes to construct a desalination facility near Moss Landing, California to produce up to 25,000 AFY of potable water that could provide water to communities in Monterey and Santa Cruz Counties. SqCWD is interested in evaluating the potential for participation and purchase of water from the DWD Project. The MPWMD is providing some funding assistance to the DWD Project for the environmental permitting of the project as an option for a supplemental water supply for Monterey County. This report provides SqCWD and MPWMD with an evaluation of the reported construction and operating costs of the DWD Project to support their evaluation of supplemental water supply alternatives.

1.1 Deep Water Desalination Project Overview

The DWD Project proposes to construct a desalination facility near Moss Landing, California to initially produce approximately 10,000 AFY (9 mgd) of potable water and up to 25,000 AFY (22 mgd) in a future phase. The DWD Project proposes to co-locate the Desalination Facility with a Data Center that would share infrastructure with the Desalination Facility. Co-location of these two

facilities should reduce the capital and operating cost of each facility as compared to building and operating the two facilities separately.

The DWD Project proposes to form a joint powers authority (JPA) to own, finance and operate the Desalination Facility in parallel with a privately financed and operated Data Center. Under the JPA, the member agencies would be responsible for financing the capital cost of the Desalination Facility, with the exception of the intake and outfall infrastructure. The JPA would also be responsible for operating and maintenance costs of the Desalination Facility.

1.2 DWD Project Cost Evaluation Approach

The Monterey Peninsula Regional Water Authority (MPRWA) conducted an evaluation of three proposed seawater desalination projects, including the DWD Project, in 2012 and early 2013 (2013 Evaluation). The 2013 Evaluation included a comparison and analysis of the capital costs and operating costs for the proposed desalination projects. The DWD Project has evolved since the 2013 Evaluation was conducted and Kennedy/Jenks evaluated the project costs in light of those project changes.

The approach to the evaluation of the DWD project costs includes the following elements:

1. Review and discuss the current DWD Project components and costs based on meetings and information provided by DWD.
2. Prepare an independent cost estimate for similar 9-mgd Desalination projects with the same components as the proposed DWD Project.
3. Evaluate the differences and the potential reasons for differences for the high level project capital and operating cost elements.
4. Evaluate the impact that cost differences may have on the overall project unit water cost.
5. Benchmark the projected costs for the DWD Project with other desalination projects.
6. Provide an opinion on the reasonableness of the projected DWD Project capital and unit water costs.

1.3 Review Documents

The evaluation of the capital and operating costs for the DWD Project is based on meetings and phone conversations with the DWD Group and review of the reports, conceptual and preliminary designs, and cost estimates provided by the DWD Group.

Section 2: Description of Proposed DWD Project

The DWD Project proposes to construct a desalination facility near Moss Landing, California to initially produce approximately 10,000 AFY (9 mgd) of potable water and up to 25,000 AFY (22 mgd) in a future phase. The major elements of DWD Project that have changed from late 2012 to present include the following:

- DWD proposes to co-locate the Desalination Facility with a Data Center that would share infrastructure with the Desalination Facility to save capital and operating costs. The Desalination Facility and Data Center elements of the project are critical to the overall success of each, but are structured as separate project elements as described below.

- DWD proposes to finance the capital cost of the intake and outfall with the Data Center, and therefore reduce financing costs for the Desalination Facility.

- The Data Center is proposed to be seawater cooled, and then the warmer seawater would become the feed for the Desalination Facility, which should lower the operating cost of each facility as compared to building and operating two separate facilities.

- DWD has developed a Municipal Power Authority agreement with the City of Salinas which should help the project obtain low cost energy.

- The DWD has a greater level of detail in the preliminary design and has conducted additional studies to support the environmental and regulatory permitting of the project, providing more definition to the project.

2.1 Proposed DWD Project Financing and Ownership

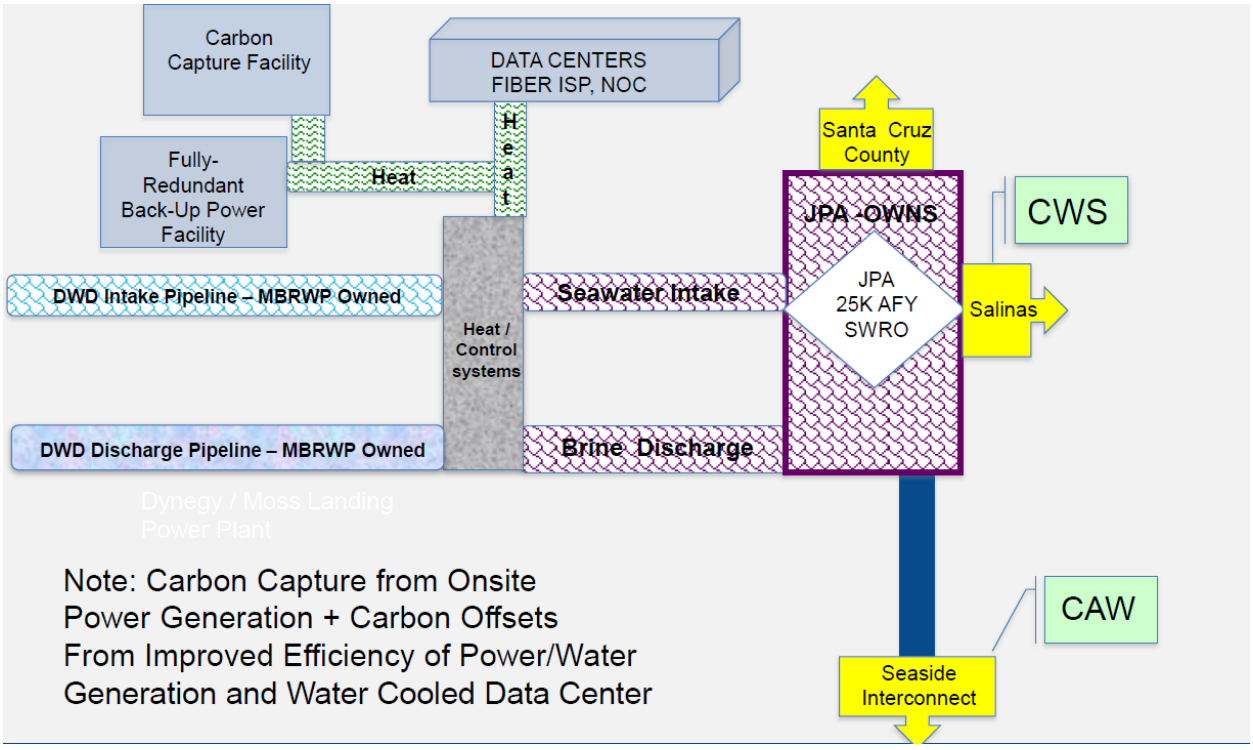
The overall DWD Project is proposed to be a form of a public-private partnership. The DWD Group would privately design, finance, construct and operate a seawater-cooled Data Center that would provide high speed internet servers for Silicon Valley companies and the Central California region. The DWD Project proposes to form a JPA, made up of public water agencies, to finance and operate the Desalination Facility separate from the Data Center part of the project.

The JPA is required for the water supply part of the project to meet the law that requires water providers in Monterey County be public agencies. The JPA may also be beneficial in obtaining lower interest loans for the Desalination Facility. Under the JPA, the member agencies would be responsible for financing the capital cost of the Desalination Facility, with the exception of the intake and outfall infrastructure. The JPA would also be responsible for operating and maintenance costs of the Desalination Facility. The JPA would pay the DWD Group for a portion of the operations and maintenance costs of the intake and outfall system.

The DWD Project proposes that the JPA Desalination Facility would operate on a take or pay system for a period of at least 20 years. The take or pay system provides stable income to the JPA and helps to secure lower financing but requires the JPA members to take the water every year (or pay the equivalent if they choose not to take the full subscribed amount) for the full 20 years.

The benefits of the proposed DWD Project rely on the successful co-location of both elements of the Project: the private DWD Data Center and the public JPA Desalination Facility. Figure 1 below, shows the proposed infrastructure that the DWD Data Center would own and operate (in blue and grey colors) and the infrastructure that the JPA Desalination Facility would own and operate (purple color). The major components of each project element are further described below.

Figure 1: Proposed DWD Project Facility Ownership Approach



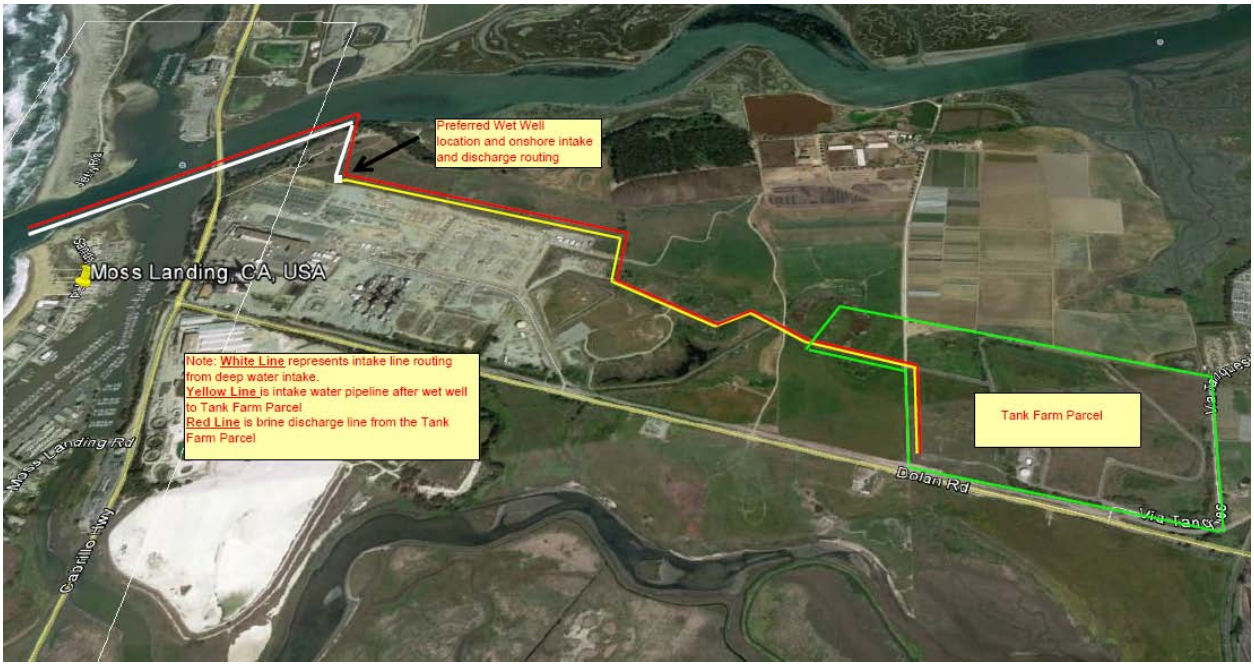
2.2 DWD Data Center and Project Intake and Outfall Pipelines

The DWD Data Center would own and operate the following infrastructure that would also support the JPA Desalination Facility.

- Screened Intake System offshore in "deep water" to meet requirements for minimizing entrainment and preventing impingement of marine life. (hence the name Deep Water Desalination Project.)
- Dual offshore intake pipelines designed to convey up to approximately 49 mgd of raw water to the onshore pump station (for future 25,000 AFY assuming 45% system recovery).
- Intake Pump Station and Pipelines from the shoreline to the nearby DWD Data Center and JPA Desalination Facility location.
- Heat exchange systems that would provide cooling water to the DWD Data Center and heated feed water to the JPA Desalination Facility.
- Main electrical substation that would provide power to the DWD Data Center and to the JPA Desalination Facility through separate metered services.
- Brine heat exchange and discharge pipelines that would convey the cooled brine (up to approximately 27 mgd) from the JPA Desalination Facility, to offshore diffusers to rapidly mix the brine into the ocean water to meet discharge requirements.

Figure 2 shows the onshore pipelines from the Intake Pump Station area to the "Tank Farm Parcel" where the DWD Data Center and the JPA Desalination Facility are proposed to be co-located.

Figure 2: DWD Data Center Infrastructure that Supports the JPA Desalination Facility



From a technical perspective, the concept of co-locating the Data Center and Desalination Facility is innovative and has the potential to lower capital and operating costs. Compared to an air-conditioned Data Center, the seawater cooling provides significant energy savings for the DWD Data Center. The heating of the seawater by approximately 5 to 10 degrees also reduces the energy costs for the JPA Desalination Facility. Both elements of the proposed project are important to the success and proposed benefits of the overall project. The major challenge to this co-location concept could come from the permitting and regulatory perspective.

The ownership of the intake and outfall infrastructure by the DWD Data Center saves up front capital cost financing, but adds risks for the JPA Desalination Facility. If the Data Center were to cease operations, the DWD group would be required to continue to operate the intake and discharge pipelines. The rent for the Desalination facility fully covers the capital and operating costs for those pipelines. DWD has discussed this potential scenario with MPWMD and states that this scenario would not result in any increased charges to the JPA.

The intake and outfall pipelines are planned to be sized to meet the needs of the Desalination Facility. The Data Center would only use a percentage of the total desalination supply for cooling. The DWD Project proposes that the JPA Desalination Facility would pay for a portion of the operating and maintenance costs for the intake and brine outfall facilities. It is also possible that the JPA Desalination Facility would maintain the intake and brine discharge permits for the intake and outfall infrastructure. This shared arrangement has benefits, but adds complexity to the project.

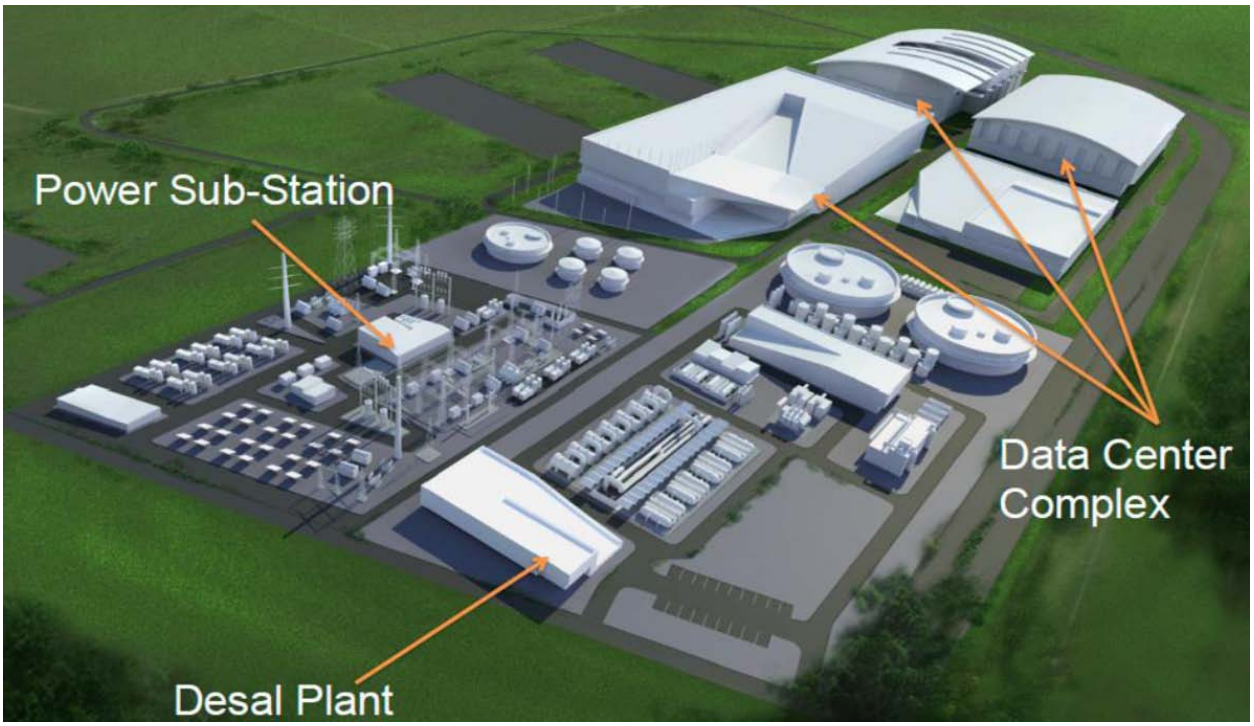
2.3 JPA Desalination Facility Components

The JPA Desalination Facility would finance, own and operate the following infrastructure to provide potable water to the JPA member agencies.

- Granular media filters to remove suspended solids from the seawater and associated coagulation pretreatment and backwash systems.
- Cartridge filtration, acid and antiscalant pretreatment systems for the seawater reverse osmosis (SWRO) system.
- SWRO treatment systems with energy recovery to remove salts from the filtered seawater.
- Calcite lime stabilization systems to add appropriate minerals back into the desalted water to minimize the corrosivity of the potable water.
- A Treated Water Tank to provide disinfection contact time and treated water storage.
- Spent washwater and solids handling systems to capture, treat and dewater the suspended solids from the filtration process.
- Associated Process Buildings, Electrical Service, and Supervisory Controls and Data Acquisition (SCADA) system.
- Piping and pump stations around the Desalination Facility including intake, and brine discharge pipelines to connect to the DWD Data Center provided Intake and Brine pipelines.

Figure 3 shows the proposed DWD Project location on an approximately 6 acre site at the "Tank Farm Parcel" where the Data Center and the Desalination Facility would be co-located. The Desalination Facility, shown in the lower center area of the figure, is approximately one quarter of the developed area and shares site infrastructure components with the Data Center. The costs of site infrastructure for the Desalination Facility should be lower as a result of co-locating the facility with the proposed Data Center Project, in comparison to a separate stand-alone Desalination Facility.

Figure 3: JPA Desalination Facility Co-Located with the DWD Data Center



2.4 Treated Water Pump Stations and Distribution Pipelines

Treated water pump stations and pipelines would be required to convey treated water from the JPA Desalination Facility to the members of the JPA. The DWD Project currently proposes that the distribution pump stations and pipelines would be financed, owned and operated by the JPA member agencies. A treated water distribution pipeline heading south would serve communities in Monterey County and a separate pipeline heading north would serve communities in Santa Cruz County. For this report, a northern pipeline and pump station is assumed to be owned and operated by SqCWD, and a southern pipeline and pump station is assumed to be owned and operated by MPWMD.

A potential northern pipeline route to SqCWD is shown in Figure 4. Based on the 1,500 AFY water needs of SqCWD the northern pipeline would be at least 12 inches in diameter. The northern pipeline could be larger diameter to accommodate additional potential JPA members. The pipeline would be about 75,000 to 80,000 feet (approximately 15 miles) long to get from the DWD Project in Moss Landing to the southern portion of the SqCWD distribution system in La Selva Beach. Additional improvements to the SqCWD distribution system may be required to move the new water supply throughout the system to reduce groundwater pumping.

Figure 4: Potential Northern Distribution Pipeline

For MPWMD, the southern pipeline could extend south from Moss Landing as shown in Figure 5. To supply up to 6,000 AFY of water, the southern pipeline would be at least 24 inches in diameter.

Figure 5: Potential Southern Distribution Pipeline

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Section 3: DWD Project Capital Cost Evaluation

This section presents an evaluation of the DWD Group's projected construction costs for the JPA Desalination Facility part of the overall DWD Project. The section also provides an opinion of probable cost for the treated water distribution pipelines to develop a unit cost of water delivered to customers for SqCWD and MPWMD.

3.1 Probable Construction Cost of a 10,000 AFY Desalination Facility

Table 1 presents a conceptual level, opinion of probable cost for a 10,000-AFY (9 mgd) seawater desalination facility near Moss Landing, similar to the proposed JPA Desalination Facility proposed by the DWD Project. This cost only includes the desalination treatment facility and does not include the DWD Data Center project elements that would support the desalination facility such as the intake and outfall, and does not include distribution system piping costs.

The opinion of probable costs presented in Table 1 are based on the DWD proposed project elements described above and use information developed in technical studies conducted as part of the Marin Municipal Water District and Santa Cruz and Soquel Creek Water District (**scwd²**) Desalination Programs, projections developed by DWD, and supplemental cost estimates from similar projects and professional experience. The level of accuracy represents a conceptual level, Class 4 estimate with an estimate accuracy contingency of -20 to +30 percent (AACE, 1997).

Table 1: Probable Cost for a 10,000 AFY Desalination Facility (No Intake/Outfall)

Desalination Facility Cost Component	Estimated Capital Cost
Pretreatment	
Filtration:	
Chemicals	$1,400,000
Conventional Filters	$9,200,000
Filtrate and Backwash Supply Tank	$1,000,000
SWRO Feed Pump Station	$1,100,000
Solids Handling:	
Backwash Equalization Basin	$1,900,000
Dewatering Equipment	$3,000,000
Backwash Supply Pump Station	$600,000
Desalting	
Single Pass SWRO System	$18,200,000
Post Treatment	
Chemical Storage and Systems	$1,500,000
Calcite System	$600,000
Carbon Dioxide System	$500,000
Other	
Treated Water Storage	$3,000,000

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Desalination Facility Cost Component	Estimated Capital Cost
Control Room & Admin/Maintenance Building	$600,000
Subtotal of Treatment Costs	**$42,600,000**
Additional Facility Costs	
Sitework (1%):	$500,000
Electrical (8%)	$3,500,000
Yard Piping (3%)	$1,300,000
Plant Instrumentation and Controls (7%)	$3,000,000
Protective Coatings (1%)	$500,000
Subtotal of Additional Costs	**$8,800,000**
Subtotal of Facility Direct Costs	**$51,400,000**
Indirect Costs	
Contingency:	
Contingency (20%)	**$10,300,000**
Escalation:	
Escalation to Midpoint of Construction (3%)	**$1,900,000**
Engineering and Contractor Markups:	
Overhead (6%)	$3,800,000
Profit (5%)	$3,100,000
Mob/Bonds/Insurance (5%)	$3,100,000
Engineering (8%)	$5,000,000
Permitting (2%)	$1,300,000
Subtotal Indirect Costs	**$16,300,000**
DWD Markups:	
DWD Phase 1 Costs	$5,000,000
DWD Engineering, Management, & Admin	$5,000,000
Profit (10%)	$6,000,000
Subtotal DWD Markups	**$16,000,000**
Total Indirect Costs	**$44,500,000**
Total Probable Desalination Facility Cost	**$95,900,000**
Potential Project Cost Range	
Project Cost at -20%	**$76,700,000**
Project Cost at +30%	**$124,700,000**

Note:

(a) -20% to +30% estimate range is based on Association for Advancement of Cost Engineering (AACE) recommended practice for conceptual cost estimates.

The additional facility costs and indirect costs in Table 1 are estimated as a percentage of the facility direct cost and assume a design-build project delivery approach. Standard cost percentages were reduced to reflect cost savings based on the proposed shared site and electrical service for the JPA Desalination Facility and the DWD Data Center. The DWD Markups cost components were provided by DWD Project.

3.2 Comparison of Desalination Facility Projected Construction Costs

The costs presented in Table 1 are summarized in Table 2 to permit a comparison of project components with the costs developed for the DWD Project by the DWD Group.

Table 2: Comparison of Probable Costs for a 10,000-AFY Desalination Facility (No Intake/Outfall)

	Kennedy/Jenks Estimate	DWD Group Estimate
Pretreatment	$18,200,000	$16,700,000
Desalting	$18,200,000	$17,165,000
Post Treatment	$2,600,000	$2,643,000
TW Storage and Other	$3,600,000	$4,810,000
Additional Facility Costs	$8,800,000	$4,300,000
Facility Direct Cost	**$51,400,000**	**$45,618,000**
Indirect Costs and DWD Markups	$44,500,000	$32,700,000
Total Desalination Facility Capital Cost	**$95,900,000**	**$78,318,000**
Annual 30-year Amortization Bond Payments (P&I) @ 4.3%	$5,750,000	$4,700,000
Unit Water Cost ($/AF)	**$600**	**$500**

Kennedy/Jenks opinion of probable Facility Direct Cost for the JPA Desalination Facility part of the DWD Project is approximately 10% higher than the projected DWD Direct Cost ($51.4M vs. $45.6M). The major cost difference is in the category of Additional Facility Costs. These costs are estimated based on percentages and the DWD Project used lower percentages than Kennedy/Jenks. The DWD Project also did not have a specific line item for "protective coatings" or "sitework." The DWD Group lower costs in this category could be reasonable depending on the sitework, yard piping and electrical costs that are covered by the DWD Data Center part of the project.

Kennedy/Jenks opinion of Total Desalination Facility Cost, including the Indirect Costs and DWD Markups, is approximately 18% higher than the project DWD Total Desalination Facility Cost ($95.9M vs. $78.3M). A major difference, approximately $6.1M, between the indirect costs is the assumed level of project contingency. Kennedy/Jenks recommends and used a 20% contingency based on the guidance from AACE; DWD used a 12% contingency.

The DWD Project's projected cost for the JPA Desalination Facility is within the -20% to +30% range of the Kennedy/Jenks opinion of probable cost. With a focus on project cost control and value engineering, it is reasonable that the proposed JPA Desalination Facility could have a Total Desalination Facility cost of as low as $80M; however, it could also have a higher cost of $95M or more, as the detailed design is developed and the project proceeds.

The estimated Desalination Facility Capital Cost has been amortized to estimate an annual bond payment cost based on a 30-year bond with 4.3% interest. This amortization rate was provided by the DWD Group based on their financing approach. The table also shows a unit cost for desalinated water in dollars per AF for the JPA Desalination Facility only, based on 10,000 AF per year projected water production. To realize this unit water cost, the project would need to have enough JPA members to fully subscribe and commit to the take or pay for 10,000 AFY and be co-located with the DWD Data Center.

3.3 Probable Construction Cost of Distribution Pipelines

Table 3 presents a conceptual level, opinion of probable cost for pump stations and pipelines to convey treated water to SqCWD (assuming the pipeline is not shared with other Santa Cruz communities) and MPWMD. The cost for SqCWD is based on the 1,500 AFY of water to SqCWD. The northern pipeline could need to be larger diameter to accommodate additional potential JPA members; however, this technical memorandum assumes that SqCWD alone would construct the northern pipeline. If additional JPA members participated, the unit of water cost for the distribution system would decrease.

The costs for the southern pipeline are from the DWD Project cost estimates to deliver water to the California-American Water connection point in Seaside, CA.

Table 3: Probable Costs for Distribution System Pump Stations and Pipeline

Cost Components	North to SqCWD	South to MPWMD
Distribution Pump Station and Pipeline	$33,000,000	$50,000,000
Annual 30-year Amortization Bond Payments (P&I) @ 4.3%	$1,980,000	$2,995,000
Assumed Water Supplied (AFY)	1,500	6,000
Unit Water Cost ($/AF)	**$1,350**	**$500**

3.4 Probable Construction Cost of Intake and Outfall Facilities

The DWD Data Center proposes to own and operate the intake and outfall infrastructure to help reduce the upfront capital cost for the JPA Desalination Facility. If the Data Center were to cease operations, the DWD group would be required to continue to operate the intake and discharge pipelines. The rent for the Desalination facility covers the capital and operating costs for those pipelines. Kennedy/Jenks prepared a conceptual level cost of the proposed intake and outfall for the DWD Project to determine potential additional costs to the JPA if they desired, or were required, to purchase the intake and outfall.

Table 4 presents a conceptual level, opinion of probable cost for an intake and outfall sized for the full 25,000 AFY desalination facility proposed by the DWD Project. This cost only includes the

intake and outfall components and does not include the desalination treatment facility, other DWD Data Center project elements, and does not include distribution system piping costs.

Table 4: Probable Costs for a 25,000-AFY Capacity Intake/Outfall Facility

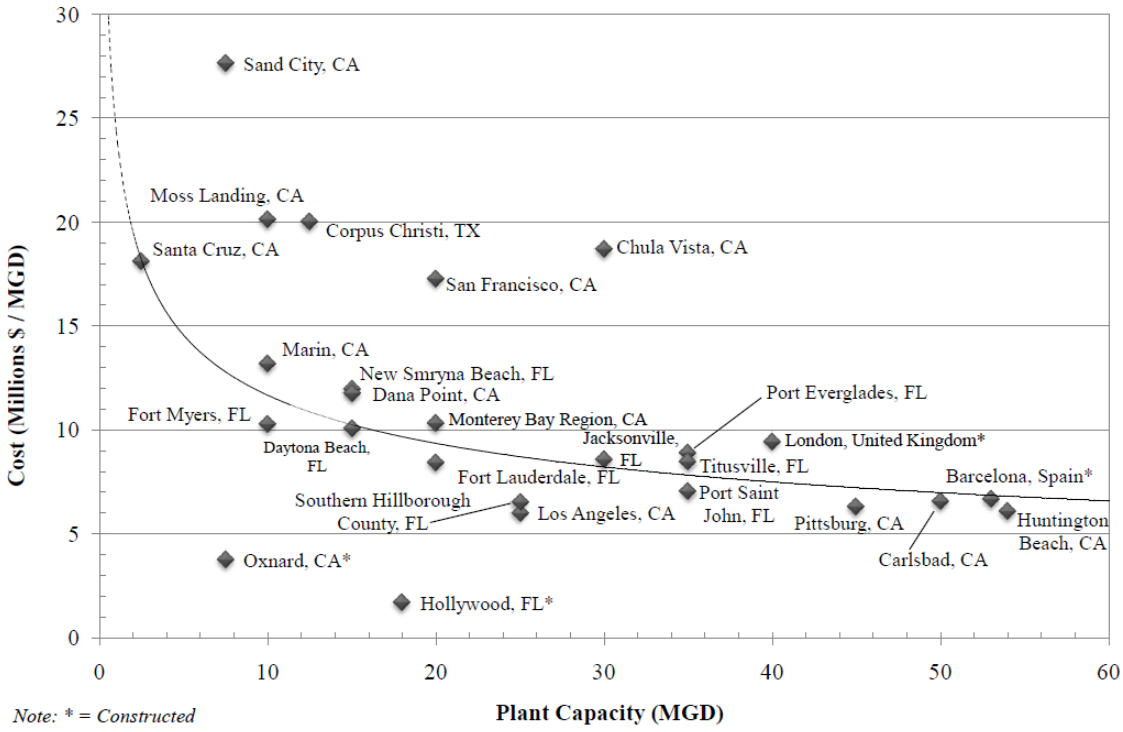
Intake/Outfall Facility Cost Component	Estimated Cost
Intake System Offshore	$2,900,000
Intake Pump Station	$2,600,000
Intake Pipeline Onshore	$2,700,000
Brine Pipeline Onshore	$1,800,000
Brine Pipeline Offshore	$2,100,000
Subtotal	**$12,100,000**
Additional Facility Costs	
Sitework (1%)	$130,000
Electrical and Instrumentation (5%)	$610,000
Yard Piping (3%)	$370,000
Protective Coatings (1%)	$130,000
Subtotal	**$1,240,000**
Subtotal Direct Facility Cost	**$13,400,000**
Indirect Costs	
Contingency:	
Contingency (20%)	**$2,700,000**
Escalation:	
Escalation to Midpoint of Construction (3%)	**$500,000**
Engineering and Contractor Markups:	
Overhead (6%)	$1,000,000
Profit (5%)	$900,000
Mob/Bonds/Insurance (5%)	$900,000
Engineering (8%)	$1,300,000
Permitting (2%)	$400,000
Subtotal	**$4,500,000**
Total Indirect Costs	**$7,700,000**
Total Intake/Outfall Capital Cost	**$21,100,000**
Annual 30-year Amortization Bond Payments (P&I) @ 4.3%	$1,265,000
Unit Water Cost ($/AF)	**$200**
Potential Project Cost Range	
Project Cost at -20%	**$16,900,000**
Project Cost at +30%	**$27,400,000**

3.5 Benchmarking Costs with Other Desalination Projects

Figure 6, illustrates a compilation of desalination project costs around the world which had an element of beneficial co-location of desalination facilities with other facilities. Most of the facilities identified in the associated WaterReuse Report were in various stages of planning and only a few had actually been constructed. Figure 6 presents a general cost trend for the cost of the

desalination facility per MGD of treated water capacity. The capital costs in Figure 6 include the treatment facility and associated intake and outfall facilities. In each case the facilities were to be co-located with other facilities in order to take advantage of some existing infrastructure. Distribution and treated water pipelines were not included in the costs shown in Figure 6.

Figure 6: Desalination Capital Costs Research (Source: WateReuse 2013)



Based on the WaterReuse cost curve presented in Figure 6, the 9-mgd JPA Desalination Facility, including intake and outfall costs, would be approximately $110M. Table 5 presents probable costs for the JPA Desalination Facility and Intake/Outfall elements of the proposed DWD Project.

Table 5: Comparison of Probable Costs for a 10,000-AFY Desalination Facility (With Intake/Outfall)

	Kennedy/Jenks Estimate	DWD Group Estimate
Desalination Plant Cost	$95,900,000	$78,318,000
Intake/Outfall Cost	$21,100,000	$21,100,000
Total Desalination Plant and Intake/Outfall Cost	**$117,000,000**	**$99,418,000**

Based on the WaterReuse cost curve presented in Figure 6, the costs for the proposed DWD Project JPA Desalination Facility plus the estimated Intake and Outfall costs, presented in Table 5, are reasonable and consistent with other benchmarks for co-located desalination facilities.

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Section 4: DWD Project O&M Cost Evaluation

This section presents an evaluation of the of the DWD Group's projected annual operating and maintenance (O&M) costs for the JPA Desalination Facility part of the overall DWD Project. The section also provides estimated O&M costs for the treated water distribution pipelines and develops a unit cost of water delivered to customers for SqCWD and MPWMD.

4.1 Comparison of Desalination Facility Projected O&M Costs

The conceptual level annual O&M costs for the JPA Desalination Facility are presented by the following O&M cost categories:

- Desalination Facility power use;
- Labor, Administration and Other costs.
- Pretreatment and post treatment chemical use;
- Maintenance costs
- Membrane replacement;

The annual O&M costs presented in Table 6 are grouped to permit a high level comparison with the O&M costs developed by DWD Project.

Table 6: Comparison of Probable O&M Costs for a 10,000-AFY Desalination Facility

	Kennedy/Jenks Estimate	DWD Group Estimate
Desalination Facility Energy	$2,350,000	$840,000
Labor, Admin and Other	$2,000,000	$1,980,000
Chemicals	$1,370,000	$1,230,000
Maintenance and Parts	$1,060,000	$500,000
Membrane Replacement	$400,000	$390,000
Total Operations and Maintenance	**$7,180,000**	**$4,940,000**
Unit Water Cost ($/AF)	**$800**	**$500**

Kennedy/Jenks opinion of probable O&M cost for the JPA Desalination Facility part of the DWD Project is higher than the projected DWD construction O&M cost in two categories: energy and maintenance and parts.

The DWD projected energy costs are significantly lower than Kennedy/Jenks estimated energy costs. Kennedy/Jenks energy cost is based on $0.12 per kWhr. The current projected DWD energy cost based on a Municipal Power Agreement with the City of Salinas and a low cost of natural gas is

estimated at approximately $0.04 per kWhr. A higher unit energy cost may be more appropriate if the JPA Desalination Facility purchases renewable energy as a part of its energy supply to meet greenhouse gas reduction requirements from the Coastal Commission or other regulatory agencies. The energy cost of $0.12 per kWhr may be more appropriate for energy with a larger portion of renewable power sources. There will also be some energy savings, approximately 5%, for the JPA Desalination Facility from the heating of the source water by the cooling system for the DWD DATA Center.

The maintenance materials and parts costs are often estimated based on percentage of the equipment capital cost and it appears that the DWD Project used a lower percentage than Kennedy/Jenks.

Depending on the cost of energy, it could be possible that the proposed JPA Desalination Facility could have an annual O&M cost of as low as $5M per year; however, it could also have a higher O&M cost of $7M per year or more.

The JPA Desalination Facility annual O&M Cost is presented in dollars per AF (for the JPA Desalination Facility only), based on 10,000 AF per year projected water production. To realize this unit water cost, the project would need to have enough JPA members to fully subscribe and commit to the take or pay for 10,000 AFY and be co-located with the DWD Data Center.

4.2 Probable O&M Cost of Water Distribution

Table 7 presents a conceptual level, opinion of probable O&M cost for treated water pumping energy to deliver water to SqCWD and MPWMD. The energy cost for SqCWD is based on 1,500 AFY of water to SqCWD, delivered to La Selva Beach, CA. The energy costs for the southern pipeline are from the DWD Project cost estimates to deliver water to the California-American Water connection point in Seaside, CA.

Table 7: Probable O&M Costs for Distribution System Pump Stations and Pipeline

Cost Components	North to SqCWD	South to MPWMD
Treated Water Pumping Energy	$200,000	$700,000
Assumed Water Supplied (AFY)	1,500	6,000
Unit Water Cost ($/AF)	**$130**	**$120**

4.3 Probable O&M Cost of Intake and Outfall Facilities

The DWD Project proposes that the JPA Desalination Facility would pay for a portion of the operating and maintenance costs for the intake and brine outfall facilities. For this technical memorandum, Kennedy/Jenks assumed that the cost share would be 50%.

Table 8 presents a conceptual level, opinion of probable O&M cost for an intake and outfall for the 10,000 AFY seawater desalination facility proposed by the DWD Project. This cost includes only the intake and outfall components and does not include the desalination facility.

Table 8: Probable O&M Costs for a 10,000-AFY Intake/Outfall Facility

Intake Pumping Energy	$600,000
Labor, Admin and Other	$200,000
Chemicals	$250,000
Maintenance and Parts	$250,000
Total Operations and Maintenance	**$1,300,000**
Total Unit Water Cost ($/AF)	**$130**
Assumed JPA Intake/Outfall Unit Water Cost ($/AF)	**$65**

Based on further discussion with the DWD Group, the DWD states that the rent for the Desalination facility at the Tank Farm site covers the shared operating costs for the intake and outfall pipelines. The DWD Group stated that the rent for the initial 10,000 AFY facility would be approximately $40,000 per month. This is approximately $500,000 per year or about $50 per AF.

EXHIBIT 3-A

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Section 5: DWD Project Unit Water Cost Evaluation

This section presents an evaluation of the DWD Group's projected unit water cost (capital and O&M) costs for the JPA Desalination Facility part of the overall DWD Project. The section also provides estimated O&M costs for the treated water distribution pipelines to develop a unit cost of water delivered to SqCWD and MPWMD customers.

5.1 Comparison of Desalination Facility Projected Unit Water Costs

Table 9 compares the projected total unit water costs ($/AF) for the JPA Desalination Facility providing 1,500 AFY of water to SqCWD. Table 10 compares the projected total unit water costs for the JPA Desalination Facility providing 6,000 AFY of water to MPWMD. The unit cost of the JPA Desalination Facility component is based on 10,000 AFY production and relies on full JPA Member subscription to the take or pay contract. If the project is not fully subscribed, the JPA Desalination facility would have a higher unit cost. The lower delivery volume for SqCWD increases the unit water cost as compared to MPWMD with the larger assumed water delivery.

Table 9: Comparison of Probable Unit Water Costs for SqCWD Share of a 10,000-AFY JPA Desalination Facility

Project Cost Component	Kennedy/Jenks Estimate	DWD Group Estimate
Desalination Facility Annual Bond Payments	$600	$500
Desalination Facility O&M	$800	$500
Site Rental and Intake/Outfall O&M Share	$65	$50
JPA Desalination Facility Subtotal, $/AF	**$1,465**	**$1,050**
SqCWD Distribution System Annual Bond Payments	$1,350	$1,350
SqCWD Distribution System O&M	$130	$130
Distribution System Subtotal, $/AF	**$1,480**	**$1,480**
Total Unit Water Cost ($/AF)	**$2,945**	**$2,530**

Table 10: Comparison of Probable Unit Water Costs for MPWMD Share of a 10,000-AFY JPA Desalination Facility

Project Cost Component	Kennedy/Jenks Estimate	DWD Estimate
Desalination Facility Annual Bond Payments	$600	$500
Desalination Facility O&M	$800	$500
Intake/Outfall O&M Share	$65	$50
JPA Desalination Facility Subtotal, $/AF	**$1,465**	**$1,050**
Distribution System Annual Bond Payments	$500	$500
Distribution System O&M	$120	$120
Distribution System Subtotal, $/AF	**$620**	**$620**
Total Unit Water Cost ($/AF)	**$2,085**	**$1,670**

Kennedy/Jenks opinion of probable total unit water cost for the JPA Desalination Facility part of the DWD Project is approximately 15 percent higher than the projected DWD unit water cost, primarily due to the higher unit energy costs ($300 per AF for renewable energy) and the higher percentage of contingency. With a focus on project cost control during construction, and a low energy rate obtained through the City of Salinas, it is reasonable that the proposed JPA Desalination Facility could provide delivered water to SqCWD in the range of $2,600 to $3,000 per AF and to MPWMD in the range of $1,700 to $2,100 per AF.