Hand Delivered to Andy Sawyer

PETITION
TO MODIFY SWRCB RESOLUTION 2016-0040

May 9, 2018

The Planning and Conservation League, Monterey One Water (formerly the Monterey Regional Water Pollution Control Agency), the Monterey Peninsula Water Management District, the Monterey Regional Water Authority, the Marina Coast Water District, Land Watch Monterey, the Sierra Club, Citizens for Just Water, the Public Trust Alliance, and Public Water Now ("Moving Parties") hereby petition the State Water Resources Control Board ("Board") to modify the ordering paragraphs of Cease and Desist Order ("CDO") (STATE WATER RESOURCES CONTROL BOARD RESOLUTION NO. 2016-0040) for the purpose of adding parallel milestones relating to the potential expansion of the Pure Water Monterey ("PWM") project.

Satisfaction of the proposed parallel (not substitute) milestones by the Board would allow California American Water Company ("Cal-Am") to eliminate diversions of Carmel River water without valid basis of right by the existing CDO deadline of December 31, 2021.

I. Background

The compliance milestones in the CDO were adopted by the Board with the expectation that the desalination project would be approved and constructed in time to meet the December 31, 2021 deadline for Cal-Am to cease all unauthorized diversions from the Carmel River.

The next milestone is California Public Utilities Commission approval of a Certificate of Public Necessity and Convenience (CPCN) for the desalination project by September 30th of this year. The September, 2019 milestone is the commencement of construction of the desalination project.

For a variety of reasons it is possible that the desalination project will not meet those milestones and potentially fail to afford a replacement water supply to Cal-Am to substitute for ongoing unauthorized diversions from the Carmel River by the CDO's final 2021 deadline.

By adding the requested parallel milestones related to expansion of PWM, the Board would establish an alternative option for Cal-Am to cease all unauthorized diversions by the 2021 deadline. The Board added a similar parallel milestone related to the initial PWM project in RESOLUTION NO. 2016-0040 which amended the original CDO as follows:

2015-2016 CPUC approval of (1) the Water Purchase Agreement for Cal-Am's purchase of Pure Water Monterey water, and of (2) construction of the Cal-Am components of the Pure Water Monterey conveyance facilities, including the Monterey Pipeline and pump station. December 31, 2016

2016-2017 Start of construction of the Cal-Am components of the Pure Water Monterey project, meaning commencement of physical work after issuance of required regulatory permits and authorizations to begin work. September 30, 2017

Those milestones were met, the PWM construction is well underway and it will provide Cal-Am with 3,500 acre feet per year ("AFY") before the December, 2021 deadline.

This petition requests similar parallel milestones for the PWM expansion opportunity. This would facilitate the option of Cal-Am completing the substitution of all unauthorized Carmel River diversions as a result of water developed by the PWM expansion project, inclusive of the initial 3,500 AFY project plus the 2,250 AFY (minimum) expansion.

A. Source Water Availability

Monterey One Water (M1W) and the Monterey Peninsula Water Management District recently completed an extensive feasibility study concerning the potential for expansion of the PWM project, the "Preliminary Progress Report on Pure Water Monterey Expansion," May 7, 2018 ("Report"). https://mrwpca1-my.sharepoint.com/:f:/g/personal/alison_mrwpca_com/EowyMUurrutKg7Hf-ly5BfIBifvfib0ecpw3I05s-K3e9Q?e=2kILwo

A copy of the Report is attached. The Report analyzed key issues including source water, financial feasibility, the necessary level of environmental review, permitting requirements relating to the potential project expansion, and the estimated schedule for PWM expansion.

The Report identifies water sources for Pure Water Monterey expansion:

Winter Wastewater (Winter Water). On November 3, 2015 M1W entered into a contract titled the Amended and Restated Water Recycling Agreement ("ARWRA") with the Monterey County Water Resources Agency (MCWRA). Per Section 4.01(c) of that Agreement, M1W has the right to use any wastewater that is not used for irrigation through MCWRA's Castroville Seawater Intrusion Project (CSIP). For the 20 years of operation of the Salinas Valley Reclamation Plant, there has consistently been 6,000 to 8,000 AF of water discharged through the outfall to the ocean every year in the winter months. (Report, p. 27.)

Approximately 47% to 69% of the feed water needed for expansion would come from the excess winter wastewater currently being discharged to the ocean. (Report, p. 26.) As discussed in the Report, M1W modeled the availability of this winter wastewater even assuming a substantial increase in agricultural use of this supply and found that there still sufficient supply availability for PWM expansion. (Report, pp. 27-28.)

Winter Industrial Wastewater and Storm Water (Pond Return). Per the ARWRA Section 4.01(c), M1W has the right to use any wastewater that is not used for irrigation through MCWRA's CSIP system. The Industrial Wastewater is not required to meet MCWRA demands during the winter. Thus, it would not be diverted to the M1W Salinas Pump Station but instead, flow to the Salinas Industrial Wastewater Treatment Facility (SIWTF). Similarly, the storm water from the City of Salinas that is received during the winter would be diverted to the SIWTF. The combined waters at the ponds would be returned to M1W in the summer using a new return pump station and pipeline to be constructed in 2018-2020 under a storm water grant. (Report, Attachment B.) M1W is currently negotiating an agreement with the City of Salinas to define how the storage ponds will be operated and maintained. It is anticipated that M1W and the City of Salinas will have a Memorandum of Understanding by the end of June 2018 and a full agreement by the end of September 2018. An important consideration is whether one or more of the SIWTF ponds would be lined. Depending on the number of ponds lined, approximately 23% to 40% of the feed water needed for expansion would come from the returned industrial wastewater and storm water. (Report, Attachment B.) If no ponds are lined, the PWM Expansion Project could still provide up to 2,331AFY and would be expected to meet the proposed yield of 2,250 AFY. (Report, p. 26.)

Dry Season Allocations of 650 AFY in the months of May through August from MCWRA (Summer Water). Per the ARWRA Section 4.01.1(d), M1W has the right to 650 AF of water during May through August as shown in the ARWRA Table 2. This water, like MCWD's summer allocation of 300 AFY, is available even if there is not enough wastewater to meet CSIP irrigation demands. (Report, p. 26.) This water is the water to be utilized for MCWD's Phase 1 and Phase 2 landscape irrigation projects, but until build out of MCWD's Phase 2 project, it would be available to meet expansion influent water needs. (*Id.*)

M1W evaluated the availability of all of its presently available sources of supply for PWM expansion during each month and found that, even assuming substantial expansion of agricultural use of winter wastewater, there is sufficient source water for PWM expansion to produce greater than 2,250 AFY. (See Attachment 1 to this Petition.)

The report only considers existing water to confirm the availability of source water for the PWM expansion. However, additional new supplies may be available in the future as well. Per the ARWRA Section 4.01.2, M1W is entitled to one-half the volume of wastewater flows from areas outside of the M1W's 2001 boundary provided that M1W passes those waters through the SVRP or the PWM facilities. M1W is pursuing expansion of its service area to bring in additional waters in the future.

B. PWM Expansion Schedule

The Report projects that before September 30, 2020 all civil site work can be complete and all equipment required to expand PWM Facility can be delivered and on-site. Further, the schedule demonstrates that before September 30, 2021 all construction can be complete. In fact, the schedule shows completion and start-up of all the increased capacity facilities much earlier on January 27, 2021.

The Report found that it is feasible to expand the PWM project by an additional 2,250 AFY. Engineering design is already 30% complete and the expansion can be developed along with the already-approved 3,500 PWM project affording up to 5,750 AFY for Cal-Am ahead of the end of 2021.

This would allow Cal-Am to terminate all unauthorized diversions from the Carmel River by the CDO deadline of December 31, 2021. Such option could prove essential if the desalination project is delayed or not approved.

Therefore, this petition seeks to amend the CDO to add parallel (not substitute) milestones correlated to progress on expansion of PWM as shown below. These specific and readily verifiable alternative milestones would not change the requirement for Cal-Am to eliminate further diversions of Carmel River water without valid basis of right by December 31, 2021.

II. Requested Modifications to the CDO Milestones Shown in Underline

Moving Parties respectfully urge that the milestones set forth in Section 3(b)(v) of the ordering section of the CDO be amended as follows:

Start of construction of any of the Cal-Am Components of the MSWSP Desalination Plant, meaning commencement of physical work after issuance of required regulatory permits and authorization to begin work; or, alternatively, CPUC approval of a Water Purchase Agreement (or amendment of the existing Water Purchase Agreement applicable to the PWM Project) for the PWM expansion project (minimum of 2,250 AFY) including information demonstrating availability of source water for the Pure Water Monterey expansion project to the satisfaction of the CPUC; September, 30, 2019

(1) Drilling activity for at least one MPWSP Desalination Plant source water production well complete; (2) foundation and structural framing complete for MPWSP Desalination Plant pretreatment seawater reverse osmosis, and administration buildings at desalination plant; (3) excavation complete for MPWSP Desalination Plant brine and backwash storage basins; and (4) 25% of MPWSP Desalination Plant transmission pipelines installed based on total length, including 100% installation of the "Monterey Pipeline and other ASR related improvements"; or, alternatively, all civil site work, including concrete work, underground piping, and site drainage will be complete and all equipment required for the PWM expansion project will have been delivered and on-site; September 30, 2020

For MPWSP Desalination Plant: (1) 50% of drilling activity complete for source water production wells based on total number of wells required; (2) mechanical systems for brine and backwash storage basins complete; (3) construction of filtered water tanks and finished water tanks complete; (4) 50% of transmission pipelines installed based on total length; or, alternatively, all construction for PWM expansion project will be complete; September 30, 2021

Substantial completion of the Cal-Am Components of the MPWSP Desalination Plant, meaning the Cal-Am Components are sufficiently complete and appropriately permitted to allow delivery of MPWSP Desalination Plant produced potable water to Cal-Am's Monterey Main system, eliminating further Cal-Am diversions of Carmel River water without valid basis of right; or, alternatively, completion of the PWM Project (including PWM expansion) eliminating further Cal-Am diversions of Carmel River water without valid basis of right; December 31, 2021

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Monterey SWRCB petition final May 9, 2018

Attachment 1

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	*Total (AFY)*
Source Waters Used for PWM Expansion of 2,250 AFY													
Winter water	344	317	212	0	0	0	0	0	0	0	339	363	**1,574**
Pond return water	0	0	127	252	157	113	110	140	78	0	0	0	**977**
Summer water	0	0	0	0	66	99	109	98	0	0	0	0	**371**
Total feed water	344	317	339	252	223	212	219	238	78	0	339	363	**2,922**
Total product water	278	256	274	204	180	171	177	192	63	0	275	294	**2,367**
% of winter water	100%	100%	62%	0%	0%	0%	0%	0%	0%	0%	100%	100%	**53.9%**
% of pond return water	0%	0%	38%	100%	70%	53%	50%	59%	100%	0%	0%	0%	**33.4%**
% of summer water	0%	0%	0%	0%	30%	47%	50%	41%	0%	0%	0%	0%	**12.7%**

Monterey One Water

PRELIMINARY

PROGRESS REPORT ON PURE WATER MONTEREY EXPANSION

Prepared by

Monterey One Water

May 7, 2018

Preliminary Progress Report on Pure Water Monterey Expansion
May 7, 2018

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Attachment B. Summary Memorandum - M1W, Salinas Industrial Wastewater Treatment Facility Percolation and Water Reuse, March 19, 2018.

Attachment C. Draft Technical Memorandum - M1W and MPWMD Feasibility Analysis of Potable Water Extraction Wells for the Pure Water Monterey Expansion, May 7, 2018.

Attachment D. Preliminary Draft Technical Memorandum - Trussell Tech Draft Preliminary Synopsis of Ocean Plan Compliance Assessment, April 6, 2018.

Attachment E. Technical Memorandum - Trussell Tech Pathogen Crediting Alternatives for Pure Water Monterey Advanced Water Purification Facility Expansion, May 2018.

Attachment F. Technical Memorandum - Geo-Logic Associates, Inc.– Comparison Study between HDPE Liner versus Bentonite Admix Soils, April 20, 2018.

Attachment G. Pure Water Monterey Project Schedule

Attachment H. Water Purchase Agreement

Attachment I. SWRCB General Application

Attachment J. Pure Water Monterey Expansion Injection Well Field Phase 3 Draft Civil Work Plan, April 25, 2018

Attachment K. Technical Memorandum - NBS Government Finance Group, Economic Analysis of PWM Expansion, April 27, 2018, with MPWMD transmittal memorandum.

INTRODUCTION

Monterey One Water (M1W) in partnership with the Monterey Peninsula Water Management District (MPWMD) is developing a Pure Water Monterey Groundwater Replenishment Project (PWM Project) to create a reliable source of water supply to replace existing water supply sources for the Monterey Peninsula in northern Monterey County. **Figure 1** below shows M1W's existing infrastructure and service area. This report provides additional information developed by M1W and MPWMD regarding the potential to expand the PWM Project from 5 mgd (which is currently under construction) to 7 mgd to provide additional water to the Monterey region (PWM Expansion). For reference, the PWM Expansion described in this report is "Scenario B" presented in the September 29, 2017 testimony of Paul Sciuto in CPUC proceeding, A. 12-04-019.

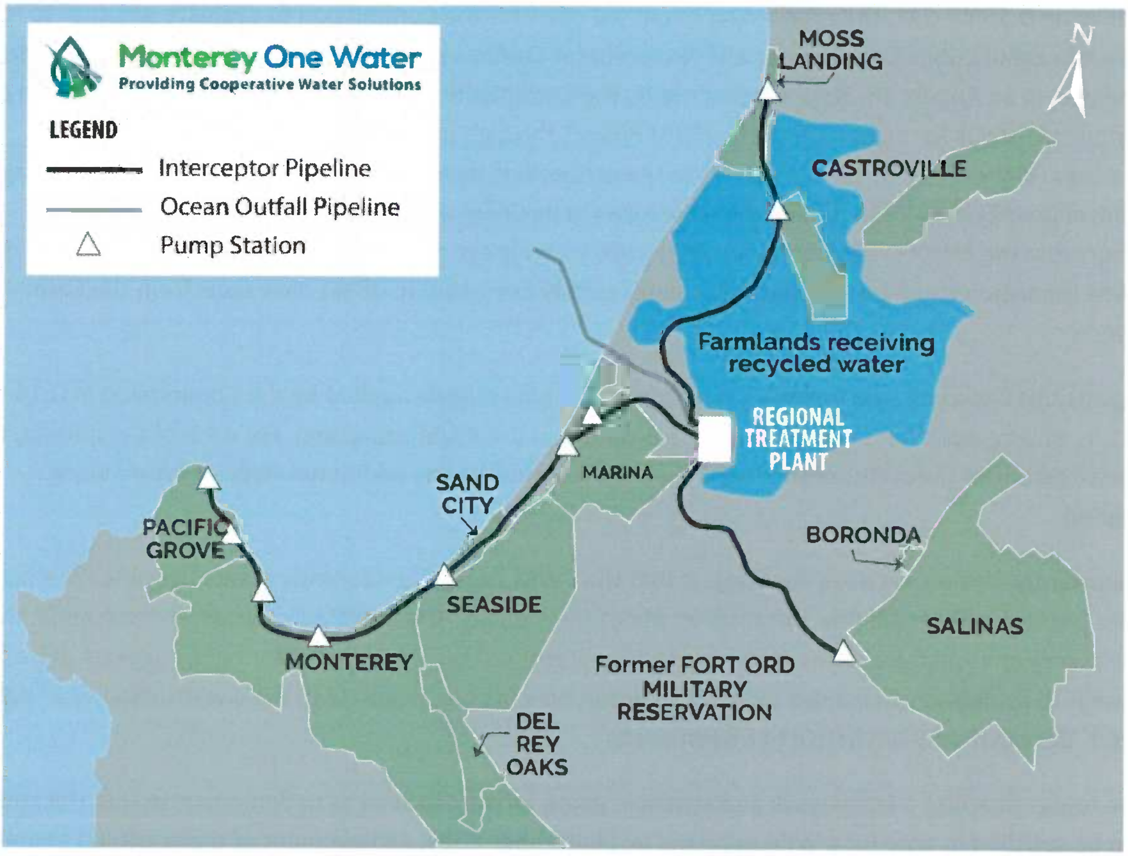

Figure 1. M1W Service Area

In the earlier Phase 2 of this proceeding, the California Public Utilities Commission (Commission) authorized California-American Water Company (CalAm) to enter into a Water Purchase Agreement (WPA) for purchase of water from the PWM Project. In doing so, the Commission utilized nine criteria to evaluate the viability of the PWM Project and reasonableness of the WPA. See D.16-09-021 at 10-17.

The nine criteria are described in more detail later in this report but are briefly summarized as follows:

- Criterion 1: Final EIR
- Criterion 2: Permits
- Criterion 3: Source Waters
- Criterion 4: Water Quality and Regulatory Approvals
- Criterion 5: PWM Project Schedule Compared to Desalination Schedule
- Criterion 6: Status of PWM Project Engineering
- Criterion 7: PWM Project Funding
- Criterion 8: Reasonableness of WPA Terms
- Criterion 9: Reasonableness of the PWM Project Revenue Requirement

Following D.16-09-021, the proceeding remained open for the Commission to evaluate whether to issue a Certificate of Public Convenience and Necessity for CalAm's proposed desalination plant and related facilities. In an August 28, 2017 scoping ruling, the Commission requested and received information on various scenarios for expansion of the PWM Project through prepared testimony and evidentiary hearings. More recently, certain parties to the proceeding have requested the State Water Resources Control Board (SWRCB) to modify the milestones in its Cease and Desist Order (CDO) to be met by progress in the PWM Expansion as an alternative to progress on the desalination plant. Ultimately, the PWM Expansion could be an alternative water supply necessary to offset diversions from the Carmel River.

Against this backdrop, the following report uses the nine criteria applied by the Commission in D.16-09-021 as a framework for demonstrating the progress of the PWM Expansion. For each of the criteria, this report describes the status of the PWM Expansion, including any additional steps or future work needed.

Importantly, this report does not suggest that the PWM Expansion currently meets the nine criteria, it does present substantial new information about the viability of the PWM Expansion. For example, the initial economic analysis of the PWM Expansion, presented herein under Criterion 9, suggests there is a benefit to ratepayers to pursue a PWM Expansion now in conjunction with the construction of a "right-sized" desalination plant in five to fifteen years.

The report provides a framework and schedule going forward as well as to demonstrate that the criteria can be satisfied in time for a WPA approval by September 2019. Achievement of these criteria assumes the Commission promptly opens a Phase 3 of this proceeding, as discussed in the parties' recent filings with the Commission, including briefs on the EIR/EIS and at the recent status conference.

DESCRIPTION OF PWM PROJECT AND OVERVIEW OF PWM EXPANSION

Previously-Approved PWM Project

On October 8, 2015, the Board of Directors of Monterey One Water (M1W) approved the PWM Project as modified by the Alternative Monterey Pipeline and the Regional Urban Water Augmentation Project (RUWAP) alignment for the product water conveyance system and certified the Environmental Impact Report (PWM EIR) (State Clearinghouse No. 2013051094). The primary objective of the PWM Project was to replenish the Seaside Groundwater Basin (Basin) with 3,500 acre-feet per year (AFY) of purified recycled water to replace a portion of California American Water Company's (CalAm) water supply as required by State Water Resources Control Board (State Water Board or SWRCB) orders.

The PWM Project as initially approved included a 4 million gallon per day (mgd) capacity Advanced Water Purification Facility (AWPF) for treatment and production of purified recycled water that will be conveyed for injection into the Basin using a series of shallow and deep injection wells. Project conveyance facilities include ten miles of pipeline from the AWPF to injection wells in the Basin. Once injected, the purified recycled water will augment existing groundwater supplies and provide 3,500 AFY of water for extraction via existing CalAm wells. The extracted water will be delivered to CalAm customers to offset use of water from the Carmel River system. The project also provides additional recycled water for crop irrigation by the existing Castroville Seawater Intrusion Project.

Initial Expansion of the PWM Project

On October 30, 2017, the Board of Directors of M1W approved modifications to the PWM Project to increase the operational capacity (peak or maximum product water flowrate) of the approved AWPF from 4.0 mgd to 5.0 mgd. This expanded capacity is achieved by using redundancies in the AWPF design and the stated purpose of the expansion is to enable delivery of 600 AFY of purified recycled water to Marina Coast Water District (MCWD) for urban landscape irrigation by MCWD customers. The additional recycled water delivery is a component of the approved Regional Urban Water Augmentation Project (RUWAP), an urban recycled water project developed by MCWD.[1] The source water for this expansion of the PWM Project is entirely from MCWD's rights to the return of its municipal wastewater. In April 2016 (amended in October 2017), M1W Board of Directors approved joint (shared) use of product water

[1] The RUWAP is a recycled water project developed by MCWD in cooperation with M1W. RUWAP was originally developed to help MCWD meet the overall needs of its service area, delivering tertiary-treated and disinfected recycled water produced at the existing Salinas Valley Reclamation Plant ("SVRP") to urban users in the MCWD service area and former Fort Ord. MCWD and M1W have agreed to jointly implement a project to convey advanced-treated (purified recycled water) through a shared pipeline for PWM Project and MCWD's initial 600 AFY of recycled water irrigation demands at the former Fort Ord (referred to as RUWAP Phase 1). Phase 1 is currently under construction. Phase 2 would include an additional 827 AFY of recycled water use for a total of 1,427 after completion of recycled water lateral pipelines to irrigation sites.

storage and conveyance facilities, including Blackhorse Reservoir, with MCWD for the PWM Project and the RUWAP Project (PWM EIR Addendum No. 3)[2].

PWM Project Overview

Figure 2 includes a map of the PWM Project. Environmental review documents for the PWM Project divided the PWM Project into the following components, as described in this document: Source Water Diversion and Storage Sites, Treatment Facilities at the Regional Treatment Plant, Product Water Conveyance, Injection Well Facilities, and CalAm Distribution System. Each of these components are described in greater detail below:[3]

Source Water Diversion and Storage Sites

The source water diversion and storage facilities include new facilities at Blanco Drain, Reclamation Ditch, and Salinas Industrial Wastewater Treatment Facility (SIWTF) and associated conveyance system. These facilities will enable new source waters to be diverted into the existing municipal wastewater collection system and to the Regional Treatment Plant to supplement the existing incoming wastewater flows with the following new inflows: 1) industrial wastewater primarily from the City of Salinas' produce washing industries, 2) stormwater flows from the southern part of Salinas, 3) surface water and agricultural tile drain water that is captured in the Reclamation Ditch, and 4) surface water and agricultural tile drain water that flows in the Blanco Drain. The PWM Project also include modifications to the SIWTF to allow seasonal storage of storm and wastewater for recovery in peak demand months.

Treatment Facilities at the Regional Treatment Plant

New treatment facilities at the Regional Treatment Plant include the Advanced Water Purification Facility (AWPF) and pump station facilities at the Regional Treatment Plant (RTP). The AWPF will include a state-of-the-art treatment system that uses multiple membrane barriers to purify the water, product water stabilization to prevent pipe corrosion due to water purity, a pump station, and a brine and wastewater mixing facility. The water treated by the AWPF would meet or exceed federal and state drinking water standards, including those set forth in Title 22. The PWM Project also includes modifications to the Salinas Valley Reclamation Plant to improve delivery of recycled water to agricultural users.

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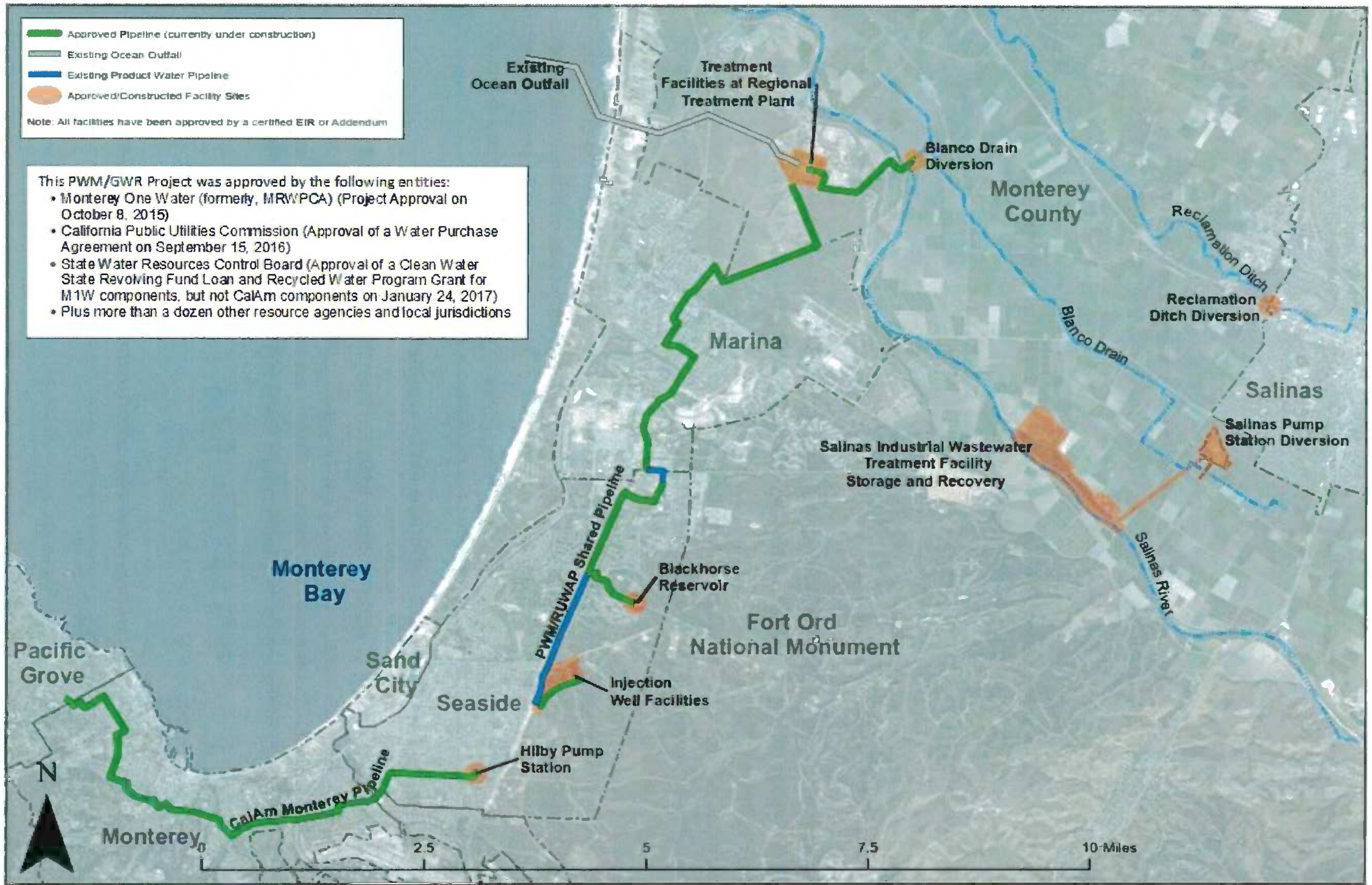
[2] The combined RUWAP-PWM conveyance system, also termed the Shared Project Water Conveyance Facilities, was also approved by MCWD in March 2016 (RUWAP Addendum No. 3)

[3] Source: Resolution October 2015, Monterey Regional Water Pollution Control Agency Board (now M1W) as modified by October 2017 Approvals (including Addendum No 3 to the PWM EIR and Addendum No. 3 to the RUWAP EIR)



Monterey One Water
Providing Cooperative Water Solutions

Pure Water Monterey

Prepared by Denise Duffy and Associates

PWM/GWR Overview Map

Pure Water Monterey
GWR Project
Addendum No. 3
October 2017

Figure
2

Product Water Conveyance

The product water facilities include the PWM/RUWAP shared pipeline referenced above, a pump station and appurtenant facilities to transport the purified recycled (product) water from the AWPF at the RTP to the Basin for injection.

Injection Well Facilities

The injection facilities include new wells (in the shallow and deep aquifers), back-flush facilities, pipelines, electricity/power distribution facilities, and electrical/motor control buildings.

CalAm Distribution System

Certain distribution facilities are to deliver PWM project water extracted from the Seaside to CalAm customers, which include the Monterey Pipeline and Hilby Pump Station.[4]

Benefits of the PWM Project

As approved and under construction, the PWM Project is a water supply project that will provide the following benefits when it is fully operational:

- **Replenishment of the Basin.** The PWM Project would enable CalAm to reduce its diversions from the Carmel River system by up to 3,500 acre-feet per year by injecting the same amount of purified recycled water into the Basin.
- **Additional recycled water for agricultural irrigation in northern Salinas Valley.** The Salinas Valley Reclamation Plant, an existing water recycling facility at the RTP, would be provided additional source waters to produce additional recycled water for use in the Castroville Seawater Intrusion Project's agricultural irrigation system. It is anticipated that in normal and wet years thousands of acre-feet per year of additional recycled water supply could be created for agricultural irrigation purposes. The PWM Project would also include a drought reserve component to support use of the new supply for crop irrigation during dry years. With the drought reserve component, the PWM Project could provide up to 5,900 acre feet per year for crop irrigation in some drought conditions. MCWRA can pull out of the new source water components as described under Criterion 3, below.

Facility Components and Modifications under the PWM Expansion

To potentially increase the amount of water available to CalAm from the PWM Project, modifications to the existing PWM Project would be required to increase the capacity of the PWM Project from 5 mgd to 7 mgd. Additional information on the modifications to facilities is available in the following attachments to this report for technical information on the modifications that would be needed for the PWM Expansion.

[4] These components were needed to address CalAm Distribution System constraints, namely a hydraulic trough near the Naval Postgraduate School in Monterey.

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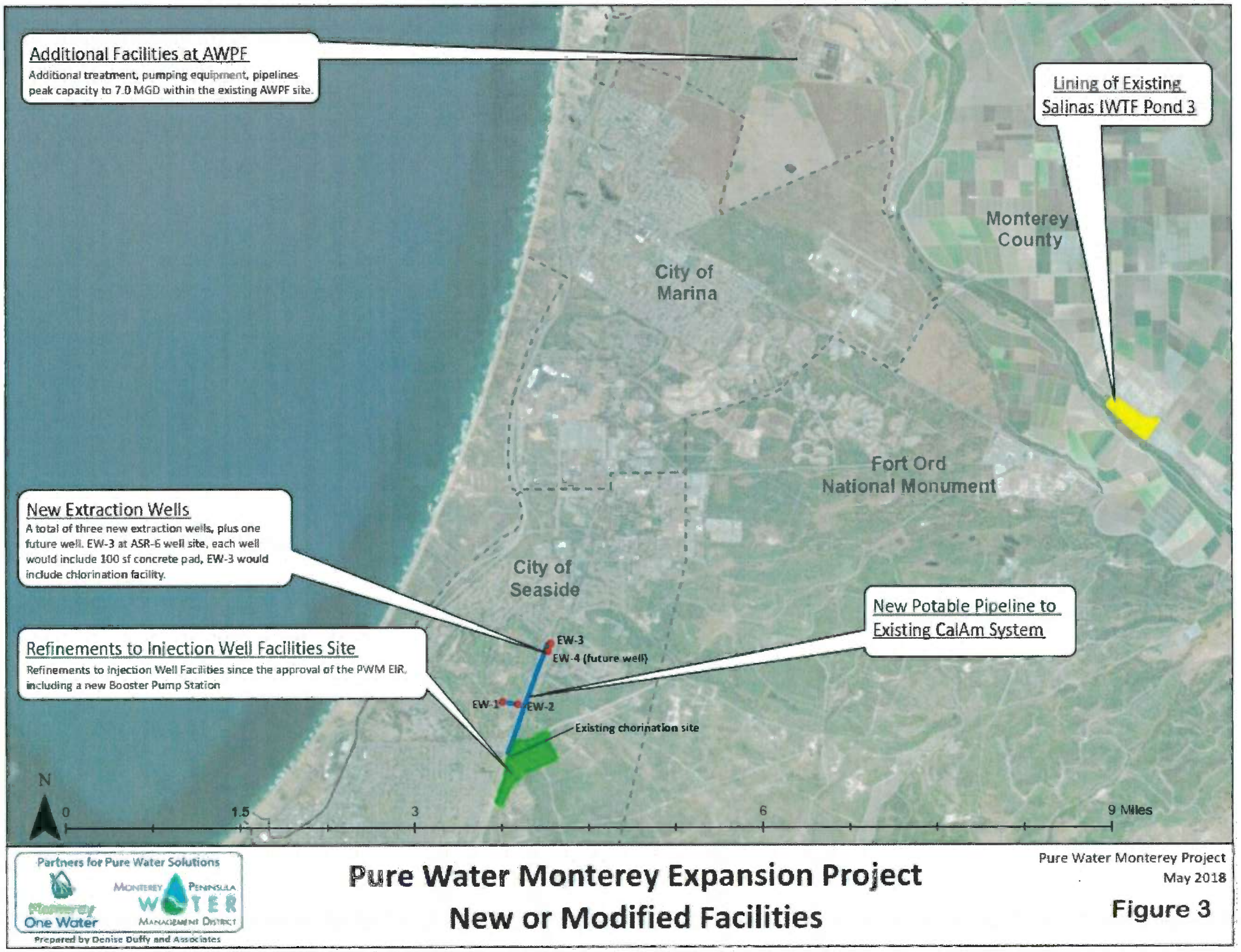
Attachment J. Pure Water Monterey Expansion Injection Well Field Phase 3 Civil Work Plan, April 25, 2018

The PWM Expansion would include facilities located within unincorporated areas of the Monterey County and the City of Seaside. **Figure 3** includes a map of the PWM Expansion. The PWM Expansion would include the following changes to those previously approved project components:

Changes to Source Water Diversion and Storage Sites

Lining of Pond 3 at SIWTF (optional component). The SIWTF receives, treats and disposes of industrial wastewaters from the City of Salinas and surrounding areas. The SIWTF is comprised of an aeration basin, three (3) infiltration/evaporation ponds, and drying beds. As an option if the need arises for new source water, M1W would line Pond 3 of the SIWTF as part of the PWM Expansion to reduce infiltration thereby storing more water for reuse during the peak demand time periods. M1W would not proposed to modify Modifications to Ponds 1 and 2 are not proposed at this time. Pond 3 is approximately 38 acres in surface area and holds approximately 359 acre-feet of water. Pond 3 would be lined using a high-density polyethylene (HDPE) geomembrane liner. Water stored in Pond 3 would ultimately be diverted to the RTP via the existing Salinas Interceptor, treated through the existing primary and secondary treatment processes, and ultimately would be routed to the AWPF. Additional source water to the AWPF would result in additional production of purified recycled water available for groundwater replenishment and potable water replacement.



Pure Water Monterey Expansion Project
New or Modified Facilities

Figure 3

The lining of Pond 3 was not included in the final Area of Potential Effect (APE) for the PWM Project approved on October 8, 2015. While this component is assumed to be required to be built for the cost analysis, it is possible that it will not be needed due to the availability of adequate water from previously approved components of the base Pure Water Monterey Project and associated agreements. More information about the ponds, pond lining options and feasibility, is available in Attachments B and Attachment F.

Changes to Treatment Facilities at the Regional Treatment Plant

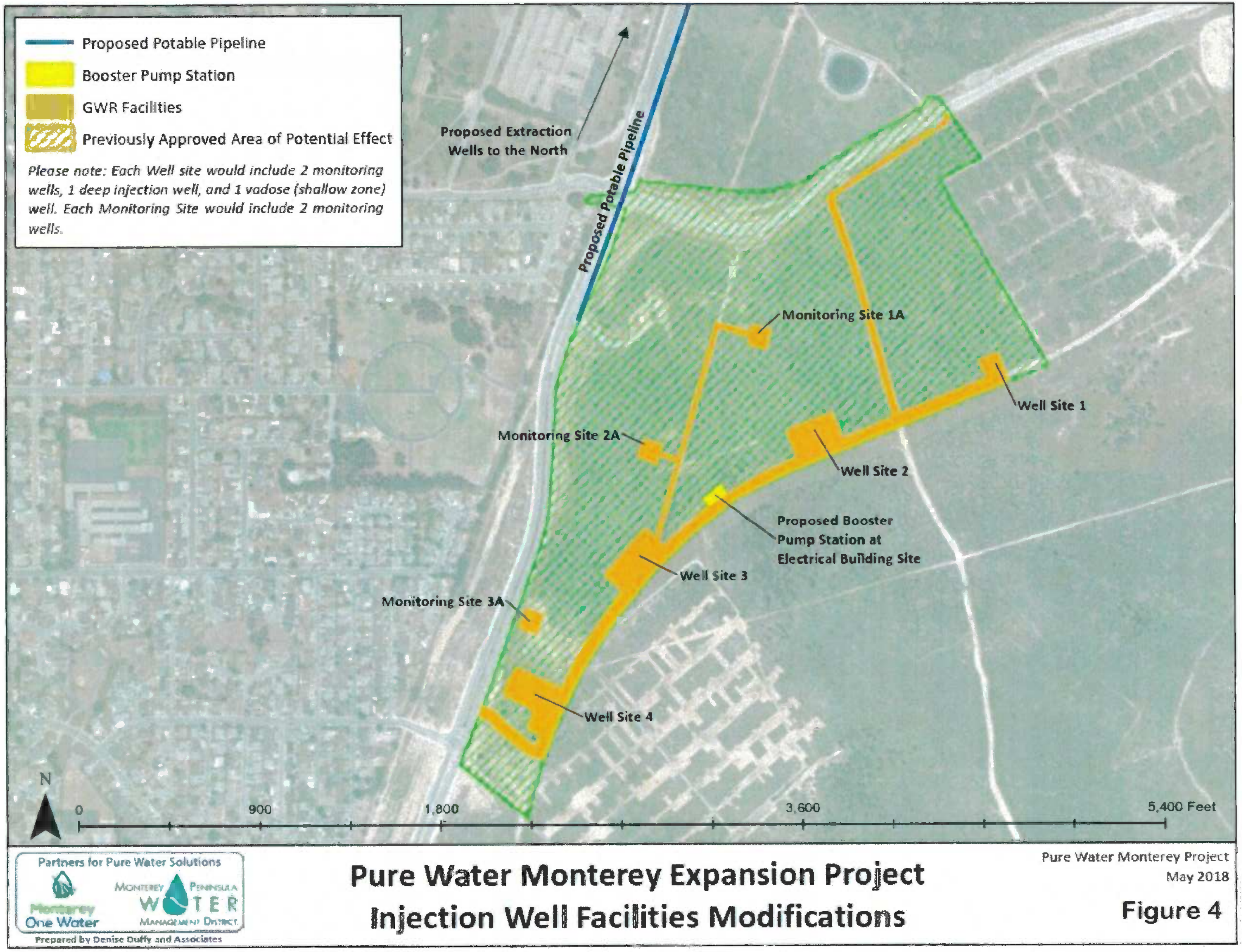
Modifications to Advanced Water Purification Facility. The design and physical features of the AWPF currently under construction (the PWM Project as approved with 5 mgd AWPF) allow operation of the AWPF at a peak capacity of 5.0 mgd. Expanding the AWPF to produce up to 7.0 mgd will require additional treatment and pumping equipment, pipelines and facility appurtenances within the 3.5-acre existing building area to provide the expansion capacity. The AWPF would be designed to produce a seasonal peak of 7.0 mgd; however, it may operate at 5.0 to 6.0 mgd during April through October. The 7.0 mgd operations during November through March allows for the maximum production and injection of advanced treated water during the winter months when irrigation demands are low and municipal wastewater is not needed for CSIP. During the period from April through October, municipal wastewater is primarily used to produce tertiary-treated recycled water for CSIP. Additional information about the expansion of the AWPF is available in Attachment A.

Changes to Product Water Conveyance

The PWM Expansion would require no changes to the Product Water Conveyance Facilities. However, a new booster pump station to improve conveyance was added within the Injection Well Facilities Area of Potential Effect, it is discussed below. Additional information about product water conveyance for PWM Expansion is available in Attachments A and J.

Changes to Injection Well Facilities

Modifications to Injection Well Facilities. Final project design and project permitting have resulted in minor modifications to the layout of the Injection Well Facilities site that would also be needed for the Injection Well Facilities for the PWM Expansion. The PWM EIR evaluated all injection well facilities that would be needed for the PWM Expansion, including the four (4) deep injection wells, four (4) shallow vadose zone well(s), associated backwash pumps, and a percolation basin for backwash water disposal (percolation into the vadose zone). In addition, the PWM Project's Area of Potential Effect used in the PWM EIR and federal environmental review and permits encompassed the location of the injection well facilities that would be needed for the PWM Expansion. Please see **Figure 4** for more information.



Pure Water Monterey Expansion Project
Injection Well Facilities Modifications

Figure 4

Booster Pump Station. The PWM Expansion would require a new booster pump station to facilitate injection of the additional water produced by the AWPF at Well Sites 1 and 2. Due to friction losses in the conveyance pipeline when the PWM Expansion is producing 7 mgd of product water, the conveyance system will not have enough energy to enable adequate injection of purified recycled water at Injection Well Site 1, the highest injection site, without additional pumping capacity. This new Booster Pump Station will be required to provide operating flexibility to maintain minimum pressures and to optimize operations at Injection Well Sites 1 and 2. Therefore, M1W would propose a small booster pump station to boost the flows to that site. The Booster Pump Station would be located between Well Sites 2 and 3 and would therefore be within the boundaries of Area of Potential Effects previously evaluated in the PWM EIR. This new booster pump station would be located near the electrical equipment area for the injection wells. Additional information is available in Attachment A.

Changes to CalAm Distribution System

Extraction Wells. For CalAm to utilize the additional purified recycled water that would be produced by the PWM Expansion, additional potable water extraction wells would be required. To reliably utilize the estimated yield of the PWM Expansion, CalAm would construct and operate a minimum of two (2) new extraction wells, plus one additional extraction well to provide system redundancy/back-up. Extraction Wells 1 and 2 would be located just north of Seaside Middle School. The Blackhorse Golf Course is located to the north and west of Extraction Well sites 1 and 2. Extraction Well 3 is located just to the east of General Jim Moore Boulevard, near the southeast corner of the intersection of General Jim Moore Boulevard and Ardennes Circle on U.S. Army-owned property in the Fitch Park neighborhood of the Ord Military Community. Extraction Well 3 is also referred to as Aquifer Storage and Recover (ASR) Well 6, except for the PWM Expansion it would operate only in extraction mode, not for injection. The well has been analyzed in previous environmental documentation, namely the CPUC EIR/EIS prepared for the Monterey Peninsula Water Supply Project (MPWSP), and an Environmental Assessment/Finding of No Significant Impact, prepared by the U.S. Army. Each extraction well would include a well pump and motor, and the associated electrical equipment. Extraction Well 3 would include chlorination dosing equipment. The well sites would be located on an approximately 100 square foot concrete pad. CalAm may elect to install emergency generators at one or more sites, depending upon their need for system reliability. These extraction wells were not included as part of the PWM Project, nor were they included in the Area of Potential Effect for the environmental review or approval of the PWM Project.

Potable Water Pipeline. For the PWM Expansion, CalAm would construct and operate a new potable water pipeline to convey the water from the new extraction wells to the existing CalAm distribution system. The 30-inch pipeline would be approximately 5,000 feet in length. The pipeline would begin at Extraction Well 3 (the northern most extraction well) and connect to the existing ASR pipe network at ASR Wells 1 and 2 (Santa Margarita site). From that point, water would be distributed to CalAm customers. This new potable water pipeline was not included in the Area of Potential Effect for the PWM Project. Additional information is available in Attachment D.

Environmental Compliance and Permits Completed for the PWM Project

The PWM Project has undergone substantial environmental review and regulatory compliance. Key environmental review documents and permitting approvals include the following:

- The PWM Project certified EIR that was prepared to meet the requirements of the Clean Water State Revolving Fund loan program that is partially funded through the U.S. Environmental Protection Agency (certified October 8, 2015; available at: www.purewatermonterey.org) and Addenda by responsible agencies,[5] and by M1W, the lead agency.
- Letter of concurrence from the State Historic Preservation Office completing the NHPA Section 106 process (dated April 19, 2016);
- Biological Assessment Supporting USFWS Biological Opinion for compliance with Endangered Species Act (ESA) Section 7 Consultation (dated March 2, 2016);
- Biological Assessment of the Effects of the Pure Water Monterey/Groundwater Replenishment project on South-Central California Coast steelhead (dated October 11, 2016);
- Letter of concurrence from the National Oceanic and Atmospheric Administration National Marine Fisheries Service (dated December 5, 2016);
- U.S. Fish and Wildlife Service Biological Opinion for compliance with Endangered Species Act (ESA) Section 7 Consultation (dated December 20, 2016);
- Clean Water State Revolving Fund (CWSRF) environmental checklist, CEQA findings and a Notice of Determination (dated January 9, 2017);[6]
- Clean Water Section 404 Authorization to Fill Waters of the U.S. from the U.S. Army Corps of Engineers for the Blanco Drain and Reclamation Ditch Diversions (Source Waters components) (initially authorized January 18, 2017 and reauthorized on March 22, 2018);
- Waste Discharge Requirements and Water Recycling Requirements for the Monterey Pure Water, Advanced Water Purification Facility and Groundwater Replenishment Project (March 9, 2017);
- SWRCB Water Rights Permit 21376 for the diversion of surface waters from Blanco Drain (March 17, 2017);
- SWRCB Water Rights Permit 21377 for the diversion of surface waters from Reclamation Ditch (dated March 17, 2017);
- Clean Water Section 401 Water Quality Certification from the SWRCB for the Blanco Drain and Reclamation Ditch Diversions (dated March 30, 2017);
- California Fish and Game Code Section 1602 Lake and Streambed Alteration Agreement for the Blanco Drain and Reclamation Ditch Diversions (dated June 8, 2017); and

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[5] MPWMD prepared and adopted two (2) Addenda to the PWM EIR to approve Water Distribution System Permit amendments to California American Water Company to approve construction and operation of their Monterey Pipeline and Pump Station and a modification to the facilities (Addendum No. 1 on June 20, 2016 and Addendum No. 2 on February 22, 2017, respectively).

[6] This review began with Initial Environmental Package submitted on October 9, 2015 and a Revised Environmental Package of the Financial Assistance Application submitted on November 18, 2015. Funding approval occurred in April 2017.

- U.S. Bureau of Reclamation Finding of No Significant Impact (FONSI) Pure Water Monterey Groundwater Replenishment Project- Monterey Regional Water Pollution Control Agency, FONSI_17-05-MP (dated May 2017).

M1W has submitted a request to the Central Coast Regional Water Quality Control Board (RWQCB) to amend the NPDES permit for the 5 mgd PWM Project currently under construction. The RWQCB completed a draft permit (Order No. 2018-0017) for M1W review on May 4, 2018. M1W expects a decision by the RWQCB on September 21, 2018.

SETTLEMENT AGREEMENT CRITERIA APPLIED TO PWM EXPANSION[7]

Criterion 1: Final EIR

Criterion 1 requires that M1W has approved the PWM Project pursuant to a certified Final EIR; no timely CEQA lawsuit had been filed; or, if a timely CEQA lawsuit has been filed, no stay of the PWM Project has been granted.

To comply with CEQA and CEQA-plus for the potential PWM Expansion, it is anticipated that a focused Supplemental EIR would be required and that some form of NEPA review such as an Environmental Assessment leading to a Finding of No Significant Impact (FONSI) may also be required from one or more funding agencies or agencies with approval authority of the PWM Expansion.

The preliminary PWM Expansion environmental review process has commenced with starting to develop a project description. The following tasks would be required to complete the CEQA/CEQA-Plus process (approximate timelines are shown in parentheses; detailed schedule information is provided in Criterion 5 and Attachment G):

- Scoping, including Notice of Preparation and 30-day Review (with funding of soft costs on June 1, completion by end of July 2018)
- Preparation and Review of the Administrative and Screen-Check Draft Focused Supplemental EIR (August – November 2018)
- Publishing and Noticing of Public Review Draft Focused Supplemental EIR (end of November 2018)
- Public Review Period for Draft Focused Supplemental EIR (November 2018 - January 2019)
- Final EIR Preparation and Review (February – March 2019)
- M1W Certification and Project Approval (March 2019)
- In parallel with the above, federal funding and permitting agencies must conduct their own environmental review (SWRCB CEQA and CEQA-Plus for Drinking Water or Clean Water State Revolving Fund, for U.S. Bureau of Reclamation or other U.S. EPA grant or loan funding National Environmental Policy Act)

An estimated, preliminary schedule (contingent upon M1W securing adequate funding for costs for environmental, design, and permitting by June 2018) for completion of the above tasks is provided in Attachment G. The following describes the anticipated content and scope of a focused Supplemental EIR, if the PWM Expansion were to be pursued.

Scope and Content of Supplemental EIR

[7] Each of the criterion are discussed below, adjusted as needed to refer to the PWM Expansion.

If PWM Expansion is pursued, M1W, as the CEQA Lead Agency, has determined that a focused Supplemental EIR would be required. A Supplemental EIR on the PWM Expansion would evaluate potential environmental effects associated with construction, operation, and maintenance activities. *As discussed in CEQA Guidelines Section 15163, a lead agency may choose to prepare a Supplement to an EIR when only minor additions or changes would be necessary to make the previous EIR adequately apply to the project in the changed situation. Thus, a Supplemental EIR addressing the PWM Expansion need to contain only the information necessary to make the previous EIR adequate for the project as revised.*

If M1W pursues PWM Expansion, the M1W Board would ultimately consider any Supplemental EIR in combination with the previous PWM Project Final EIR, which was certified in October 2015, and the adopted Addenda (referred to herein as the "PWM Project EIR").

The Supplemental EIR would be intended to serve as a supplement to the previously adopted PWM Project Final EIR, impacts and conditions presented in the previous EIR would serve as the primary base of comparison for the analysis. Thus, not all the environmental topics included in the CEQA Guidelines Initial Study Checklist would necessarily be addressed in the Supplemental EIR. Those topics that are not addressed in the Supplemental EIR would be excluded because the previous EIR concluded that there were no significant impacts associated with those topics, that the mitigation measures proposed in the 2015 Final EIR would still be feasible and would mitigate impacts of a PWM Expansion to a less-than-significant level, or for which level of significance is unchanged from that described in the PWM Project Final EIR.

The Supplemental EIR for the PWM Expansion would likely assess the following issues of potential environmental effects focusing only on the components of the PWM Project that would be changed by the PWM Expansion as discussed in the Introduction of this report:

Aesthetics Resources

PWM Expansion facilities would predominantly be underground or located on existing water and wastewater facility sites. Those facilities that are not located on existing water and wastewater facility sites would be designed to visually blend into the environment through use of vegetative screening and/or appropriate materials and colors. The Supplemental EIR would evaluate visual/aesthetic impacts related to the PWM Expansion's limited above-ground facilities, including visual character, scenic vistas, and new sources of light and glare. The only site with new above-ground facilities not already discussed in the PWM Final EIR is the Injection Wells Facilities site where a booster pump station would be placed adjacent to the electrical building currently under construction.

Agricultural and Forest Resources

There are no agricultural or forest resources within the PWM Expansion sites where components would be constructed. The evaluation of agricultural and forest resources as addressed in the PWM Final EIR would be considered adequate and does not need to be updated in the Supplemental EIR.

Air Quality and Greenhouse Gas Emissions

The PWM Expansion would be located within the Monterey Bay Air Resources District (formerly the Monterey Bay Unified Air Pollution Control District). Construction of the PWM Expansion would generate emissions from construction equipment exhaust, earth movement, construction workers' commute, and material hauling. Operation of pipelines, pump stations, wells, and treatment facilities would potentially generate emissions associated with energy use. The Supplemental EIR would evaluate construction- and operation-related emissions of criteria air pollutants from these expanded facilities and expanded operations. The PWM Expansion would be evaluated in accordance with all applicable federal, state, and regional rules and guidelines. The Supplemental EIR would quantify greenhouse gas emissions associated with the PWM Expansion incremental construction and operation above the PWM Project emissions and compare those to applicable regional thresholds of significance. The analysis would identify any potential conflict the PWM Expansion may have with an applicable plan, policy, or regulation adopted for reducing the greenhouse gas emissions.

Biological Resources

The Supplemental EIR would evaluate potential impacts of the PWM Expansion on terrestrial special-status animal and plant species, sensitive habitats, mature native trees, and migratory birds believed to occur in the PWM Expansion area. The Supplemental EIR would evaluate the potential for PWM Expansion facilities to impact terrestrial and marine biological resources, such as sensitive species and critical habitats, and would also discuss local ordinances and state and federal regulations governing biological resources. The Supplemental EIR would include a summary of the federal Endangered Species Act Section 7 compliance activities, document existing federal and state permits and conditions for the approved project and likely would recommend additional feasible mitigation measures to reduce significant impacts on biological resources as needed. The Supplemental EIR would also identify current EIR mitigation and best management practices to avoid significant impacts on biological resources. The Supplemental EIR would also address potential impacts to marine resources from the PWM Expansion and compliance with the California Ocean Plan water quality objectives.

Cultural Resources

Construction of new facilities both above and below-ground could encounter previously unknown archaeological or paleontological resources during ground disturbance and excavation. The Supplemental EIR would assess if there are any potential effects of the PWM Expansion on cultural resources, including archaeological, paleontological, and Native American resources, and Tribal cultural resources identified during the consultation process required by Assembly Bill 52. The Supplemental EIR would review cultural resource records and evaluate potential impacts on historic, archaeological, and paleontological resources, and human remains at PWM Expansion facility sites using available cultural resources records and data from the certified PWM Final EIR. The Supplemental EIR would also include a summary of the National Historic Preservation Act Section 106 compliance from the approved PWM Project. Standard mitigation measures to protect cultural resources would be included.

Geology, Soils, and Seismicity

Construction and operation of the PWM Expansion would occur in a seismically active region however the PWM Expansion sites are within the approved PWM Project site already evaluated in the 2015 EIR. The evaluation of geologic hazards in the region associated with seismic activity near faults and fault zones as addressed in the 2015 Final EIR is considered adequate and does not need to be updated in the Supplemental EIR. Ground-disturbing construction activities from the expanded facilities could expose soils to storm water erosion. The Supplemental EIR would focus on expanded ground disturbing activities and potential for soil erosion from the expanded facilities. Standard building requirements and engineering standards would be included to protect facilities and structures from seismic risks.

Hazards and Hazardous Materials

Construction of the PWM Expansion facilities would require excavation of the existing ground surface, which could uncover contaminated soils or hazardous substances that pose a substantial hazard to human health or the environment. The Supplemental EIR would rely on the summarize documented soil and groundwater contamination in the PWM Project areas from the PWM Final EIR and focus evaluation on the potential for hazardous materials that could be encountered during construction of the PWM Expansion facilities. The analysis would also consider the proper handling, storage, and use of hazardous chemicals that may be used during construction and operation of the expanded facilities. Existing hazardous materials regulatory requirements and mitigation from the PWM Final EIR would be followed to protect workers and the public from exposure to hazardous materials.

Hydrology and Water Quality

Hydrogeology and Groundwater Quality: Construction and operation of the PWM Expansion could affect groundwater levels and quality in the Seaside, Carmel Valley, and Salinas Valley Groundwater Basins. Using groundwater modeling and hydrogeologic analyses, the Supplemental EIR would evaluate changes in local groundwater quality, storage, and levels within the groundwater basins as a whole and their subbasins, as appropriate. The Supplemental EIR would describe the recharge, storage, and recovery capacities of the Seaside Groundwater Basin and describe potential impacts of recharge and extraction activities at the PWM Expansion locations. Potential effects on the seawater/freshwater interface (i.e., seawater intrusion) would also be evaluated. The PWM Expansion would be designed to comply with SWRCB Division of Drinking Water and Regional Water Quality Control Board standards and requirements to protect public health and water quality.

Hydrology and Surface Water Quality: Construction and operation of the PWM Expansion could affect surface water quality and hydrologic systems/processes in the construction areas. Potential impacts to be evaluated include alteration of drainage patterns and increase in storm water flows due to increase in impervious surfaces, and degradation of surface water quality because of erosion and sedimentation, hazardous materials release during construction, and construction dewatering discharges. The Supplemental EIR would identify storm water quality protection measures required during construction and operation of the expanded facilities. The PWM Expansion would be designed to comply with standard construction and operational requirements and permits under the National Pollutant Discharge Elimination System and General Waste Discharge Requirements.

Land Use Planning

Implementation of the PWM Expansion would include construction and operation of new facilities and water supply infrastructure within the same planning jurisdictions as evaluated in the PWM Project EIR. The Supplemental EIR would focus on the PWM Expansion facilities and determinations of consistency with established plans, policies, and regulations, as well as compatibility with the existing and future land use patterns in the area, including adjacent land uses. Because most conveyance facilities would be underground, and because the proposed treatment facilities would be located at the existing AWPF, significant effects on land use patterns are not anticipated.

Mineral Resources

The PWM Project EIR addressed local mineral resources; the evaluation of these resources as addressed in the PWM Project Final EIR is considered adequate and would not need to be updated in any Supplemental EIR for the PWM Expansion.

Noise and Vibration

Implementation of the PWM Expansion would require construction and operation of expanded facilities that would potentially generate additional noise and vibration. The Supplemental EIR would focus on the potential noise sources and evaluate the proximity of sensitive receptors to the PWM Expansion components to assess whether the facilities would comply with local noise policies and ordinances.

Population and Housing

The potential implementation of the proposed PWM Expansion would enhance the reliability of the water supply within the Monterey Peninsula area and be implemented to meet urgent deadlines for replacement supplies for CalAm's service area set by the SWRCB in CDO (Order WR 2009-0006 and amended by WR 2016-0016). The Supplemental EIR would describe the relationship of the increase in water supply to population growth in the area. The Supplemental EIR would identify current population and employment projections and identify local planning jurisdictions with the authority to approve growth and mitigate secondary effects of growth.

Public Services and Recreation

Implementation of the PWM Expansion would include new, upgraded, and expanded water supply infrastructure throughout area, however, the PWM Expansion would unlikely to affect demand for public services, or to require new or expanded facilities for public service providers. The PWM Project EIR previously assessed the potential for impacts on police and fire protection services, schools, parks and recreational facilities. This evaluation would not need to be updated in the Supplemental EIR.

Water Supply and Wastewater Systems

The Supplemental EIR would examine the water and wastewater services of the PWM Expansion facilities and address potential for the PWM Expansion to have a substantial adverse impact related to construction and operation of the new water or expanded water and wastewater treatment facilities.

Transportation and Traffic

Any Supplemental EIR would generally analyze the types of construction activities that would be generated by the PWM Expansion focusing on temporary increases in traffic volumes along local and regional roadways from expanded facilities. The installation of pipelines within or adjacent to road rights-of-way could result in temporary lane closures and traffic delays however, the expanded facilities would not likely increase either the location or amount of traffic from construction. The analysis would use information about construction activities of the PWM Expansion (e.g., the numbers of additional trucks and workers) to the extent such information is available. The analysis would focus on the existing traffic control plan measures that are currently in place from current PWM Project construction activities to reduce impacts to vehicular traffic, traffic safety hazards, public transportation, and other alternative means of transportation.

Utilities, Service Systems, and Energy

Construction and operation of the potential PWM Expansion could affect public utilities. Implementation of the PWM Expansion would result in increased use of pump stations, extraction wells, conveyance and treatment facilities, which would increase the amount of energy required locally to achieve regional water supply goals. The Supplemental EIR would evaluate energy consumption from the expanded facilities and compare the proposed energy use with energy demands in the PWM Project EIR.

Alternatives, Cumulative and Growth Inducing

Alternatives: Substantial analysis of Project alternatives was contained in the PWM Project EIR, which continues to be valid. Therefore, the alternatives analysis in the Supplemental EIR would only include alternatives that address significant impacts of facilities and PWM Expansion components that were not evaluated in the PWM Project EIR. This analysis would not need to not consider alternatives analyzed in the PWM Project EIR because such alternatives were already evaluated in that EIR. The findings of the Supplemental EIR impact analysis would guide the refinement of one or more feasible alternative(s) to be evaluated in any focused Supplemental EIR that would avoid or substantially lessen significant impacts of the PWM Expansion, while still meeting the project objectives. Using a Notice of Preparation of a focused Supplemental EIR M1W would seek comments from agencies, stakeholders, and the public regarding feasible alternatives (if any) for evaluation in the Supplemental EIR. The Supplemental EIR would include, at a minimum, a discussion of impacts associated with the No Project Alternative.

Other Environmental Issues: Other environmental issues that would be evaluated in the Supplemental EIR include the PWM Expansion's potential impacts on public services and utilities, including the PWM Expansion's beneficial effect on water supply reliability; adequacy and environmental effects due to use of RTP secondary effluent and additional new source water storage; effects on energy delivery systems due to fossil-fuel resource use (if any); and climate adaptation and sustainability benefits of the PWM

Expansion. The focused Supplemental EIR also would evaluate the potential for any indirect growth-inducing impacts of the PWM Expansion. The Supplemental EIR would address whether the PWM Expansion would have impacts that are individually limited, but "cumulatively considerable" when combined with the impacts of other past, present and reasonably foreseeable future projects (i.e., cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects).

Criterion 2: Permits

Criterion 2 states that the status of required permits is consistent with the published PWM Expansion schedule and, for required permits not yet obtained, the weight of the evidence does not show any required permits are unlikely to be obtained in a timeframe consistent with the published schedule.

The PWM Expansion would require new or amended permits, including those required for the CalAm only facilities.[8] A summary of key regulatory permits and approvals received for the PWM Project currently under construction was provided previously. The permits are divided into three categories: federal, State, and local as described below. Notably, none of the permits are currently considered to be a component of the critical path of the PWM Expansion, and thus there is some flexibility in the permitting timeline. In addition, M1W has obtained or is obtaining all these permits for the PWM Project except for the Division of Safety of Dams Coordination (required only for lining pond 3 at the SIWTF) and U.S. Army Land Easement (required only for Extraction Well #3 and connecting pipeline). In most cases, M1W would only need to amend an existing permit for expansion rather than obtain a completely new permit.

Federal Approvals and Consultations

The federal agency permitting begins with the preparation and submittal of a draft letter to federal action agencies, in this case, the PWM Project's funding agencies (the U.S. Environmental Protection Agency (EPA), the California State Water Resources Control Board (SWRCB), and/or the U.S. Bureau of Reclamation (USBR)), landowners (the U.S. Army (Army) for Extraction Well #3), and permitting agencies (the Monterey Bay National Marine Sanctuary (MBNMS)). With respect to the MBNMS, MBNMS works with the Regional Water Quality Control Board (RWQCB) to ensure Sanctuary resources are protected through terms and conditions (and authorization) of the NPDES permit amendment/revision, which is discussed in greater detail below.

After review of the changes needed for the PWM Expansion, each federal action agency would notify any other agencies with jurisdiction over resources potentially affect (in this case, U.S. Fish and Wildlife Service, National Marine Fisheries Service, and the Office of Historic Preservation). M1W is quite

[8] The permits required for CalAm Extraction Facilities are described here and shown in the attached schedule (Attachment G) even though M1W expects that CalAm would obtain the permits, acquire financing, and build the facilities themselves.

experienced in this process. There are four approvals and/or consultations that may need to be revisited due to the PWM Expansion.

Table 1. Federal Approvals and Consultation

Permit	Component of PWM Needing the Permit	Previous Action	Comments
National Historic Preservation Act (NHPA) Section 106 Compliance	CalAm only Extraction Wells and Pipeline, Salinas Industrial Water Treatment Facility	M1W obtained NHPA compliance for the Injection Well Facilities plus approval for components at the Salinas Industrial Water Treatment Facility	Potential amendment to existing Section 106 Letter of Concurrence; past inventories and site surveys near project sites did not reveal any protected resources.
Endangered Species Act Consultation with U.S. Fish and Wildlife Service (USFWS) regarding Existing Biological Opinion	CalAm only Extraction Site and Pond Lining at Salinas Industrial Water Treatment Facility	M1W received a Biological Opinion for the PWM Project. M1W's components of the PWM Expansion would not be disturbing any natural, undeveloped land not already included in the Biological Opinion.	Potential amendment to the Biological Opinion due to proximity of the pond lining work to the Salinas River riparian corridor.
Endangered Species Act Consultation with National Marine Fisheries Services (NMFS)	The Advanced Water Purification Facility (AWPF)	M1W obtained compliance for the existing AWPF reverse osmosis discharges without controversy.	Likely no action. There are no concerns related to water quality effects on the MBNMS (see Attachment E).
U.S. Army (Army) Land Easement	CalAm only Extraction Well Facilities	CalAm has experience	CalAm likely would obtain required property rights/easements. Army approval should be feasible to obtain for these facilities that are also proposed as part of the MPWSP.

There are no anticipated problems with obtaining the federal approvals in ample time to place the PWM Expansion in service by January 2021. (see Criterion #5)

State Agency Permits

The following state approvals are anticipated to be required: an amendment to the existing Water Recycling Requirements/Waste Discharge Requirements (WRR/WDR), and an amendment to the Waste Discharge Requirements/National Pollutant Discharge Elimination System (NPDES), plus, the Division of Safety of Dams (DSOD) approval (potential). The first and last permits are also described under Criterion #4. Here the permit process and work completed to date are described. Under Criterion #4, the response of the SWRCB Division of Drinking Water (DDW) and the California Regional Water Quality Control Board (RWQCB) is presented. M1W is experienced in obtaining WRR/WDR and NPDES permits. Regarding approval by DSOD, M1W staff has obtained a consultant, Geo-Logic Associates, who is very experienced working with DSOD on similar projects. They have stated that projects, such as lining of an existing Pond 3, may be approved by DSOD with minor documentation and coordination but could take many months to achieve (Monte Christie, Geo-Logic Associates, personal communication, March 2018).

This opinion was also provided by M1W's other pond lining engineering consultant (Vinod Badani, E2 Consulting Engineers, March 2018).

Table 2. State Regulatory Agency Approvals

Permit	Component of PWM Needing the Permit	Previous Action	Comments
Water Recycling Requirements/ Waste Discharge Requirements	AWPF and Injection	This permit process starts with submittal of AWPF design and hydrogeological modeling of the Basin followed by a study of anticipated groundwater geochemical interactions. M1W prepares an Engineering Report, which is reviewed by DDW. There is a public hearing, a revision of the Engineering Report and finally issuance of the permit by the RWQCB. M1W has obtained this permit for the PWM Project and does not expect any issues related to amendment to the permit to accommodate the PWM Expansion.	This is a straight forward permit because the AWPF design meets treatment standards for indirect potable reuse projects. M1W has completed an Engineering Report and amended it once. M1W has conducted the planning-level groundwater modeling for the PWM Expansion. No issues are anticipated. (see Criterion 6)
Division of Safety of Dams Coordination	Lining of Pond #3 at the Salinas Industrial Water Treatment Facility	No prior permit was required for the PWM Project. M1W will begin this process as soon as funding is obtained, and a consultant hired.	Lining of an existing pond is typically approved with minor documentation and coordination (see discussion above)
Waste Discharge Requirements/ NPDES for Regional Treatment Plant Ocean Outfall	AWPF	This permit process starts with the Report of Waste Discharge (ROWD), including modeling of the ocean from the new discharge characteristics and a comparison of the modeling results to the California Ocean Plan (Ocean Plan) requirements. M1W completed the ocean modeling and the Ocean Plan Compliance for a 6.5 mgd expanded AWPF in February 2018. Shortly thereafter, M1W's engineer determined that the AWPF could be expanded to 7.0 mgd allowing for extra flexibility. M1W's Board approved a contract to perform the modeling for a 7.0 mgd facility on March 26, 2018. M1W's consultants expect to have the new modeling completed by the end of April or early May and the Ocean Plan Compliance completed by the end of June. M1W expects the draft NPDES permit for the existing facility in April 2018 with the hearing for permit approval on September 10, 2018. MBNMS partners with the RWQCB in the issuance of an NPDES permit.	No problems anticipated. See additional discussion below and in Attachment D.

There are no anticipated constraints to timely receipt of the required State permits for the PWM Expansion to be completed by January 2021.

Local Permits

There are seven new or amended permits or easements to obtain: City of Seaside Use, Grading, and Encroachment Permits, Monterey County Use Permit, Fort Ord Reuse Authority (FORA) Right of Entry and Easement, Seaside Groundwater Basin Watermaster Water Storage Permit, and a Monterey County Health Department Well Drilling Permit. M1W is experienced in obtaining these types of permits.

Table 3. Local Approvals

Permit	Component of PWM Needing the Permit	Previous Action	Comments
City of Seaside Use Permit	CalAm-only Extraction facilities and Injection Facilities	M1W has obtained Use Permits from the City of Seaside for a monitoring well, Phase 1, and Phase 2 of the injection well facilities components.	No anticipated issues. It is anticipated that CalAm will obtain the Use Permit for their own facilities.
City of Seaside Digging and Excavating on the Former Fort Ord Permit (grading permit)	CalAm-only Extraction facilities and Injection Facilities	M1W has obtained grading permits from the City of Seaside for a Phase 1, and Phase 2 injection well facilities.	No anticipated issues. It is anticipated that CalAm will obtain the Use Permit for their own facilities M1W already has a draft of the Work Plan needed prior to applying for this permit (Attachment J)
Monterey County Use Permits	AWPF	M1W amended its use permit for the existing AWPF.	No anticipated issues.
City of Seaside Encroachment Permit	Injection Facilities	M1W has obtained Encroachment Permits from the City of Seaside for a monitoring well, Phase 1, and Phase 2 injection well facilities.	No anticipated issues.
Fort Ord Reuse Authority (FORA) Right of Entry and Easement	CalAm only pipeline facilities, Injection Facilities	M1W has obtained Right of Entry and Easements from FORA for a monitoring well, Phase 1, and Phase 2 injection well facilities.	No anticipated issues. CalAm must obtain the Right of Entry and Easements for their own facilities, if needed. M1W already has a draft of the Work Plan needed for the permit (Attachment J)
Seaside Groundwater Basin Watermaster Water Storage Permit	Injection Facilities	In March 2018, CalAm applied to the Seaside Basin Watermaster "to store and recover non-native water from the Basin" for the PWM Project. The application process is simple and there were no objections from the Watermaster Technical Advisory Committee on the application.	No anticipated issues. This permit would be obtained by CalAm.
Monterey County Health Department Well Drilling Permit	CalAm only facilities, Injection Facilities	These are permits obtained by the well drilling contractor after the construction contract is awarded. M1W has worked through this process several times.	No anticipated issues. It is anticipated that CalAm's well driller will obtain the Well Drilling Permit for the Extraction Wells.

There are no anticipated constraints to timely receipt of the required local permits so that the PWM Expansion can be operational by January 2021.

M1W has experience obtaining the permits needed for the PWM Expansion and has a team of consultants well versed in these activities. The proposed schedule (Attachment G) shows the expected time to obtain each permit. Each permit has a significant amount of float which allows some delay in obtaining the permits before the overall project schedule is adversely affected. As noted above, it is highly likely that these permits can be obtained in ample time to complete the PWM Expansion by January 2021.

Criterion 3: Source Waters

Criterion 3 requires an examination of whether there is sufficient legal certainty as to agreements or other determinations to secure delivery of source waters needed to produce sufficient product water from the PWM Expansion.

There are four sources of water for the PWM Expansion. The right to use those waters is described in the "Amended and Restated Water Recycling Agreement Between Monterey Regional Water Pollution Control Agency and Monterey County Water Resources Agency" (ARWRA) entered into on November 3, 2015. These water sources are further described below:

- *Winter Wastewater (Winter Water).* Per the ARWRA Section 4.01,1c, M1W has the right to use any wastewater that is not used for irrigation through MCWRA's CSIP system. For the 20 years of operation of the Salinas Valley Reclamation Plant, there has consistently been 6,000 to 8,000 AF of water discharged through the outfall every year in the winter months. Approximately 47% to 69% of the feed water needed for expansion would come from the excess winter wastewater currently being discharged to the ocean.
- *Winter Industrial Wastewater and Storm Water (Pond Return).* Per the ARWRA Section 4.01, 1c, M1W has the right to use any wastewater that is not used for irrigation through MCWRA's CSIP system. The Industrial Wastewater is not required to meet MCWRA demands during the winter; so, would not be diverted to the M1W Salinas Pump Station but instead, flow to the SIWTF. Similarly, the storm water from the City of Salinas that is received during the winter would be diverted to the SIWTF. The combined waters at the ponds would be returned to M1W in the summer using a new return pump station and pipeline to be constructed in 2018-2020 under a storm water grant. M1W is currently negotiating an agreement with the City of Salinas to define how the storage ponds will be operated and maintained. It is anticipated that M1W and the City of Salinas will have a Memorandum of Understanding by the end of June 2018 and a full agreement by the end of September 2018. An important consideration is whether one or more of the SIWTF ponds would be lined. Depending on the number of ponds lined, approximately 23% to 40% of the feed water needed for expansion would come from the returned industrial wastewater and storm water. If no ponds are lined, the PWM Expansion could still provide up to 2,331 AFY and would be expected to meet the proposed yield of 2,250 AFY until expanded irrigation projects are implemented (i.e., CSIP expands by more than 2,000 acres or MCWD implements their Phase 2 urban irrigation project).
- *Dry Season Allocations of 650 AFY in the months of May through August from MCWRA (Summer Water).* Per the ARWRA Section 4.01, 1d, M1W has the right to 650 AF of water during May through August as shown in the ARWRA Table 2. This water, like MCWD's summer allocation of 300 AFY, is available even if there is not enough wastewater to meet CSIP irrigation demands. This water is the water to be utilized for MCWD's Phase 1 and Phase 2 landscape irrigation projects.[9] However, until the completion MCWD's Phase 2 project, it would be available to meet expansion influent water needs.
- *New water.* This report only considers existing water once the PWM system has been built. Per the ARWRA Section 4.01, 2, M1W is entitled to one-half the volume of wastewater flows from

[9] Phase 1 of the RUWAP will provide 600 AFY of purified recycled water for irrigation demands at the former Fort Order and is currently under construction. Phase 2 would include an additional 827 AFY of recycled water use for a total of 1,427 after completion of recycled water lateral pipelines to irrigation sites.

areas outside of the M1W's 2001 boundary provided that M1W passes those waters through the SVRP or the PWM facilities. M1W is pursuing expansion of its service area to bring in additional waters in the future. Also, the Water Recovery Study for the Monterey Peninsula is looking to bring additional water to M1W. This new water would be needed to meet CSIP demands if CSIP acreage expands by more than about 9,000 acres (current plans are for about 3,500 acres) or if MCWD expands their landscape irrigation system (MCWD Phase 2). Further discussion of this water is found under Criteria 5 and 6.

Regarding the source water availability, this report assumes the following:

- CSIP has expanded during the summer months by about 14% (about 1,700 acres) and expansion during the winter months would be less than 70%. The summer expansion is required to utilize the new source waters developed by the PWM Project after replacing the 300 AF (MCWD) and the 650 AF (M1W, ARWRA 4.01d) summer water rights. M1W believes that CSIP expansion is likely within the next five to ten years. Without CSIP expansion, there should be additional water available for PWM Expansion beyond what is shown here.
- MCWD's Phase 1 project, currently under construction, is built and that MCWD's Phase 2 project will be delayed long enough for New water (defined above) to take its place. Some of M1W's 650 AFY of summer water will be utilized for MCWD's Phase 1. It is assumed that the remainder of M1W's summer water will be replaced by New water before MCWD's Phase 2 expansion is completed.
- SIWTF ponds are emptied in the following order: (1) Pond #1, (2) Pond #2, (3) aeration basin, (4) Pond #3. This order of emptying ponds was utilized in calculating the amounts of evaporation and percolation occurring during storage.
- It is a normal or wet year in which the drought reserve is being refilled at a rate of 200 AFY. If the drought reserve program has stored at least 1,000 AF in the Basin, then the PWM Expansion could produce an additional 200 AFY.
- That MCWRA meets the conditions of the ARWRA Section 16.15. If MCWRA does not meet the conditions and ARWRA Section 16.16 applies, then M1W will not be creating/refilling the drought reserve for the benefit of CSIP and 200 AFY more of product water would be available to supply the PWM Expansion.
- M1W assumes that initially the AWPF facilities will operate 90% of time. Consultants expect the operation time to increase to 95% within one to five years of start-up. Since less water is available during July through October, many scenarios assumed planned maintenance during those months and additional operational time during the other months (i.e., planned downtime of the AWPF for maintenance would occur during the peak irrigation months of July through October).
- Although M1W has existing rights to water sufficient to provide for 2,250 AFY of new yield without lining any of the ponds, costs to line Pond #3 are included to insure future source waters can be acquired in the event of increased demands for tertiary recycled water (CSIP expansion). The yield of a PWM Expansion was analyzed under scenarios, including scenarios that included lining one, all three, or no ponds.

M1W staff has conducted 12 scenarios that confirm source water adequacy to produce between 2,254 and 2,601 AFY. All scenarios produced more than the required minimum of 2,250 AFY of additional water under differing conditions following the above assumptions. If the drought reserve program (ARWRA Section 4.05) did not exist (ARWRA Section 16.16) or if the drought reserve reaches at least 1,000 AF then 200 AFY more product water would available for PWM Expansion.

Criterion 4: Water Quality and Regulatory Approvals

Criterion 4 examines whether the weight of the evidence in the record does not show that the Division of Drinking Water (DDW) or the Regional Water Quality Control Board (RWQCB) will decline to accept or approve the Project extraction or Project treatment and injection processes, respectively.

DDW and the RWQCB oversee the Water Recycling Requirements/Waste Discharge Requirements (WRR/WDR) for the PWM Project. Indeed, M1W has obtained a permit for the 5 mgd PWM Project currently under construction, which covers the water quality of the purified water used for injection and the water quality of the native groundwater, the interaction of the water with the aquifer and soil, the travel times and directions of the purified water in the two aquifers, and the requirements for monitoring and extraction. M1W anticipates no issues with the increased amount of water that would be injected by the PWM Expansion since the water will be produced from the same source waters by the same method and with the same equipment. The same hydrogeologic model was used to predict water movement, and the same monitoring and safety processes will be in place.

The results of groundwater modeling by Hydrometrics WRI under a contract with Todd Groundwater for the PWM Expansion is provided in Attachment A. The results of these analyses show that the PWM Expansion can feasibly meet regulatory requirements of DDW and the RWQCB. In addition, Trussell Technologies provided an analysis of additional opportunities for pathogen reduction (log) credits through the existing and proposed treatment processes that further support the conclusion that the PWM Expansion could feasibly treat and deliver water for reuse in compliance with State and federal safe drinking water regulations.

The WDR/NPDES process for the 5 mgd PWM Project under construction is nearly complete. M1W received a draft NPDES permit on May 4, 2018 and expects the NPDES permit hearing and decision in September. M1W has worked very closely with the RWQCB for several years to develop a multiple dilution factor methodology for the amended NPDES permit. The PWM Expansion would require only a modification to the September 2018 permit rather than a new permit. M1W meets regularly with the RWQCB to keep them up to date with the status of the PWM Project.

M1W anticipates no difficulty in obtaining either the WRR/WDR or the NPDES. M1W has an excellent track record with DDW and RWQCB. The proposed schedule (Attachment G) shows the anticipated time to obtain the various permits. The schedule for each permit has a significant amount of float, which reduces the risk that a delay would adversely affect the timely completion of the PWM Expansion.

Criterion 5: PWM Project Schedule Compared to Desalination Schedule

Criterion 5 requires a showing that the PWM Expansion is on schedule to be operable on or before the later of (a) the then-effective date of the CDO or such other date as the SWRCB states in writing is acceptable or (b) the date the MPWSP desalination project is scheduled to become operable.

The projected schedule for the PWM Expansion presented in Figure 5 is an executive summary intended to highlight critical activities necessary for the completion of the PWM Expansion by January 2021. A more detailed, multi-page, projected schedule for the PWM Expansion is included for reference in Attachment G. M1W will continue to update the CPUC and the parties as the evaluation of the PWM Expansion proceeds.

This projected schedule for the PWM Expansion provides a verifiable comparison to the latest available MPWSP Desalination schedule information. The projected schedule indicates that M1W could begin start-up activities of the increased capacity facilities on December 1, 2020 and completion on January 27, 2021 which is before: (1) the effective date of the CDO from SWRCB (currently December 31, 2021) and about the same time as (2) the operation date of MPWSP (currently between Q4 2020 and Q2 2021 per MPWSP's Newsletter 2018 Q1 dated April 30, 2018). CalAm could begin extracting water as soon as the new water is injected into the Basin.

Confirming two other key milestones, the projected schedule for the PWM Expansion demonstrates that before September 30, 2020 all civil site work will be complete, and all equipment required to expand the Advanced Water Purification Facility will have been delivered and on-site. In fact, the proposed schedule for the PWM Expansion shows the equipment being delivered to the site much earlier on April 16, 2020. Further, the PWM Expansion schedule demonstrates that before September 30, 2021 all construction will be complete. In fact, the projected schedule for the PWM Expansion shows completion and start-up of all the increased capacity facilities much earlier on January 27, 2021.

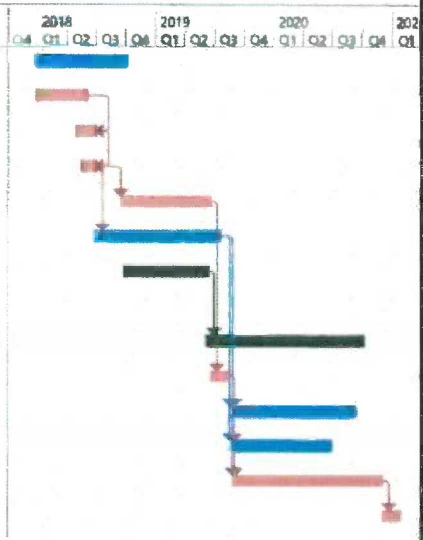
The ability of M1W to meet the projected schedule for the PWM Expansion is predicated on obtaining preconstruction project funding of soft costs by the end of June of 2018 and securing construction funding in August 2019. Delay in obtaining sufficient funding for either date will result in a delay to completion.

The overview of the PWM Expansion schedule below shows that the following activities have been commenced in the January – May 2018 timeframe:

- Seeking source water commitments by other agencies
- Initial Hydrogeological/Water Quality Studies and initial EIR Scoping
- Securing funding for preconstruction activities, "soft costs" (critical path today)

Pure Water Monterey Expansion Schedule

ID	Task Name	Start	Finish
1	**Source Water Commitments by Other Agencies (L)**	**Mon 1/1/18**	**Sun 9/30/18**
2	**Initial Hydrogeological & Water Quality Studies and Initial EIR Scoping**	**Mon 1/1/18**	**Thu 5/31/18**
3	**Funding for Soft Costs (CEQA/NEPA, design, legal, permits, etc.--A,I,L,P)**	**Thu 5/3/18**	**Fri 6/29/18**
4	**RWC & Board Approval of Consultant Contracts through bid phase (A,I,L,P)**	**Thu 5/17/18**	**Fri 6/29/18**
5	California Environmental Quality Act (CEQA-P) Review (A,C,I,L,P)	Thu 9/13/18	Mon 6/17/19
6	Final Design Documents, State & Local Permits, Bid Phase, Award (A,I,L)	Sat 6/30/18	Mon 7/15/19
7	Cal Am Only Consultants, Design, Permits (106, USFWS, Seaside), Right of Way (US Army, CA Lands Commission, FOR A & Seaside) after CPCN (C)	Fri 9/28/18	Sun 6/9/19
8	Cal Am only Bid, Award and Construction of Wells & Pipeline (C)	Sun 6/9/19	Thu 10/1/20
9	**Funding for Construction Costs, ROW, Legal, etc. (A,I,L)**	**Tue 6/18/19**	**Tue 8/13/19**
10	***Injection Wells (Bid, Award, NTP & Construction, I)***	***Mon 8/26/19***	***Sun 9/6/20***
11	***Salinas Pond Lining (Bid, Award, NTP & Construction, L)***	***Mon 8/26/19***	***Mon 6/22/20***
12	***AWPF Expansion (Bid, Award, NTP & Construction, A)***	***Mon 8/26/19***	***Tue 12/1/20***
13	**Start-up / Project Wrap-up / Completion (A,I,L)**	Tue 12/1/20	Wed 1/27/21



Summary | Manual Summary Rollup | Critical
Manual Task | Deadline

A=AWPF, C=Cal Am Only work, I=Injection, L=Liner, and P=CEQA+ and Permitting.

Figure 5. PWM Expansion Summary Schedule

As previously noted, the projected schedule shows the current critical path activity runs through obtaining preconstruction funding and then immediately getting the necessary consultant contracts in-place by the end of June 2018, so the environmental and engineering work for the PWM Expansion can be resumed quickly.

Once funding is obtained, the critical path of the PWM Expansion is then driven by the CEQA and CEQA-Plus environmental work. During this same timeline, several other important activities will be happening in parallel to the CEQA-Plus effort:

- State and Local Agency permitting
- Expansion facility engineering
- Cal Am's facilities design, permits, and right of way

The critical path could also be impacted by the timing of any re-initiation of consultation with the U.S. Fish and Wildlife Service, and the completion of an amendment to the PWM Project's Biological Opinion, if needed. The completion of re-initiation of consultation with the U.S. Fish and Wildlife Service is expected to be the last requirement needed to obtain a State Revolving Fund Loan (other funding mechanisms may require additional environmental work).[10]

At this stage of the PWM Expansion, the critical path of the schedule then flows through finalizing the construction documents of the expansion infrastructure. The bid, award, notice to proceed, and construction of the Advanced Water Purification Facility expanded components are the major critical path activities from late 2019 and through early 2021. The PWM Expansion schedule confirms completion and start-up of all the necessary facilities by January 27, 2021. It should be noted that new water production and injection should start in December 2020.

[10] As noted above, success of the PWM Expansion will depend on securing construction funding by August 2019.

Criterion 6: Status of PWM Expansion Engineering

Criterion 6 looks to the level of design completed for the PWM Expansion and requires a showing that the PWM Expansion is at least at the 10 percent level with support from a design report. Alternatively, this criterion can be satisfied for the PWM Expansion based on a showing that the GWR's level is similar to, or more advanced, than the level of engineering for the desalination project.

a) Introduction

Since M1W has already met Criterion 6 for PWM Expansion this section is more detailed than the others. The status of the engineering for the PWM Project is followed by the engineering for the PWM Expansion. M1W, in collaboration with the MPWMD, the Marina Coast Water District, and other regional stakeholders have developed the PWM Project. As described above, the PWM Project will produce purified water at M1W's Regional Treatment Plant (RTP) for injection into the Basin and subsequent potable reuse by MPWMD and the private water purveyor, CalAm.

The PWM system is under construction and includes five primary facility components:

- Source Water Facilities - that convey wastewater sources into the M1W RTP.
- Advanced Water Purification Facilities (AWPF) - that treat RTP secondary effluent to produce purified water.
- Product Water Pump Station – located at the AWPF site that pumps purified water into the conveyance system for non-potable and potable reuse.
- Conveyance Facilities - including a product water pipeline and storage reservoir that conveys purified water to the injection well facilities for groundwater recharge.
- Well Injection and Extraction Facilities – that includes both deep and vadose zone wells, and associated improvements for groundwater injection, monitoring and well backwashing in the Basin. Extraction wells include well facilities operated by MPWMD and the private water company, California American Water.

In accordance with certified Environmental Impact Report for the Project, the facilities under construction have been designed to initially produce, convey and inject up to 4 million gallons per day (mgd) of purified water. Flexibility for operating the facility at 5-mgd was included in the design of the facilities and would require operating redundant equipment at reduced system reliability. Environmental and regulatory processes are nearly complete for the facility to be operated at 5 mgd, (only NPDES permit, criterion #4 remains). Some considerations for future expansion to 6.5-mgd was incorporated into the design of the facilities under construction including;

- space was provided within the footprint of the AWPF and PWPS for additional equipment required for expansion to 6.5-mgd;
- the electrical service, switchgear, transformers and motor control centers at the AWPF and PWPS were designed to accommodate additional loads from new equipment;

- overall system hydraulics were evaluated to accommodate 6.5-mgd from the source water pump station, through the AWPF, PWPS, and conveyance facilities to the Injection Well Facilities; and
- two additional well sites, including two deep injection wells and one vadose zone well, were sited adjacent to the two well sites under construction (these facilities are evaluated in the certified final EIR for the PWM Project).

b) PWM Expansion

M1W and its partners have been actively undergoing planning and preliminary design for PWM Expansion, currently achieving a 30% level of design development. Although expansion to 6.5-mgd was previously contemplated in the testimony of Paul Sciuto, M1W has concluded that 7-mgd system capacity would better utilize the additional sources of water that vary seasonally and maximize the production of purified water for potable and non-potable uses.

The PWM Expansion's design objectives include constructing facilities capable of providing advanced treatment, conveyance and injection of up to 7-mgd of purified water, providing 5,750 AFY for groundwater recharge in the Basin, 200 AFY for drought reserve and 600 AFY for MCWD irrigation, for a total production of 6,550 AFY. The PWM Expansion would provide injection of 7 mgd during non-irrigating months, and up to 5.69-mgd of injection and 1.31-mgd of irrigation water during peak days of the irrigating season in accordance with the recently executed agreement between M1W and MCWD.

Significant engineering work has been performed related to the capacity expansion. M1W is well positioned to begin the CEQA review process, final design and associated permitting, right-of-way, and funding/financing-related work, which could be done in parallel with the construction of the PWM Project as currently approved. This section provides an overview of the engineering design work that is currently at the 30% design level.

c) Source Water Components: Lining Pond 3 at SIWTF

The City of Salinas owns and operates the SIWTF that includes an aeration lagoon, three evaporation and percolation ponds, drying beds, and rapid infiltration basins as shown on **Figure 6**. Through a Proposition 1 Storm Water Grant, the City of Salinas and M1W are designing a system to tie storm water from the southwestern corner of the City of Salinas directly into M1W's sewage pump station or into the industrial waste pipeline that takes the water to the SIWTF. Also, that project will be building a pump station that will pump water from the SIWTF directly into the sewage force main that flow between the Salinas sewage pump station and the RTP. That new pump station allows water to be stored in the ponds during the winter and then be pumped to the RTP during spring and summer when the water can be utilized. That work is nearing 100% design, should be put out to bid in May 2018, and construction should begin before the end of 2018. The result of that project is that all the SIWTF ponds should be filled each winter and emptied each summer.

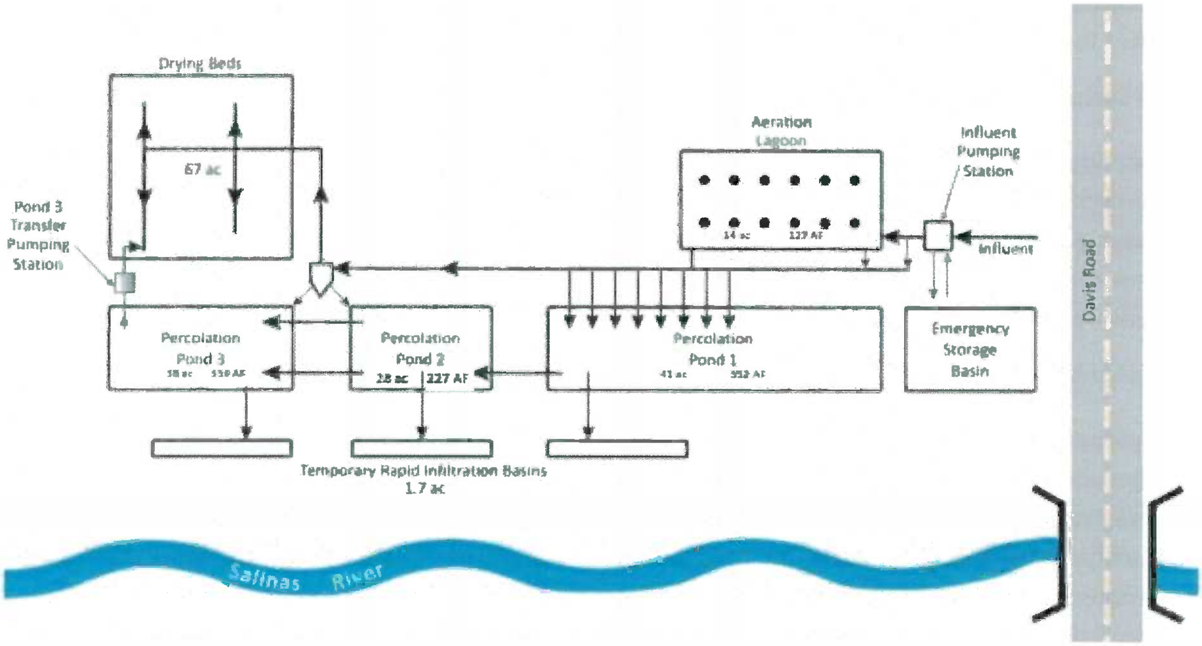


Figure 6. SIWTF Schematic

Paul Sciuto's September 29, 2017 testimony assumed that all three ponds would be lined to reduce percolation and to maximize spring and summer water recovery. A preliminary design study (E2 Consulting Engineers, 2017, included as an attachment to Geo-Logic, 2018, included as Attachment F) looked at various options including turning the drying beds into a lined fourth pond and estimated yields available by lining ponds. That study suggested using plastic lining material which was expensive. A follow-up study (Geo-Logic, 2018 in Attachment F) looked more closely at the difference in liner type (bentonite versus several types of plastic) including consideration for maintenance, California Division of Safety of Dams (DSOD) approvals, flooding issues, etc. The conclusion was that 60-mil HDPE was the preferred liner material. Geo-Logic also updated cost estimates for the option of lining pond #3. M1W has discussed the prospect of lining the pond with the City of Salinas and with growers in the community. Based on those conversations, M1W is currently pursuing only lining Pond 3 (as reflected in this report). An agreement is still needed between the City of Salinas and M1W over use of the ponds, lining, and costs. More background on the SIWTF, planned projects, percolation conditions, and options for increasing recycling yields is provided in Attachment C. As discussed under Criterion 3, M1W has existing rights to water sufficient to provide for a 2,250 AFY expansion without lining any of the ponds; however, costs of lining Pond 3 are included to insure adequate source waters can be available in the event of increased demands for tertiary recycled water due to CSIP expansion. The Geo-Logic report evaluating options for pond lining is included as Attachment F.

d) AWPF and PWPS Pre-Design

The final design of the AWPF and PWPS (currently under construction) shows the location where additional process equipment, piping, pumps, motors, and related improvements will be required. The design drawings, equipment pre-purchase documents and project specifications can be quickly adapted, after the final design work for increasing the capacity from 6.5 to 7-mgd is completed.

e) System Hydraulics Evaluation

Extended period hydraulic modeling has been performed for the Conveyance Pipeline and Reservoir, confirming that there is adequate storage available for both injection and MCWD irrigations under varying seasonal conditions. This evaluation also confirmed that a small booster pump station will be required to be constructed adjacent to the electrical building (**Figure 7**) in the Well Injection Facilities to provide adequate pressure service for two of the well sites (Well Sites #1 and #2).

f) Hydrogeologic Modeling

Hydrogeologic modeling has been performed using the field results from construction of the first deep injection well and the Seaside Basin Watermaster's numerical model. This modeling was performed using various injection and extraction scenarios that bracket a broad range of anticipated operating conditions using historical data and considering the impacts of climate change. This work confirms the proposed four well site configuration of the injection facilities will be adequate and that subsurface travel times will be adequate, in combination with treatment processes, to assure compliance with Division of Drinking Water regulations. Based on MPWMD-supplied assumptions about supply and demand of the water supply systems and the hydrogeologic modeling, additional well extraction facilities have been identified and sited to provide potable water for CalAm (section 2.6).

g) Injection Facilities Pre-Design

The Final Design of the Injection Facilities currently under construction can be readily adapted for the final design of the new pipelines, deep injection wells, vadose zone wells and site improvements. The preliminary site plan and building layout for Booster Pump Station has been completed, and the backwash percolation basin capacity has been confirmed for operating four deep injection wells.

f) CalAm Only Extraction Facilities

While modeling the Basin for particle travel paths and times for water to travel from injection to extraction (HydroMetrics, 2018), CalAm indicated that they would need additional wells within the Basin to extract peak demand with greatest operational flexibility including to meet their firm supply goals under a PWM Expansion. MPWMD worked with CalAm, HydroMetrics, and Todd Groundwater to determine CalAm's needs for water extraction (MPWMD, 2018). **Figure 7** shows the new extraction wells (EW-1, EW-2, and EW-3) for PWM Expansion along with a 30-inch potable connection pipeline between injection and extraction. **Figure 8** shows the continuation of the pipeline to the ASR-6 site where the third extraction well would be located.11 The CalAm-only extraction facilities are needed to

[11] For the purpose of this analysis, it is assumed that up to three wells may be built; however, in accordance within information from MPWMD staff only two new wells would be required to extract the total amount of PWM Expansion water needed to meet system demands during peak days. The third well would only be needed as a stand-by (or backup) well for the overall CalAm system redundancy requirements. For this reason, the cost analysis discussed later, does not include a third well and only two of the three wells would be built to meet the capacity/yield requirements of the PWM Expansion (Dave Stoldt, personal communication, April 12, 2018)

extract water from the Basin until the desalination facility is built. At that time, ASR-6 would be repurposed in the future to be an Aquifer Storage and Recovery well for injection in addition to being used for extraction. For PWM Expansion assumptions, the well would only be used for extraction because using it for injection of desalinated or Carmel River potable water would require approval of the desalination water supply project and water rights, respectively. For this report, it is assumed that CalAm would use their own consultants to design and permit their facility and their own financing for the construction. The cost estimate is based on recent nearly identical well drilling and pipe laying costs.

g) Estimates of Probable Capital Costs

Detailed estimates of probable construction costs have been prepared for the treatment, conveyance and injection facilities using standard cost estimating guidelines, recent bid costs for the facilities under construction; and supplemented with budgetary cost estimates from selected equipment manufacturers and recent experience on comparable projects.

The following estimate is considered a Class 3 level estimate for 30% design development in accordance with the Association for the Advancement of Cost Engineering International (1997 International Recommended Practices and Standards); thus, the estimate has an expected accuracy range of up to +20 to -15%. The estimate is in Q1 2018 dollars and includes contractor's overhead and profit and a contingency of 15%. This estimate does not include source water and extraction related facilities capital costs, as well as costs associated with CEQA review, regulatory permitting, project financing, right-of-way costs which are being developed by others.

Table 4. Estimates of Probable Construction Costs for Expansion to 7-mgd (excluding CalAm-Only Extraction Facilities)

PWM System Component	Opinion of Probable Cost
Lining of Pond #3 at the SIWTF	$6.8M
AWPF and PWPS Expansion Construction Cost	$8.7M
Booster Pump Station Construction Cost	$1.1M
Well Injection Facilities Construction Cost	$10.5M
Subtotal	$27.1M
Planning, Environmental, Permitting, Engineering, Legal, etc.	$5.4M
Total Opinion of Construction, Engineering and CM Costs for M1W's PWM Expansion components	$32.5M

h) Estimates of Energy Use and Chemical Cost for the PWM Expansion

Energy and chemical usage are estimated for the 7-mgd expansion producing 6,550 AFY (5,750 AF recharge + 600 AFY MCWD Irrigation + 200 AFY drought reserve).

Energy usage for the AWPF and PWMS is estimated assume the facilities operate with 90 percent run time and loads are adjusted for VFD or infrequent operation. Under these assumptions, the facility would draw approximately 31,140,000 KWH annually and produce 7057 AF of purified water at an annual energy usage of 3,972 KWH/AF. Assuming only 6,550 AFY of purified water is produced, reduces the energy use to approximately 28,890,000 KWH and 3,686 KWH/AF.

Chemical usage for the AWPF assumes a total of 6,550 AFY are produced at the AWPF. The estimated cost for the twelve chemicals in use at the AWPF totals approximately $2.01M annually for a unit cost of about $307/AF of purified water produced.

Energy usage for the Injection Facilities is estimated assuming the 500 HP backwash pumps operate for four hours each week, for each of the four deep injection wells, with 90% up time. The wells vary in terms of ground surface elevation and water surface elevation in the wells. It is assumed the four wells will use an average of 450 HP during backwash. The resulting energy use is approximately 310,000 KWH annually and 54 KW/AF (assuming 5,750 AF/YR is injected). Additional energy will be required to operate the booster pump station during certain periods of time.

Figure 7. PWM Expansion Injection and Extraction Facilities

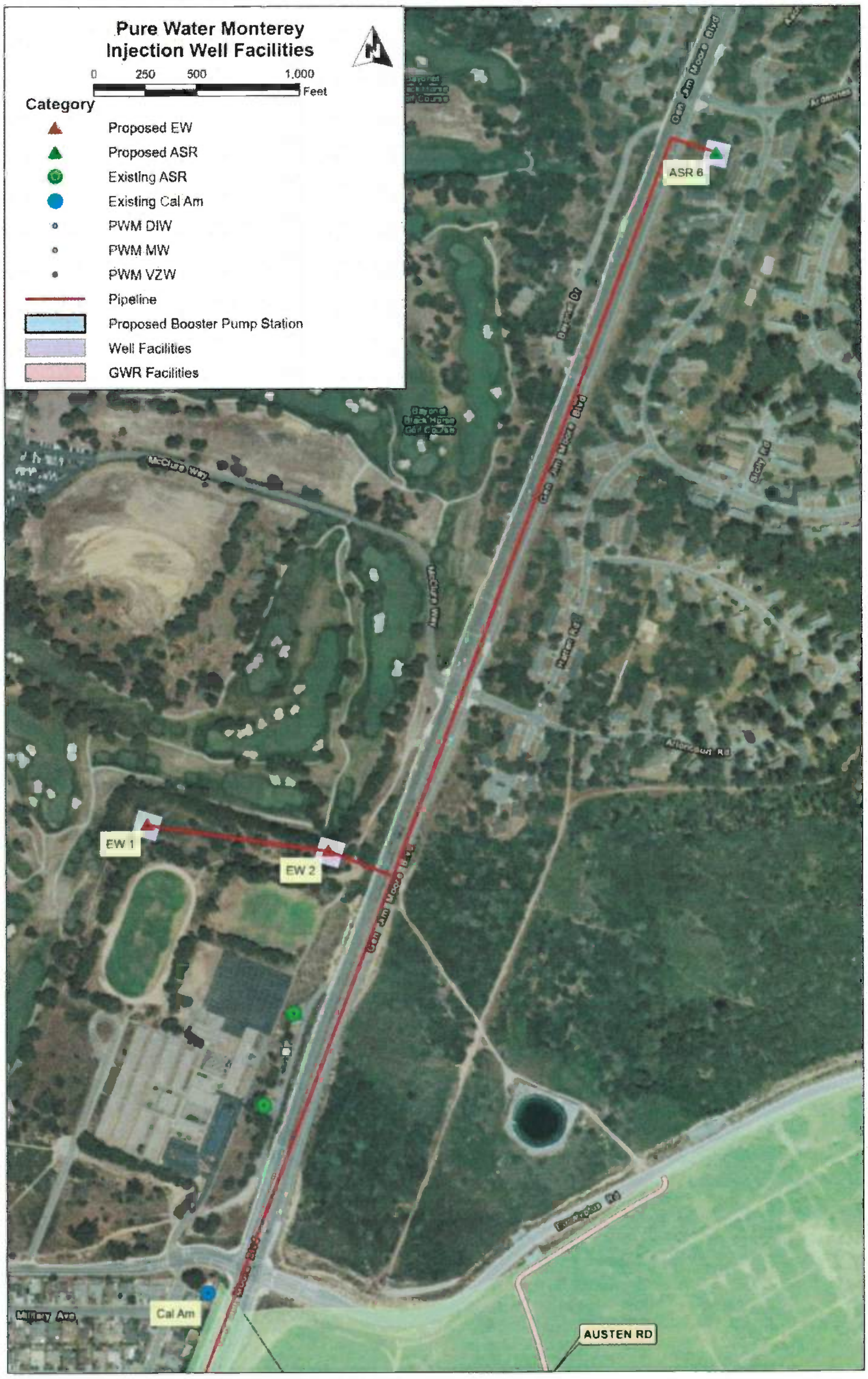


Figure 8. PWM Expansion CalAm Extraction Facilities

Current Cost Estimate for the PWM Expansion

Due to extensive design work and reports, M1W's cost estimate for the work has been adjusted. Table 5 contains a summary of those costs.

Table 5. Estimated Capital Costs for 2,250 AFY PWM Expansion

Descriptions	Amount	Comments
Planning	$504,000	Work through April 2018
Environmental	$723,000	Supplemental EIR/EA with legal & consultants
CPUC & Water Purchase Agreement	$385,000	Mostly legal
Partner Agency Agreements	$33,000	Mostly legal
Additional pathogen removal credit	$132,000	Mostly consultants
Permitting (Federal, State & Local) & ROW	$665,000	See list of permits in text Criteria #2 and #4
<u>Pond Storage & Return</u>		
Design	$680,000	
Construction	$6,804,000	Lining one pond with HDPE liner (37 of 104 acres)
ESDC, CM, Legal & In-house Labor	$1,361,000	
<u>AWPF Expansion</u>		
Design	$874,000	
Construction	$8,739,000	
ESDC, CM, Legal & In-house Labor	$1,748,000	
<u>Product Water Conveyance Pump Station</u>		
Design	$110,000	
Construction	$1,101,000	Booster PS built at Injection site
ESDC, CM, Legal & In-house Labor	$220,000	
<u>Injection</u>		
Design	$1,046,000	
Construction	$10,462,000	
ESDC, CM, Legal & In-house Labor	$2,092,000	
<u>CalAm Only Extraction Facilities</u>		
Design, Permitting & Right-of-Way	$865,771	
Construction	$9,377,364	
ESDC, CM, Legal & In-house Labor	$1,273,350	
Total Cost	**$49,195,485**	
Pre-Construction Cost	*$2,442,000*	included in total does not contain CalAm Only
Costs Nov '17 thru Apr '18 (incl. in Pre-Constr.)	*$504,000*	included in total does not contain CalAm Only

Table 6 contains the summary preliminary cost of water CalAm-only facilities results in the following cost of water.

Table 6. Preliminary Cost of Water Calculation

Expansion (M1W) Capital Cost	$ 37,679,000	all costs
Pre-Construction Costs		included above
Reimburse Expended Costs		included above and in total
2 Extraction Wells	$ 11,516,485	CalAm only
TOTAL Capital	$ 49,195,485	
Annualized Capital (30 year; 4.0%)		$ 2,844,980
O&M Expense ($ 2018)	$ 1,747,895	
O&M Expense ($ 2021)		$ 1,872,393
Overhead		$ 316,434
MPWMD Expense		$ 131,067
Cost per AF w/o Replacement		
TOTAL Annual Expense ($ 2021)		$ 5,164,874
Acre-Feet Output = 2,250		
Cost per Acre-Foot		$ 2,295.50
Cost per AF with Replacement		
Annual Replacement Fund ($ 2018)	$ 370,126	
Annual Replacement Fund ($ 2021)		$ 396,489
TOTAL Annual Expense ($ 2021)		$ 5,561,363
Acre-Feet Output = 2,250		
Cost per Acre-Foot		$ 2,471.72

Summary

The PWM Expansion to 7-mgd can be completed in an efficient and expedited manner if desired. Facilities for 5-mgd system capacity are under construction and are anticipated to begin initial operations by late 2019. The expansion to 7-mgd capacity has been planned and evaluated to a 30% level of design development and the CEQA review process could be initiated at any time. Final design of the expansion could be performed as the current facilities are constructed and placed into service. Additional details can be found in the Draft Technical Memorandum dated 12 April 2018, titled Pure Water Monterey System Expansion Study Update for 7-mgd Capacity and other related project documentation, attached.

Criterion 7: PWM Expansion Funding

Criterion 7 requires a project funding plan, sufficient in detail to be accepted as an application for a State Revolving Fund loan, is in place.

M1W has taken steps to fulfill this aspect of the settlement by submitting an application to the State Revolving Fund and also completing a financial analysis for the PWM Expansion. The remainder of this section describes various funding mechanisms and how M1W is in a good position to obtain funding for the PWM Expansion.

To develop a Project Funding Plan for the PWM Expansion, M1W staff is exploring a wide variety of funding mechanisms to provide the necessary funding required for the PWM Expansion. These mechanisms may include the State Revolving Fund program, WIFIA, IBank, and borrowing on the open market, as explained in more detail below. M1W is also considering a combination of one or more of these mechanisms to complete the funding package.

M1W submitted a General Information Package for the PWM Expansion on April 6, 2018 via the SWCRB's online portal (Attachment I) and was issued a PIN for the loan application on May 2, 2018. The portal, Financial Assistance Application Submittal Tool (FAAST), is administered by the Board's Division of Financial Assistance (DFA). This application is the first step for obtaining funds from the State Revolving Fund (SRF) program. M1W will have to complete several technical, environmental and financial components to secure the loan. M1W is familiar with these requirements as the DFA approved the loan in which the PWM Project was funded.

The initial amount listed in the General Information Package submitted to the SWRCB was for the PWM Expansion was approximately $44 Million. This amount was based on initial design reports and cost calculations. A revised amount that is being utilized in other sections of this report is $38 Million. Final costs for the project can change due to the bidding environment, contractor availability and cost of materials.

Another possible funding mechanism is the Water Infrastructure Finance and Innovation Act (WIFIA), which is directed by the Environmental Protection Agency (EPA). WIFIA funds can be used for eligible water and wastewater infrastructure projects. WIFIA only funds 49% of eligible project costs and the interest rate will be equal to or greater than the U. S. Treasury rate of a similar maturity at the date of closing of the project's loan application. WIFIA has similar credit requirements of the applicant, such as dedicated sources of revenues, and project applicants must comply with federal provisions, such as NEPA and American Iron and Steel.

M1W will also investigate another potential funding mechanism managed by the California Infrastructure & Economic Development Bank (IBank). One of the programs that the IBank oversees is called the Infrastructure State Revolving Fund program (ISRF). This program provides financing to public agencies for infrastructure and economic development projects. Project funding ranges from $50,000 to $25 million. Loans are typically issued for the useful life of the project with a maximum repayment length of 30 years.

The last option for obtaining construction funds is to have the agency issue revenue bonds through the open financial market. This option provides the highest degree of flexibility but comes with the highest cost. There is a wide selection of financial institutions that could provide the funds, with varying length of terms for repayment.

The table below summarizes the various financial options available to M1W for funding the PWM Expansion.

Table 7. Financial Options

Loan Type	Maximum amount of Loan	Approximate Loan Rate *	Years of Maturity	Status
SRF	Cost of the project	2%	30	Initial application submitted
WIFIA	Up to 49% of the loan amount	3%	Up to 35	Letter of Interest to be submitted prior to July 2018
IBank	Up to $50 Million	4%	30	In progress
Revenue Bonds	Cost of project	5%	1 to 40	As needed

***Initial estimote for rates as of April 2018**

Financial Status of M1W: To qualify for loans, M1W has to demonstrate its financial stability. A common method for analyzing an M1W's financial condition is its debt coverage ratio. M1W has some existing obligations and in order for the M1W to take on any new debt, the existing financial institutions require the M1W to maintain a debt coverage ratio of at least 1.25 of net revenues over its annual debt service. M1W has met this requirement during the past several fiscal years.

M1W has these existing long-term debt obligations as of June 30, 2017:

- Pension Bonds of approximately $6 Million, which mature in 2026
- Revenue Bonds for Agency Projects of approximately $8 million, maturing in 2026
- State Revolving Fund (SRF) Loans for the PWM of $8 million (with a total upon project completion in 2018 of $98 million and maturing in 2048)
- United States Bureau of Reclamation Loans (USBR) of $12 million, maturing in 2036

M1W secured a Water Purchase Agreement with CalAm and the MPWMD to cover the costs of constructing the new facilities associated with the PWM Project. The debt associated with the PWM Project has its own dedicated revenue stream and is also covered in part by the MPWMD as well as some of the revenues from M1W.

M1W also has a $12 Million line of credit to assist in maintaining cash flow disbursements to vendors during the construction process. The time between paying vendors for work on the PWM Project and receiving reimbursements from the SWRCB from the SRF loan can result in a significant drain on M1W's cash reserves. The line of credit allows the M1W the ability to maintain sufficient cash reserves, so M1W can pay its vendors on a timely basis.

Criterion 8: Reasonableness of WPA Terms

Criterion 8 requires that CalAm, M1W, and MPWMD have agreed upon a WPA whose terms are just and reasonable.

The Commission approved the WPA for up to 3,500 AFY of product water produced by the PWM Project between CalAm, M1W, and MPWMD in Decision 16-09-021.

M1W's position is that the approved WPA could be amended and approved by the Commission in a Phase 3 proceeding, a stand-alone application or, potentially, through an advice letter filing. The "Company Allotment" would be revised to 5,750 acre-feet and other terms such as "Minimum Allotment," "Operating Reserve Minimum," would be subject to revision based on negotiation between the parties. The Performance Start Date would require amendment to reflect the current date for phase 1 (3,500 acre-feet) and a second date for the expansion. The Term would be extended to thirty (30) years from the second (new) Performance Start Date. The Section 12 Water Delivery Guarantee would reflect the new Company Allotment number. Finally, the Commission would need to approve a new soft cost cap in Section 16 for the per acre-foot cost of water based on the blended cost estimate of the PWM Project and the PWM Expansion. These modifications can be executed quickly and brought to the Commission for approval long before the September 30, 2019 milestone under the SWRCB's CDO.

Criterion 9: Reasonableness of the PWM Project Revenue Requirement

Criterion 9 requires that the revenue requirement for the combination of the PWM Project with the smaller desalination project is just and reasonable when compared to the revenue requirement for the larger desalination project alone.

Criterion 9 is not relevant when examining the PWM Expansion because the reason for approval of the expansion would be as an alternative interim project that would allow CalAm to comply with the Cease and Desist Order and end the moratorium on new connections. As a result, PWM Expansion will provide an alternative water supply if the desalination plant is delayed because of legal challenges, delays in permitting, or other challenges during construction or operation. Hence, there is not an objective "just and reasonable" comparison to make about a revenue requirement when the objective is to lift the CDO and the combination of projects are separated by an unknown amount of time.

Nonetheless, M1W and MPWMD worked with NBS Government Finance Group (NBS) to examine the revenue requirements of the Pure Water Monterey expansion in conjunction with various sizes of desalination facility delayed to various dates in the future. **Attachment K** includes the initial economic analysis of the PWM Expansion, allowing the Commission to better understand the potential rate impacts in the near-term versus the long term, the lifecycle costs of various combinations of projects, and the time value of delaying investment in the desalination alternatives. **Figures 9a and 9b** are the MPWMD transmittal memorandum to M1W for the NBS economic analysis; MPWMD's memorandum summarizes MPWMD's view of the economic analysis results while highlighting several relevant general conclusions. The conclusion of this section is that PWM Expansion is a viable solution to the CDO issues should Cal Am be delayed in completing the MPWSP.

MONTEREY PENINSULA WATER MANAGEMENT DISTRICT

MEMORANDUM

To: Paul Sciuto, Monterey One Water
From: Dave Stoldt, Monterey Peninsula Water Management District
Date: April 27, 2018
Subject: Economic Analysis of Pure Water Monterey Expansion

We have received the Report titled "Economic Analysis of Pure Water Monterey Expansion" prepared by NBS, the consultant hired by the Monterey Peninsula Water Management District (District) on behalf of Monterey One Water and the District. The analysis was to examine the expansion as an interim measure to relieve the Monterey Peninsula of the moratorium on new service connections and lift the State-imposed Cease and Desist Order (CDO) in the event the proposed 6.4 MGD desalination facility is delayed several years or more.

The purpose of this memorandum is to summarize the District's view of the results presented in Tables S-1 and S-2, and Figures S-1, S-2, S-3, and S4 of the report. These tables and figures represent the net present value (NPV), as well as the total revenues required from ratepayers, for the 30-year life-cycle beginning 2021.[1] It is also instructive to examine Table CF-1 in Appendix B of the report to see individual annual revenue requirements for the combined projects vis a vis the 6.4 MGD desalination project online by 2021.

In general, the following global conclusions can be reached.

- In all cases, the net present value of the 30-year revenue requirement is lower for Pure Water Monterey expansion combined with any of the reduced size and delayed desalination plants.

- In all but one case, the total revenue requirement over the 30-year period is favorable for Pure Water Monterey expansion combined with any of the reduced size and delayed desalination plants. In that one scenario, expansion combined with a 4.8 MGD plant delayed 5 years, ratepayers would pay $11 million additional over a 30-year period in order to relieve the moratorium and lift the CDO 5 years early.

- The combined annual revenue requirement (Table CF-1), once the desalination plant does come on line, is shown to be higher than it would have been with only the 6.4 MGD desalination project online by 2021. This augers toward attempting to further reduce the construction cost of the desalination alternative, when and if it is ready to proceed.

[1] Revenue requirements for either project beyond the 30-year period are truncated and not included.

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831-658-5600 • Fax 831-644-9560 • http://www.mpwmd.net

Figure 9a. Summary Memorandum of NBS Report (page 1 of 2)

Mr Paul Sciuto
Page 2 of 2
4-27-18

- It should be noted that waiting on the eventual construction of a 6.4 MGD plant without a Pure Water Monterey expansion, would result in escalation of both capital and O&M costs of the project, leading to $3-5 million per year in additional annual revenue requirement over the base case shown in Table CF-1.

We recognize that scenarios that include a 1.6 MGD desalination plant, or a delay of 25 years to 2036 are unlikely. However, there does appear to be a benefit to ratepayers to expand Pure Water Monterey today, in conjunction with a delay of 5 or 15 years in the start of a "right-sized" desalination plant.

Thank you for the opportunity to provide my high-level review of the NBS report.

Sincerely,

David J. Stoldt
General Manager
Monterey Peninsula Water Management District

Figure 9b. Summary Memorandum of NBS Report (page 2 of 2)

Attachment A

Draft Technical Memorandum - Kennedy Jenks, Pure Water Monterey System Expansion Study Update for 7-mgd Capacity April 2018.

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12 April 2018

DRAFT Technical Memorandum (Updated)

To: Mr. Paul Sciuto, General Manager, Monterey One Water
Mr. Bob Holden, Project Manager, Monterey One Water

From: Craig Lichty - Project Director
Todd Reynolds - Project Manager

Subject: Pure Water Monterey System Expansion Study Update for 7-mgd Capacity
K/J 1668001*61

1.0 Introduction

Monterey One Water (M1W), formerly Monterey Regional Pollution Control Agency, in collaboration with the Monterey Peninsula Water Management District, the Marina Coast Water District, and other regional stakeholders have created the Pure Water Monterey Groundwater Replenishment Project. This Project will produce purified water at M1W's Regional Treatment Plant (RTP) for injection into the Seaside Groundwater Basin and subsequent potable reuse by the Monterey Peninsula Water Management District (MPWMD) and the private water purveyor, California American Water.

This Draft Technical Memorandum (TM) updates a previous TM dated 25 September 2017 with new information, in response to recent program developments.

The current Pure Water Monterey (PWM) design objective is to construct facilities capable of providing 3,500 AFY for groundwater recharge and recovery for potable use, and 200 AFY for drought reserve, for a total of 3,700 AFY recharge in the basin. The PWM system is under construction and includes five primary facility components:

1. Source Water Facilities - that direct wastewaters into the M1W RTP.
2. Advance Water Purification Facilities (AWPF) - that treats RTP effluent to produce purified water.
3. Product Water Pump Station – located at the AWPF site that pumps purified water into the conveyance system for non-potable and potable reuse.
4. Conveyance Facilities - including a product water pipeline and storage reservoir that conveys purified water to the injection well facilities for groundwater recharge.
5. Injection Well Facilities – that includes both deep and vadose zone wells, and associated improvements for groundwater injection, monitoring and well backwashing in the Seaside Groundwater Basin.

In accordance with certified Environmental Impact Report for the Project, the facilities under construction have been designed to initially produce, convey and inject up to 4 million gallons per day (mgd) of purified water. Flexibility for operating the facility at 5-mgd was included in the design of the facilities. The original TM summarized the feasibility and cost of operating at 5, 6.5, and 10-mgd capacity to deliver additional purified water for recharge in the Seaside Groundwater Basin.

1.1 Purpose

M1W and its partners would like to obtain information related to the feasibility and cost of expanding the production, conveyance and injection capacity from 4-mgd to 7-mgd capacity. Although expansion to 6.5-mgd was previously evaluated, it has been determined by M1W that 7-mgd capacity would better utilize the additional sources of water that vary seasonally.

The expanded Pure Water Monterey (PWM) program objective would be to construct facilities capable of providing advanced treatment, conveyance and injection of up to 7-mgd of purified water, providing 5,750 AFY for groundwater recharge in the basin. The expanded program would also provide MCWD with 600 AFY, at a maximum rate of 1.31-mgd, for irrigation in accordance with the recently executed agreement between M1W and MCWD.

This evaluation is focused on identifying facilities requirements, estimated costs and operating constraints associated with expanding each of the primary PWM facilities components from 4- to 7-mgd capacity, except for the additional source water supply and groundwater extraction facilities are which being evaluated separately by M1W and MPWMD, respectively. This evaluation and supporting documents represents a 30% level of design development.

1.2 Contributors

This TM was prepared through collaboration with many individuals involved in planning, regulatory permitting and facilities design for the Pure Water Monterey Program including:

Monterey One Water – Bob Holden, Principal Engineer, provided source water related information including source water availability, injection and extraction data used as the basis for determining the size of facilities and operating scenarios.

Kennedy/Jenks Consultants - the design team for the AWPF, PWPS and Groundwater Injection Facilities provided input in their areas of expertise, including:

- Rod Houser – PWPS and Injection Facilities, Conveyance System Hydraulics
- Sandy Schuler – AWPF, PWPS and Injection Facilities Electrical Service and Equipment

- Janet Hoffman – Estimates of Probable Construction Costs

Separation Processes – the design team for the AWPF membrane processes, including microfiltration and reverse osmosis – Alex Wesner

Trussell Technologies – the regulatory compliance and design team for the AWPF Ozone, UV/AOP and post treatment unit processes and estimates of chemical usage.

- Elaine Howe – AWPF Facilities and Regulatory Compliance Strategy
- Fred Gerringer – AWPF Facilities
- John Kenny – AWPF Facilities

Todd Groundwater – the planning, injection well design criteria and hydrogeologic modeling for the recharge and extraction of purified water – Edwin Lin. Hydrometrics provided groundwater modeling of the injection/extraction scenarios as a subconsultant to Todd Groundwater.

2.0 Summary of PWM Facilities Currently Under Construction

2.1 AWPF Facilities

The AWPF is designed to treat 4-mgd with process reliability and redundancy for all the major and ancillary treatment processes. The AWPF will can produce up to 5-mgd by operating redundant process equipment, however at this capacity the facility will operate at a lower level of reliability. Provisions were included in the current design to facilitate future capacity expansion to 6.5-mgd within the existing facilities footprint, however this would require design and construction of additional improvements.

The AWPF will produce purified water that meets the specific water quality objectives including a significant portion of the overall pathogen removal requirement for groundwater recharge (7-logs of the 12-log pathogen reduction requirement are met by the AWPF). The remaining 5 logs of pathogen removal at 4-mgd will to be achieved through natural treatment via subsurface flow in the aquifer. Trussell Technologies assessed the feasibility of achieving additional pathogen removal credits and this work is documented in a progress memorandum dated 6 April 2018.

2.2 Product Water Pump Station

The Product Water Pump Station (PWPS) is located at the AWPF site and has a current firm design capacity of 5-mgd with 3 pumping unit's duty and one standby. The PWPS can produce 6.5-mgd capacity by operating the standby pump, however the facility will operate at a lower level of reliability. Space in the existing structure was provided for the future addition of a fifth pumping unit, which would provide 6.5-mgd capacity using 4 pumping unit's duty, with one standby.

2.3 Conveyance Facilities

The Conveyance Facilities will convey water from the AWPF to the groundwater recharge site. These facilities include approximately 9-miles of new and existing pipeline and a new 2 million gallon (mg) above-ground storage reservoir. The conveyance pipeline includes five sections of previously installed pipe that are smaller in diameter than the new 24-inch diameter pipeline under construction.

2.4 Injection Well Facilities

The Injection Well Facilities include the Seaside Groundwater Basin and MPWMDs extraction wells, and PWM's new groundwater injection facilities including up to four deep injection well sites and associated facilities. Well Sites #2 and #3 are designed and under construction. The Injection Well Facilities and Seaside Groundwater Basin have two major functions for the PWM System:

1) they provide a means to recharge and store purified water in the groundwater basin for future use;

2) the system provides the adequate subsurface travel time to achieve pathogen removal credits for regulatory compliance.

Hydrogeologic modeling using well pumping test results from the construction of the first deep injection well confirmed that 4-mgd injection capacity may be achieved using two deep injection wells and one vadose zone well, while maintaining the necessary 5-log reduction credit for pathogen removal. Although these facilities have hydraulic capacity to inject 5-mgd, the pathogen removal credits drop just below the 5-log minimum required for regulatory compliance. So, to operate at 5-mgd, additional pathogen removal credits will need to be obtained using disinfection with chloramines in the conveyance pipeline. The hydrogeology evaluation is summarized in a Draft TM by Todd Groundwater in Appendix A.

3.0 Concept Evaluation of PWM System Capacity Expansion to 7-mgd

The concept-level facilities requirements for PWM Capacity expansion to 7-mgd are outlined for each major facility component, except for source water supply and groundwater extraction wells which are being evaluated by others. The estimate of probable construction cost, energy use and chemical usage for expansion to 7-mgd is also summarized.

3.1 Assumptions

Through discussion with M1W, the following assumptions are used in the development of this evaluation.

- The AWPF was designed with flexibility for future capacity expansion to 6.5-mgd within the existing facilities footprint. Some facility elements, such as interconnecting piping were designed to accommodate 6.5-mgd of production. Other elements were designed with space for addition pumps, treatment skids, piping, valves, electrical equipment, etc. for expansion to 6.5-mgd. The expansion of the AWPF is now being planned for 7-mgd capacity and there may be impacts to space allowances, operations (chemical delivery frequency), equipment and other facilities will need to be evaluated more closely during preliminary design. The facilities are currently under construction using the May 2017 AWPF Project Drawings prepared by Kennedy/Jenks Consultants.
- The maximum production rate from the AWPF for 7-mgd is based on having redundant treatment process components (N+1) for all systems, except the Ozone and Reverse Osmosis (RO) Trains.
- The evaluation of the Conveyance System will consider the impacts of increased system headloss at higher flow rates using an extended period hydraulic model simulation during winter (no MCWD irrigation demands) and summer (including peak MCWD irrigation demands).
- The expansion of the Groundwater Recharge Facilities from 4- to 7-mgd would use the four, deep injection wells and two vadose zone wells configuration at the proposed injection well facilities site that was evaluated in the approved PWM EIR in 2015. These facilities will match the facilities that are designed and under construction for Well Sites #2 and #3.
- The maximum 7-mgd injection rate for the Groundwater Recharge Facilities assumes 4 deep injection wells and 2 vadose zone wells are operating, with no wells in standby. At 4-mgd, each deep injection well is anticipated to backwash for 4 hours a week at a rate of up to 2,400 gpm, which is approximately two times the injection rate. At 4 and 5-mgd, the injection rate will drop by about half during backwash to operate within the maximum injection capacity of any well. At 7-mgd, there is flexibility to redistribute the entire 7 mgd injection rate to the remaining three deep wells and vadose zone wells in operation.
- Additional pathogen removal/inactivation credits have been reviewed for operation above 4-mgd. Several options exist including obtaining credits for the existing RTP facilities upstream of the AWPF, via ozone disinfection based on an O3:TOC ratio, strontium rejection through RO membranes, and/or by using disinfection (chloramines) in the conveyance pipeline. At this time, the preferred method is to use disinfection in the conveyance pipeline.

- M1W Staff and consultants will provide the estimated costs for additional source water and extraction facilities and all associated CEQA, permitting, real property and right-of-way requirements for the system expansion.
- Cost information presented herein are in Q1 2018 dollars.
- Costs associated with a separate electrical service from Monterey Regional Waste Management District are not included.

3.2 AWPF Facilities Capacity Expansion to 7-mgd

Expansion of the AWPF and the additional equipment would be installed in the locations designated and shown in the current AWPF design drawings. The AWPF includes the following major facility sub-components. The expansion requirements for each sub-component are summarized below.

3.2.1 Source Water Pump Station

The following additional major equipment are required for expansion to 7-mgd:
- One (1) duty source water pump and associated piping and valves
- One (1) source water pump variable frequency drive (VFD) and associated electrical and instrumentation

The source water pump station wet well and piping infrastructure were sized for 6.5-mgd, but can accommodate the 7.7% increase to 7-mgd without compromising system hydraulics. The structure and MCC -1 were designed with space to accommodate the additional pump and VFD. During preliminary design, the shop drawings for the pump, impellers, motor and MCC should be reviewed to confirm how the system curve shift from 6.5 to 7-mgd will impact operating efficiency and if there is a need to modify/replace pump impellers.

3.2.2 Ozone System

The following additional major equipment are required for expansion to 7-mgd:
- One (1) liquid oxygen (LOX) storage tank
- One (1) standby LOX vaporizer (239 SCFM)
- Two (2) injection skids
- Three (3) air release valves
- Two (2) ozone destruct units
- Associated piping, electrical and instrumentation

No major changes are anticipated to be required to the following Ozone system components for 7-mgd:

- Sodium hypochlorite chemical system
- Ozone generators
- Power supply units (PSU)
- Cooling water system
- Nitrogen boost system
- Ozone side stream strainers
- Ozone contactor
- Sodium bisulfite chemical dosing system

At 7-mgd, the ozone generators can be operated at a higher gas flow rate, but lower % ozone, to achieve an adequate design dose. The equipment redundancy of the system will be reduced as there will be 5 injection pumps duty with 1 standby, two recirculation pumps duty with 1 standby, 2 ozone generators duty with no standby and 4 ozone destruct units with 1 standby, 1 Open Loop Cooling Water Pump duty with one standby.

Additional Pathogen Removal Credits are not planned to be obtained using this Ozone system, until a pilot study and full-scale bioassay is completed.

3.2.3 Membrane Filtration (MF) System

The following additional major equipment are required for expansion to 7-mgd:

- One (1) duty MF feed pump
- One (1) duty MF unit
- Associated piping, VFDs, electrical and instrumentation

No major changes are anticipated to be required to the following MF system components for 7-mgd:

- MF feed tank
- MF filtrate storage tank
- MF feed strainers
- Backwash system
- MF clean-in-place (CIP) system
- Compressed air system
- Air scour blowers
- Sulfuric acid, sodium hydroxide, and sodium hypochlorite transfer pumps
- Sodium hydroxide storage tank

At 7-mgd, the redundancy of the MF system will include 5 MF unit's duty with 1 standby, 3 MF feed pumps duty and 1 standby. The membrane flux rate at 7-mgd is anticipated to be 27 gfd. The MF demonstration project was operated initially at 30 gfd, but was reduced to 25 gfd to optimize run time between backwash cycles. If at 27 gfd, backwashing frequency is too high, there is up to 10% spare space provided for additional MF elements which could be added to reduce the flux rate down to 25 gfd. During preliminary design, the duty points on feed and chemical pumps will need to be reviewed and confirmed for operation at 7-mgd.

3.2.4 Reverse Osmosis System

The following additional major equipment are required for expansion to 7-mgd:

- One (1) duty reverse osmosis (RO) transfer pump
- One (1) duty RO feed pump
- One (1) small (1.5 mgd) RO train
- Associated piping, VFDs, electrical and instrumentation

No major changes are anticipated to be required to the following RO system components for 7-mgd:

- RO cartridge filters
- RO CIP system
- RO flush system
- Scale inhibitor storage tank and pumps
- Sulfuric acid storage tank and pumps

The RO System will operate at 12gfd with 2 large (2mgd) + 2 small (1.5) RO trains with no standby.

3.2.5 Ultraviolet Light and Advanced Oxidation Process System

The current facility design provides space for expansion to 6.5 mgd and this could be accomplished using 6 duty reactors and 1 standby reactor. The original design dose criteria of 1600 mJ/cm^2 and 95% UVT for this process was established to achieve specific regulatory compliance objectives (0.5 log removal of 1, 4-diaxane and < 10 ng/L NDMA), while providing a factor of safety for uncertainties associated with potential variations in source water quality (increased concentrations of these compounds).

The following additional major equipment are required to meet the original design dose criteria for expansion to 7-mgd:

- One or two (2) duty LBX1500e UV reactors (for a total of 6 or 7 duty reactors + 1 Standby)
- Associated piping, power supply, electrical and instrumentation

No major changes are anticipated to be required to the following UV/AOP system components for 7-mgd:

- Hydrogen peroxide storage tank and metering pumps

It may be possible to demonstrate that 6 duty reactors and 1 standby reactor can achieve regulatory compliance at a lower dose after the system is constructed and completes validation testing. Through discussions with the equipment manufacturer Wedeco, they estimate 6 LBX 1500e UV reactors can deliver a 1380 mJ/cm^2 dose with 95% UVT at 7-mgd. This dose may be adequate to achieve regulatory compliance requirements and avoid the need for a 7th duty reactor. Should the 7th duty reactor be required for 7 mgd capacity, there will be impacts to the building layout which could require relocation of existing panels to accommodate the new ballast and some crowding in the RO CIP area, and external routing of conduit, etc.

3.2.6 Post Treatment System

No major changes are anticipated to be required to the following Post Treatment system components for 7-mgd:
- Decarbonation system
- Lime storage tank and metering pump
- Sodium hypochlorite metering pump
- Ammonium sulfate storage tank and metering pump

3.2.7 Waste Collection System

The following additional major equipment are required for expansion to 7-mgd:
- One (1) duty waste transfer pump
- Associated piping, VFD, electrical and instrumentation

No major changes to the following are anticipated to be required for the following:
- Waste equalization wet well
- Ferric chloride storage tank and metering pump
- Neutralization chemical transfer pumps (sulfuric acid, sodium hydroxide, and sodium bisulfite)

At 7-mgd there will be 2 waste equalization pumps duty with 1 standby.

3.2.8 Electrical Service, Switchgear, Transformers and MCCs

The AWPF/PWPS electrical power system is fed from a 21kV Switchgear (SWGR-P). Switchgear P is rated for 1200Amp and feeds two transformers, XFMR-T1 and XFMR-T2, each at 3750kVA, 21kV to 480Y/277V, 3 phase, 4 wire, protected by 100A circuit breakers. Transformer XFMR-T1 and XFMR-T2 provide power to the Switchgear 1 and 2 in a main-tie-main configuration. Both Switchgear 1 and Switchgear 2 are 480Y/277V, 3 phase, 4 wire, 4000A. Switchgear 1 feeds Motor Control Centers MCC-1 (Source Water Pump Station), MCC-

2 (Ozone building), MCC-3 (Membrane AOP Building), and has one spare circuit breaker. Switchgear 2 feeds Motor Control Centers MCC-4 (Membrane AOP Building), MCC-5 (Chemical Building), MCC-6 (Product Water Pump Station), and has one spare circuit breaker.

The electrical service was originally designed for expansion to 6.5-mgd. Additional loads will be added to increase the capacity of the plant to 7-mgd including an Ozone Injection Pump (increasing the total pump load from 4 duty, 1 standby to 5 duty, 1 standby), additional Ozone Water Recirculation pump (increasing the total load from 1 duty, 1 standby to 2 duty, 1 standby) and potentially one additional UV system (increasing the total UV load from 5 duty, 1 standby to 6 duty, 1 standby). This increased load may cause Switchgear 1 to exceed its 4000A capacity based on a load analysis. Switchgear 2, and both transformers T1 and T2 ratings will not be exceeded. MCC 3 will exceed its capacity. All other MCCs appear sufficiently rated to meet the 7-mgd expansion.

The National Electrical Code (NEC) allows for the recalculation of loads based on real time, meter readings. The most accurate method is review data over the past 12 months to identify the maximum demand. If the facility is designed for expansion prior to having 12 months of meter data, another acceptable alternative is to review 30-days of operating data, identify the maximum peak demand, add any seasonal/periodic loads (air conditioning), and increase this cumulative demand by 125%, and then add all new loads.

There are two options to proceed with expansion from an electrical service perspective.

Option 1: “Fast Track Expansion”, would involve designing to the 7-mgd expansion while the 4-mgd facility is being constructed and placed into service. Under Option1, our recommendation is to temporarily feed the MF Backwash Pump 1 from Motor Control Center MCC-4 instead of MCC-3. This requires conduit, cable and breaker modifications at MCC-3 and MCC-4 for a 100HP pump. The VFD will remain in MCC-3. Upon completion of the 7.0-mgdg construction, the 30day reading may eliminate the temporary feed and allow MF Backwash Pump 1 to be refed from MCC-3. Or the MF Backwash Pump 1 could be made the standby pump and locked out until a 30day reading or 1-year reading proves that MCC-3 is sufficiently sized. By modifying the load on MCC-3, SWGR 1 will become sufficiently sized. The cost associate is minimal if loads are shifted and there is no cost associated with locking out the MF backwash pump (disadvantage is no redundancy).

Option 2: “Sequential Expansion” would involve designing to the 7-mgd expansion after the 4-mgd plant is operated for a minimum of 30 days with no power issues. A load analysis will be developed adding in additional pumps for the 7-mgd design plus seasonal loads.

Under any option, PG&E will need to be notified of the increased loads and review the approach to the expansion.

3.3 Product Water Pump Station Capacity Expansion to 7-mgd

The following additional major equipment are required for expansion to 7-mgd:

- One (1) duty product water pump and motor
- Associated piping, VFD, electrical and instrumentation

The source water pump station wet well, piping and surge tank infrastructure appear to be adequate for 7-mgd capacity, but this should be confirmed during preliminary design. The duty condition for this facility will change and it is estimated from approved shop drawings for construction, that with 4 pumping unit's duty and one standby, only 6.7-mgd will be produced. Therefore, the standby unit will need to operate, or new impellers will need to be provided in one or more pumps, or the pumps will need to operate at ~102% of normal synchronous speed to achieve 7-mgd with 1 pump standby.

3.4 Conveyance Facilities Capacity Expansion to 7-mgd

In order to review the adequacy of the system hydraulic performance and reservoir storage capacity at 7-mgd, extended period simulations were performed with the project hydraulic model and this work is presented in a separate Conveyance and Reservoir Operations Evaluation TM, dated 3 April 2018 (Appendix B). Various scenarios were evaluated to confirm and review the adequacy of storage and conveyance capacity to serve up to 7-mgd for injection during winter months, and MCWD's peak day irrigation demand of 1.31-mgd and 5.89-mgd for injection during peak irrigating times during the summer. The winter/summer periods bracket the range of anticipated operating conditions for the 7-mgd system. The minimum pressure requirement for recharge is 5 psi at the wellhead, which allows the well to remain under pressure and avoid water column separation during injection.

The modeling confirmed the adequacy of the 2-mg storage capacity under both winter and summer operating conditions, but showed high system headloss resulted in negative pressures at the wellhead for Well Site #1 during winter and summer conditions, and potentially inadequate pressures during winter conditions at Well Site #2.

Two options were reviewed to improve the system hydraulics and meet performance requirements. Option 1 involves installing a new booster pump within the wellfield (between Well Sites #2 and #3, adjacent to the electrical building) to increase injection pressures. Option 2 involves replacing existing sections of undersized pipe in the conveyance system with new 24-inch diameter pipe to eliminate the hydraulic constraints. Option 1 has the lowest capital cost, but will require identifying a site for a new pump station building on Fort Ord and will have long-term O&M costs as well as and additional energy costs. Option 2 could cost over four times more than the pipe replacement option, but eliminates ongoing energy and O&M costs associated with operating the booster pump station.

Option 1 is recommended. Following construction of the 4-mgd project, flow tests should be conducted on the conveyance system. The hydraulic model can be calibrated to operating conditions and used to confirm the location and size for the booster pump station.

3.5 Groundwater Recharge Facilities Capacity Expansion to 7-mgd

The Groundwater Recharge Facilities current design estimated injection capacity is 4-mgd with two deep injection wells and one vadose zone well. The Groundwater Recharge Site is configured for up to 4 deep injection well (DIW) installations along with two vadose zone wells (VZW), five monitoring wells (four onsite and one offsite), piping, access, electrical service and switchgear, backflush pumps and motors, and a percolation basin. The evaluation of expanding groundwater recharge to 7-mgd includes consideration of well injection and backflush requirements, as well as evaluation of subsurface travel time of injected water and its impact on the amount of pathogen removal credits each alternative might be able to obtain for regulatory compliance. This work is based on average monthly injection and extraction schedules provided by M1W and MPWMD and assumes the AWPF and injection facilities operate at 90% run time. Varying climatic conditions, including wet and dry cycles were evaluated and the PMW injection volumes are based on established drought reserve goals. This evaluation is summarized in a Draft TM prepared by Todd Groundwater dated 27 March 2018 (Appendix A).

3.5.1 Injection Volume and Backflush Evaluation for 7-mgd

The backwash percolation basin is designed to hold up to 2 AF and is sized adequately to store 100 percent of the backwash water for one deep injection well (1.72 AF). Infiltration testing was performed for this site, and using the lower-end percolation rate of 3-inches per hour, the backwash basin can percolate 0.5 AF every four hours or 3 AF per day. Each of the four-deep injection well is planned to be backwashed for 4 hours, once per week. The backwash basin appears adequate for expansion to 7-mgd.

3.5.2 Evaluation of Subsurface Travel Time Estimates for 7-mgd

Based in the average monthly injection and extraction schedule, the Watermaster modeling estimates the shortest subsurface retention time to the nearest extraction well is 208 days (6.8 months).

3.5.3 Evaluation of Pathogen Log Reduction Credits for 7-mgd

Assuming the constructed project will confirm subsurface travel time using an intrinsic tracer study, the pathogen removal credit is calculated by multiplying the shortest travel time by a factor 0.67. The resulting travel time is 208 x 6.8 months = 4.6 pathogen log removal credits. This is less than the required 5 log removal used during design and therefore at least 0.4

additional removal credits will need to be obtained via chloramination disinfection in the conveyance system between the AWPF and the storage reservoir. As previously mentioned there are also other ways to derive additional pathogen removal credits, and therefore, meeting the overall pathogen removal objective of 12 logs is not anticipated to be a challenge to operating a 7.0-mgd program.

3.6 Estimates of Probable Capital Cost for PWM System Expansion to 7-mgd

Kennedy/Jenks opinion of probable costs for expansion of the PWM System to 7-mgd is summarized below. This estimate was prepared using standard cost estimating guidelines, recent bid costs for the AWPF, conveyance pipeline and groundwater recharge system projects, and supplemented with budgetary cost estimates from selected equipment manufacturers, and other professional experience on comparable projects.

Table 2.4 presents a summary of standard cost estimating level descriptions, accuracy and recommended contingencies based on the development level of the project. These data were compiled from the AACE, the Association for the Advancement of Cost Engineering International.

Table 3.1: Standard AACE Cost Estimating Guidelines

Cost Estimate Class[a]	Project Level Description	Estimate Accuracy Range	Recommended Estimate Contingency
Class 5	Planning	-30 to +50%	30 to 50%
Class 4	Conceptual (1 to 5% Design)	-15 to +30%	25 to 30%
Class 3	Preliminary (10 to 30% Design)	-15 to +20%	15 to 20%
Class 2	Detailed (40 to 70% Design)	-5 to +15%	10 to 15%
Class 1	Final (90 to 100% Design)	-5 to +10%	5 to 10%

Note:

(a) Association for the Advancement of Cost Engineering, 1997. International Recommended Practices and Standards.

Kennedy/Jenks opinion of probable costs for expansion of the PWM System to 7-mgd was developed using the design criteria, concepts and drawings for the current 4-mgd facilities. This estimate is considered a Class 3 level estimate in accordance with AACE guidelines. Typically this level of estimate has an expected accuracy range of up to +20 to -15%.

Table 3.2 summarizes the Opinion of Probable Construction Costs for PWM Expansion to 7-mgd. The estimates include a contingency as well as markups for Contractor mobilization, bonds, and overhead and profit. Estimated Costs for Engineering and Construction management are also included. The costs for the Product Water Pump Station are included with the AWPF. This estimate assumes the 7-mgd program may be constructed on a fast-track basis, and design may occur concurrent with construction and start-up of the initial facilities.

Table 3.2: Estimates of Probable Cost for PWM System Expansion to 7-mgd

PWM System Component	Opinion of Probable Cost
AWPF and PWPS Expansion Construction Cost	$8.0M
Conveyance Pipeline Expansion Construction Cost	$1.0M
Groundwater Recharge Facilities Construction Cost	$9.6M
Subtotal	$18.6M
Engineering and CM (20%)	$3.8M
Total Opinion of Construction, Engineering and CM Costs for Expansion from 4-mgd to 7-mgd	$22.4M

Cost estimate spreadsheet summaries are included in Appendix C.

3.8 Estimates of Energy and Chemical Use for PWM System Expansion to 7-mgd

Energy and chemical usage are estimated for the 7-mgd expansion producing 6,550 AFY (5,750 AF recharge + 600 AFY MCWD Irrigation + 200 AFY drought reserve).

Energy usage for the AWPF and PWMS is estimated assume the facilities operate with 90 percent run time and loads are adjusted for VFD or infrequent operation as shown in the table presented in Appendix C. Under these assumptions, the facility would draw approximately 31,140,000 KWH annually and produce 7057 AF of purified water at an annual energy usage of 3,972 KWH/AF. Assuming only 6,550 AFY of purified water is produced would reduce the energy use to approximately 28,890,000 KWH and 3,686 KWH/AF.

Chemical usage for the AWPF assumes a total of 6,550 AFY are produced at the AWPF. The estimated cost for the twelve chemicals in use at the AWPF is summarized in Appendix D by chemical, and totals approximately $2.01M annually for a unit cost of about $307/AF of purified water produced.

Energy usage for the Injection Facilities is estimated assuming the 500 HP backwash pumps operate for four hours each week, for each of the four deep injection wells, with 90% up time. The wells vary in terms of ground surface elevation and water surface elevation in the wells. It is assumed the four wells will use an average of 450 HP during backwash. The resulting energy use is approximately 310,000 KWH annually and 54 KW/AF (assuming 5,750 AF/YR is injected).

Appendices

Appendix A – Aquifer Testing and Groundwater Modeling Results TM

Appendix B – Conveyance and Reservoir Operations Evaluation TM

Appendix C - Cost Estimate Tables

Appendix D – Energy and Chemical Use Tables

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Appendix A

Aquifer Testing and Groundwater Modeling Results TM

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TODD GROUNDWATER

April 12, 2018

REVISED DRAFT TECHNICAL MEMORANDUM

TRANSMITTED VIA EMAIL ONLY

To: Craig Lichty, PE
Vice President
Kennedy/Jenks Consultants
clichty@kennedyjenks.com

From: Edwin Lin, PG, CHG, Principal Hydrogeologist

Re: Pure Water Monterey (PWM) System Expansion to 7-MGD Capacity – Task 2.3: Assess Aquifer Testing and New Groundwater Modeling Results

INTRODUCTION

The Monterey One Water (M1W) Pure Water Monterey (PWM) project will produce purified water from the MW1 Regional Treatment Plant (RTP) via the Advanced Water Purification Facility (AWPF). Purified water will be sent through the Purified Water Conveyance Pipeline to the Injection Well Facilities for injection into the Seaside Basin.

The current project goal is to recharge an average of 3,500 acre-feet-per-year (AFY) to provide a new water supply for the Monterey Peninsula. A 3,500-AFY project corresponds to a AWPF design product water capacity of 4 million gallons per day (mgd). The AWPF has a maximum product water capacity of 5-mgd and space reserved for future expansion up to 7-mgd. Expansion scenarios would permit the PWM System to recharge more water and operate at higher production rates in the winter when there is additional unused RTP effluent available. M1W has considered the availability of source waters, AWPF capacity, and operational guidelines to develop injection schedules for recharge to the Seaside Basin. Based on the M1W analyses, a 5-mgd project would provide an additional 600 AFY of groundwater production in the Seaside Basin (totaling 4,100 AFY of recharge), while a 7-mgd project would provide an additional 2,250 AFY (totaling 5,750 AFY of recharge).

To date, design criteria and environmental review for the Injection Well Facilities have been completed for a 4-mgd project. M1W would like to evaluate the impacts of AWPF expansion up to 7.0-mgd with respect to injection facility design criteria and pathogen log reduction credits from subsurface retention. Todd Groundwater was asked to evaluate well design criteria and review results groundwater flow modeling performed to estimate subsurface retention times for various project alternatives. The evaluation includes the following tasks:

- Assess the number of Deep Injection Wells (DIWs), Vadose Zone Wells (VZWs), and backflush percolation basins and associated flow rates needed to accommodate product water deliveries from the AWPF for 4-mgd, 5-mgd, and 7-mgd project alternatives.

- Develop well design criteria for PWM expansion up to 7-mgd assuming a four-DIW layout, considering aquifer hydraulic testing data collected during Phase 1 construction.

- Identify the impact of PWM expansion up to 7-mgd on subsurface retention times of recycled water in the Santa Margarita Aquifer to nearest production wells and associated pathogen reduction credit, incorporating results of groundwater flow model simulations (see attached technical memorandum titled, "Pure Water Monterey Project 7.0 MGD Expansion Modeling" by HydroMetrics LLC, dated March 20, 2018).

This technical memorandum presents the results of the evaluation of Injection Well Facilities for identified PWM expansion scenarios. Groundwater flow modeling results pertinent to subsurface retention times and pathogen reduction credits are also presented.

INJECTION SCHEDULES AND OPERATION OF THE DROUGHT RESERVE ACCOUNT

M1W has identified six potential injection schedules that could occur under a 4-mgd, 5-mgd, or 7-mgd project.

Table 1A through 1C shows the calculated monthly flow rates for the six potential injection schedules (labeled A through F) for the three analyzed project flow rates. Injection rates assume a 90 percent run-time of the AWPF. Additionally, the injection schedule incorporates the concept of a drought reserve account for the Castroville Seawater Intrusion Project (CSIP). Specifically, during wet and normal years, the project will convey an extra 200 AFY of purified water (from October through March) to the Seaside Basin for credit in the drought reserve account, up to a cumulative total of 1,000 AF. During dry conditions, the Project could reduce its deliveries to the Seaside Basin by as much water as had accumulated in the drought reserve. This amount of water will be treated to a tertiary level and delivered instead to CSIP for supplemental irrigation supply. During these reduced deliveries to the Seaside Basin, Cal-Am will continue to extract 5,750 AFY for municipal supply in the Seaside Basin by using the water stored in the drought reserve account. These operational guidelines have been incorporated into monthly injection amounts to the Seaside Basin based on simulated future hydrologic conditions.

Review of the three injection schedules indicates a maximum injection of purified water (maximum total net recharge rate) to the Injection Well Facilities of 331 AFM (10.69 AF per day [AFD]) for a 4-mgd project, 372 AFM (12.01 AFD) for a 5-mgd project, and 592 AF (19.11 AFD) for a 7-mgd project. Daily net recharge rates are based on the 31-day month.

TODD GROUNDWATER

Table 1A. Purified Water Available for Injection (4-MGD at 90 Percent Run-Time)

4.0 MGD Purified Water Delivery Schedule for Injection (AF)			Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Total
before drought reserve complete	wet/normal year	A	331	321	331	331	299	331	288	297	288	297	297	288	3,700
after drought reserve complete	wet/normal year	B	297	288	297	297	268	297	288	297	288	297	297	288	3,500
before drought reserve complete	drought year (1,000 AF to CSIP)	C	331	321	331	331	299	331	124	128	124	128	128	124	2,700
before drought reserve complete	drought year (400 AF to CSIP)	D	331	321	331	331	299	331	222	230	222	230	230	222	3,300
before drought reserve complete	drought year (200 AF to CSIP)	E	331	321	331	331	299	331	255	263	255	263	263	255	3,500
after drought reserve complete	drought year (1,000 AF to CSIP)	F	297	288	297	297	268	297	124	128	124	128	128	124	2,500
			Maximum Net Recharge Rates (AF)												
Santa Margarita Aquifer (90%)			298	289	298	298	269	298	259	268	259	268	268	259	3,330
Paso Robles Aquifer (10%)			33	32	33	33	30	33	29	30	29	30	30	29	370
TOTAL (100%)			331	321	331	331	299	331	288	297	288	297	297	288	3,700

Table 1B. Purified Water Available for Injection (5-MGD at 90 Percent Run-Time)

5.0 MGD Purified Water Delivery Schedule for Injection (AF)			Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Total
before drought reserve complete	wet/normal year	A	372	338	338	354	315	358	344	385	377	388	373	357	4,300
after drought reserve complete	wet/normal year	B	338	305	304	320	284	324	344	385	377	388	373	357	4,100
before drought reserve complete	drought year (1,000 AF to CSIP)	C	372	338	338	354	315	358	180	216	213	219	204	193	3,300
before drought reserve complete	drought year (400 AF to CSIP)	D	372	338	338	354	315	358	278	318	311	321	306	291	3,900
before drought reserve complete	drought year (200 AF to CSIP)	E	372	338	338	354	315	358	311	351	344	354	339	324	4,100
after drought reserve complete	drought year (1,000 AF to CSIP)	F	338	305	304	320	284	324	180	216	213	219	204	193	3,100
			Maximum Net Recharge Rates (AF)												
Santa Margarita Aquifer (90%)			335	304	305	319	283	323	309	347	339	349	336	321	3,870
Paso Robles Aquifer (10%)			37	34	34	35	31	36	34	39	38	39	37	36	430
TOTAL (100%)			372	338	338	354	315	358	344	385	377	388	373	357	4,300

Table 1C. Purified Water Available for Injection (7-MGD at 90 Percent Run-Time)

7.0 MGD Purified Water Delivery Schedule for Injection (AF)			Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Total
before drought reserve complete	wet/normal year	A	331	563	592	576	525	572	524	511	491	508	467	288	5,950
after drought reserve complete	wet/normal year	B	297	530	558	542	495	538	524	511	491	508	467	288	5,750
before drought reserve complete	drought year (1,000 AF to CSIP)	C	331	563	592	576	525	572	360	342	327	339	298	124	4,950
before drought reserve complete	drought year (400 AF to CSIP)	D	331	563	592	576	525	572	458	444	425	441	399	222	5,550
before drought reserve complete	drought year (200 AF to CSIP)	E	331	563	592	576	525	572	491	477	458	474	433	255	5,750
after drought reserve complete	drought year (1,000 AF to CSIP)	F	297	530	558	542	495	538	360	342	327	339	298	124	4,750
			Maximum Net Recharge Rates (AF)												
Santa Margarita Aquifer (90%)			298	507	533	519	473	515	472	460	442	458	420	259	5,355
Paso Robles Aquifer (10%)			33	56	59	58	53	57	52	51	49	51	47	29	595
TOTAL (100%)			331	563	592	576	525	572	524	511	491	508	467	288	5,950

Notes:
AF – acre-feet
CSIP – Castroville Seawater Intrusion Project

INJECTION FACILITY DESIGN CRITERIA

Table 2 shows the number of DIWs and VZWs along with corresponding injection and backflush rates for the current AWPF design product water capacity of 4-mgd, 5-mgd and 7-mgd expansion alternatives. Assumptions include (1) a project net recharge goal of 90 percent into the lower Santa Margarita Aquifer and 10 percent in upper Paso Robles Aquifer, (2) 164 hours per week of injection and 4 hours per week of backflushing per DIW at twice the design DIW injection rate, and (3) continuous injection in VZWs.

Table 2. Recharge Facility Design Criteria (4-mgd, 5-mgd, and 7-mgd)

PWM Alternative	Peak Purified Water Delivery Rate[1] (AF/day)	No. of DIWs	DIW Peak Injection Rate (normal)[2] (gpm)	DIW Peak Injection Rate (during backflush)[3] (gpm)	DIW Backflush Rate (gpm)	No. of VZWs	VZW Peak Injection Rate (gpm)	Basin Peak Perc Rate (AF/week)	Basin Peak Perc Rate (AF/week per DIW)	Basin Percolation Duration (days/week)
#1 (4.0-mgd)	10.69	2	1,171	2,342	2,342	1	130	3.45	1.72	2
#2 (5.0-mgd)	12.01	2	1,316	2,632	2,632	1	146	3.88	1.94	2
#3 (7.0-mgd)	19.11	4	1,047	1,396	2,094	2	116	6.17	1.54	4

1 - Based on maximum monthly injection rate in Table 1
2 - Normal (non-backflushing) operation of DIWs; 164 hours per week per DIW; 152 hours per week in total for four DIW-project; 160 hours per week in total for a two DIW-project
3 - Backflushing operation of DIWs; 4 hours per week per DIW; 16 hours per week in total for four DIW-project; 8 hours per week in total for two DIW-project

4-MGD Project. As shown in the table, a combination of two DIWs, one VZW, and one backflush basin is assumed for normal operation of the current 4.0-mgd project (Alternative #1).

During normal (non-backflushing) operation, DIW and VZW design injection rates are 1,171 gallons per minute (gpm) and 130 gpm, respectively. The current design backflush basin holds 2.00 AF, sufficient to store 100 percent of the design backflush water for one DIW (1.72 AF). Based on a conservative infiltration rate of 3 inches per hour (lower-end estimate from short-term infiltration testing), the backflush basin can infiltrate 0.50 AF every 4 hours or 3.0 AF per day (i.e., the basin can infiltrate 100 percent of backflush water generated per day from one DIW).

During backflushing periods, when one of the DIWs is offline, purified water would ideally be injected into the active, non-backflushing DIW without reducing deliveries from the AWPF. Assuming deliveries are apportioned to the active DIW, the design injection rate would be 2,342 gpm (twice the injection rate during normal, non-backflushing operation). This condition would occur in two 4-hour periods each week (for a total of 8 hours per week). It is possible that unused VZW capacity could be used to accommodate a portion of the purified water flow during backflushing periods.

Based on results of pumping test conducted on DIW-1 in November and December of 2018, pumping capacities greater than 3,000 gpm are feasible. While injection testing has not been completed to-date, injection capacities up to 1,500-2,000 gpm are within reason for planning purposes (recognizing that the degree and rate of well performance decline over time is unknown). If the goal is to maintain injection rates during backflushing periods, a third DIW is likely needed for a 4-mgd project.

5-MGD Project. As shown in the table, a combination of two DIWs, one VZW, and one backflush basin is assumed for normal operation of a 5-mgd project (Alternative #2).

During normal (non-backflushing operation) DIW and VZW design injection rates are 1,316 gpm and 146 gpm, respectively. The current design backflush basin is sufficient to store 100 percent of the design backflush water for one DIW (1.94 AF).

Assuming deliveries are apportioned to the active DIW during backflush periods, the design injection rate would be 2,632 gpm (twice the injection rate during normal non-backflushing operation). Similar to the 4-mgd scenario, it is possible that unused VZW injection capacity could be used to accommodate a portion of the purified water flow during backflushing periods. However, if the goal is to maintain injection rates during backflushing periods, a third DIW is likely needed for a 5-mgd project.

7-MGD Project. As shown in the table, a combination of four DIWs, two VZWs, and one backflush basin is required for normal operation of the current 7-mgd project (Alternative #3).

During normal (non-backflushing operation) DIW and VZW design injection rates are 1,047 gpm and 116 gpm, respectively. These rates are slightly lower than those for the current 4.0-mgd project. The current design backflush basin holds 2.00 AF, sufficient to store 100 percent of the design backflush water for one DIW (1.54 AF).

Assuming injection flows are apportioned to the three active DIWs during backflush periods, the design injection rate would be 1,396 gpm. Based on results of pumping test conducted on DIW-1, flows during backflushing periods could be reasonably injected into the three active DIWs (again recognizing that the degree and rate of well performance decline over time is unknown). It is also possible that unused VZW injection capacity could be used to accommodate a portion of the purified water flow during backflushing periods.

Subsurface Travel Time (Santa Margarita Aquifer) and Pathogen Log Reduction Credits

Groundwater flow modeling has been used to estimate the subsurface retention time of injected water for two 4-mgd projects (based on two DIWs and four DIWs) and a 7-mgd project (based on four DIWs). **Table 3** shows the estimated shortest subsurface travel times to the nearest production well. While modeling was not performed to evaluate the 5-mgd project, an analytical approach was used to estimate the subsurface retention time. For modeled scenarios, key model inputs for the future simulation period include projected pumping rates from key basin production wells, injection schedules for the MPWMD ASR program, and varying climatic conditions that include wet and dry periods. The annual volume of PWM injection are based on established drought reserve goals.

Table 3. Shortest Travel Time and Pathogenic Log Reduction Credits

PWM Expansion Alternative	Peak Delivery (AFD)	No. of DIWs	Estimated Shortest Subsurface Retention Time		Travel Time Calc[1]	Path. Log-Reduction Credit (0.67 * months)
			days	months		
EIR	10.69	4	327	10.8	Modeled	7.2
#1 (4.0-mgd)	10.69	2	253	8.3	Modeled	5.6
#2 (5.0-mgd)	12.01	2	216	7.1	=253/(4,100/3500)	4.8
#3 (7.0-mgd)	19.11	4	208	6.8	Modeled	4.6

Groundwater Modeling of 4.0-MGD Project. For the Environmental Impact Report (EIR), subsurface flowpaths and travel times (in Santa Margarita Aquifer) were evaluated using the official Seaside Groundwater Basin Groundwater Model for a 4-mgd project (with four DIWs separated by 1,000 feet at PWM Sites 1 through 4). Modeling results indicate that the shortest travel time to a nearby water supply well (ASR 1 and 2) was 327 days, or 10.8 months. The minimum travel time corresponds to the end of a simulated multi-year drought, during which there is no injection in the nearby ASR wells, and the ASR wells are pumping.

The Watermaster model was also used to evaluate flowpaths and travel times for a 4-mgd project assuming injection via two DIWs (at PWM Sites 2 and 3 [interior sites]) (Scenario #1). Modeling results indicate that the shortest travel time to a nearby water supply well (ASR 1 and 2) was 253 days, or 8.3 months.

Groundwater Modeling of 7-MGD Project. The Watermaster groundwater flow model was recently used to evaluate flowpaths and travel times for a 7-mgd project (Scenario #3) assuming injection via four DIWs (separated by 1,000 feet at PWM Sites 1 through 4). Modeling results indicate that the shortest travel time to a nearby water supply well was 208 days, or 6.8 months (from DIW-3 to ASR 1 and 2).

Retention Time Estimate for 5.0-MGD Project (Analytical Method)

Relative to the 4-mgd project, PWM expansion to 5-mgd will increase the hydraulic gradient towards the nearby water supply wells and, in turn, decrease subsurface retention time of recycled water and pathogen reduction credits. Groundwater flow modeling for a 5-mgd project has not been conducted to date. However, the subsurface retention time can be estimated analytically based on the ratio of the annual recharge rate for a 5-mgd scenario (4,100 AFY) versus the annual recharge rate for the 4-mgd scenario (3,500 AFY). The analytical equation is as follows:

- Travel time (5-mgd in 2 DIWs) = Travel time (4-mgd in 2 DIWs) / (4,100 AFY / 3,500 AFY)

The travel time estimate is considered preliminary and assumes that the relative increase in average recharge rate (in AFY) corresponds to the relative decrease in subsurface travel time.

Pathogen Log Reduction Credits. Table 3 shows the log reduction credits for subsurface retention derived from estimated subsurface retention times. The log reduction credit is calculated by applying a factor of 0.67 to the shortest subsurface retention time (in months) for each PWM alternative. The 0.67 factor assumes successful travel time confirmation with an intrinsic tracer study.

The following preliminary conclusions can be made regarding pathogen log reduction:

- **5-mgd project**: Expansion up to 5-mgd (assuming two DIWs) results in a reduction in pathogen log credits compared to a 4-mgd project with two DIWs (from 5.6 to 4.8).

- **7-mgd project**: Expansion up to 7.0-mgd (assuming four DIWs) results in a reduction in pathogen log credits compared to a 4-mgd project with two DIWs (from 5.6 to 4.6).

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Attachment

Technical Memorandum: Pure Water Monterey Project 7.0 MGD Expansion Modeling, HydroMetrics LLC

March 20, 2018

1814 Franklin St, Suite 501
Oakland, CA 94612

TECHNICAL MEMORANDUM

To: Ed Lin/Todd Groundwater

From: Esther Adelstein and Derrik Williams

Date: March 20, 2018

Subject: Pure Water Monterey Project 7.0 MGD Expansion Modeling

Executive Summary

Monterey One Water (M1W) is evaluating expansion of the Pure Water Monterey (PWM) groundwater replenishment project from the current 5 Million Gallons per Day (MGD) plant capacity to 7 MGD (Project). The Project will increase the recharge of high quality purified water into the Seaside Groundwater Basin by an additional 2,250 acre-feet per year.

The calibrated groundwater model of the Seaside Groundwater Basin (HydroMetrics WRI, 2009) was used to estimate impacts from the Project. A predictive model incorporating reasonable future hydrologic conditions was developed for this impact analysis. PWM Project injection is projected to begin in October, 2020, eight years into the 33-year predictive model.

The model simulated PWM injection, municipal pumping, and Aquifer Storage and Recovery (ASR) injection and extraction using Carmel River water. The amount of Carmel River water available for winter injection into the Seaside Basin was estimated by Monterey Peninsula Water Management District (MPWMD) staff. They compared historical daily stream flows with minimum stream flow requirements for each day and then identified how much water could be extracted from the Carmel River for injection each month.

We assumed California American Water's (Cal-Am's) future water demand is a constant 10,400 acre-feet per year. Roughly two-thirds of the total Cal-Am demand was predicted to be met by extraction of native groundwater, injected Carmel River water, and injected PWM water from the Seaside Basin. Extraction from the Carmel Valley, Cal-Am's Carmel River Table 13 diversion, and the Sand City Desal plant supplied the remainder of the total Cal-Am demand. Monthly Seaside Basin pumping rates were set to meet monthly Cal-Am demand.

Model results show that the Project increases groundwater elevations in the Seaside Basin. Simulated groundwater elevations under Project conditions are higher than those under No-Project conditions at several observation points. The long-term coastal groundwater elevations under Project conditions are also higher than those under No-Project conditions, indicating that the Project is likely to help avoid the potential for seawater intrusion.

Particle tracking was used to estimate the travel time of injected Project water from the point of recharge to the closest point of extraction. Particle tracking showed that the shortest travel time for any recharged PWM water is 208 days. Travel times of less than 12 months occur in almost all 25 years of the simulation period during which the PWM project is in operation. These travel times are conservative estimates, and the majority of observed travel times are likely to be longer.

Project Description

Monterey One Water (M1W) is considering expanding the Pure Water Monterey groundwater replenishment project from the current 5 million gallons per day (MGD) plant to 7 MGD (Project). The Project will increase recharge of the Seaside groundwater basin with high quality purified water by an additional 2,250 acre-feet per year. The Project will not alter the two groundwater banking programs (drought reserve and operational reserve) that are part of the existing project. The drought reserve builds a water storage account of up to 1,000 acre-feet (AF) of water in the Seaside Basin during normal and wet years. The extra recharge during normal and wet years will be offset by an increase in CSIP deliveries and a corresponding decrease in Seaside groundwater basin injection during dry years, during which Cal-Am will continue to pump from the drought reserve account. The operational reserve will be established before the Project is built and represents 1,000 AF of water in the Seaside Basin to act as an emergency reserve should an extended operational issue at the Advanced Water Purification Facility preclude the normal injection of water into the Seaside Basin. Because the operational reserve is an emergency reserve, it is not analyzed in this modeling study of the Project impacts.

The Project also includes two new extraction wells, EW-1 and EW-2. These two wells are necessary because the existing Cal-Am Seaside well capacity is insufficient to meet predicted demand during all months. The locations of the project's facilities, along with other operating production wells, are shown on Figure 1.

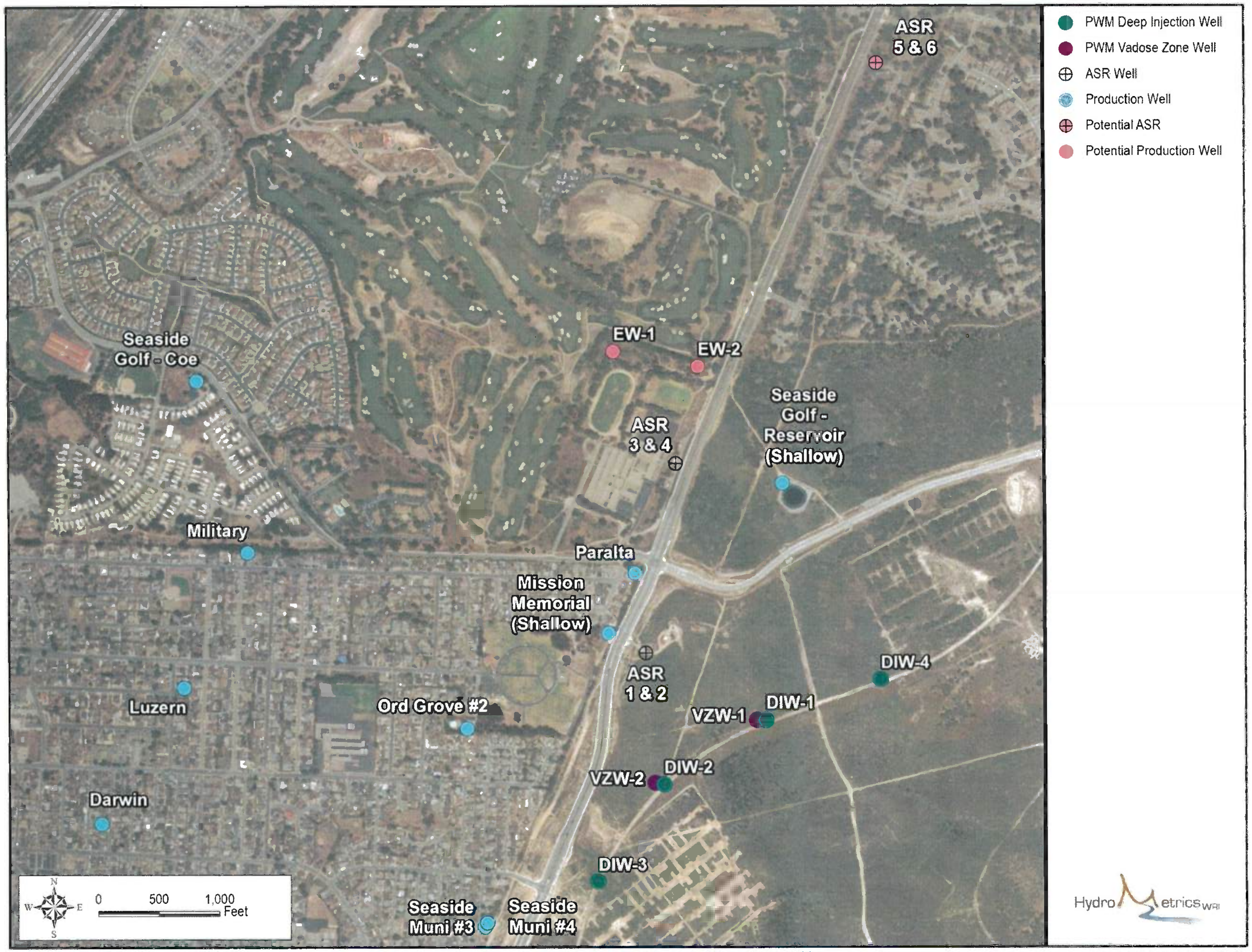

Figure 1: Production and GWR Injection Well Locations

Model Background and Assumptions

The model used for this analysis is the same groundwater model used in support of the Project EIR. The model background and assumptions are repeated here for completeness.

The calibrated groundwater model of the Seaside Groundwater Basin (HydroMetrics WRI, 2009) was used to estimate the impacts from the Project. Minor modifications were made to the calibrated hydrogeologic parameters to incorporate data from aquifer tests completed in 2017. The groundwater model was calibrated through 2008. A predictive model incorporating reasonable future hydrologic conditions was developed for this impact analysis. Pure Water Monterey Project water injection was assumed to start in October 2020, eight years into the simulation, and continue through the remaining 25 years of the simulation, consistent with modeling efforts for previous versions of the project.

Updated Parameters Based on Aquifer Tests

Aquifer tests conducted in 2017 provided new hydrogeologic property data for the Santa Margarita aquifer at deep injection well DIW-1. Estimated transmissivity and storativity values at this location are 164,000 gallons per day per foot and 9.3×10^{-4}, respectively (Lin, 2017). Model parameters at the DIW-1 site were updated to these values. Santa Margarita aquifer parameters within a 3100-foot radius of well DIW-1 were then re-interpolated based on the new data. This re-interpolation ensures smooth spatial variation between calibrated parameters and updated parameters at well DIW-1; calibrated parameters are unchanged outside this relatively small area. The model was not recalibrated with updated well DIW-1 parameters.

Predicted Hydrology Assumptions

The Seaside Basin predictive model simulates a 33-year period (Hydrometrics WRI, 2009). The hydrology (rainfall and recharge) used to calibrate the groundwater model was applied to the predictive model. To extend the hydrology through the predictive period, the 1987 through 2008 hydrology data were used to simulate model years (MY) 1 through 22, and the 1987 through 1997 hydrology data were then repeated for MY 23 through 33 (Figure 2). This is the approach that has been adopted for all predictive models of the Seaside Basin since 2009. By using this hydrology, even during the period from MY1 to present when actual hydrology is known, model runs can be compared to evaluate relative groundwater levels.

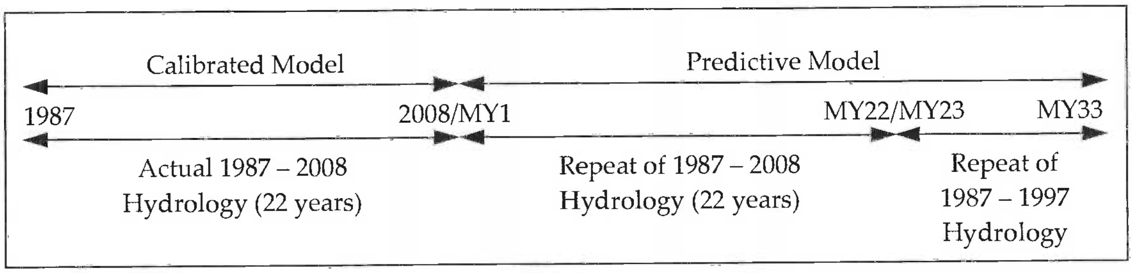

Figure 2: Repetition of Hydrology for Predictive Model

Following advice from MPWMD, the PWM Project starts in October 2020. To be consistent with previous PWM simulations and allow for comparison between model runs, we assume that injection from the simulated PWM Project starts in October MY8 and operation continues through the remaining 25 years of the simulation. In this simulation, MY8 is equivalent to future calendar year 2020; the 33-year simulated period spans future years 2013-2045. We assume Cal-Am has met the cease-and-desist order (CDO) upon implementation of the PWM Project expansion. This assumption allowed the injected Carmel River water to be carried over from year to year in the Seaside Basin as a reserve.

Predicted Carmel River Flow and Injection Assumptions

Monterey Peninsula Water Management District (MPWMD) estimated the amount of Carmel River water available for ASR injection for the predictive simulation based on historical streamflow records. Because the future simulated hydrology is based on the historical hydrology between 1987 and 2008, the future stream flows are a repeat of historical stream flows. MPWMD staff compared historical daily stream flows between water year 1987 and water year 2008 with minimum streamflow requirements for each day to determine whether ASR water could be extracted from the Carmel River on a given day. Using a daily diversion rate of 29 acre-feet per day (AF/day), MPWMD calculated how many acre-feet of water from the Carmel River could be injected into the ASR system each month.

Figure 3 shows the estimated monthly ASR injection volumes for the predictive simulation. The Carmel River water available for injection was split equally between the ASR 1&2 and ASR 3&4 well sites.

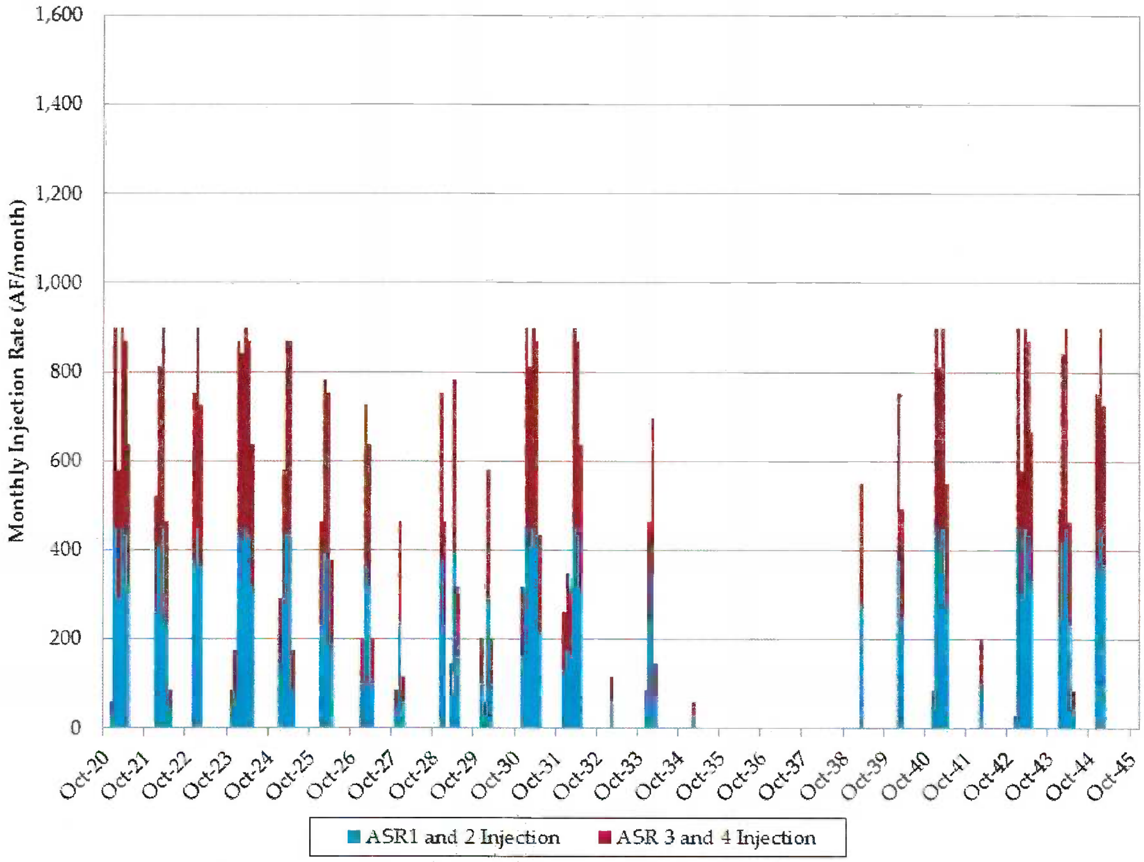

Figure 3: Estimated Monthly Carmel River ASR Injection Volumes during the Project

PURE WATER MONTEREY PROJECT RECHARGE ASSUMPTIONS

Project water is recharged through four deep injection wells (DIW) and two vadose zone wells (VZW). The Project recharges variable volumes of water each year, with an average of 5790 acre-feet recharged per year including previous project waters. Of this, 90% of the water is delivered to the Santa Margarita aquifer through the deep injection wells, and the remaining 10% is delivered to the Paso Robles aquifer through the vadose zone wells. The amount of water recharged each year depends on whether the predicted hydrology is in a drought or non-drought year, and on the rules for banking and delivering water to CSIP. A monthly recharge schedule that includes an accounting and description of the CSIP banking and delivery program is shown on the 11 x 17 sized table at the end of this technical memorandum.

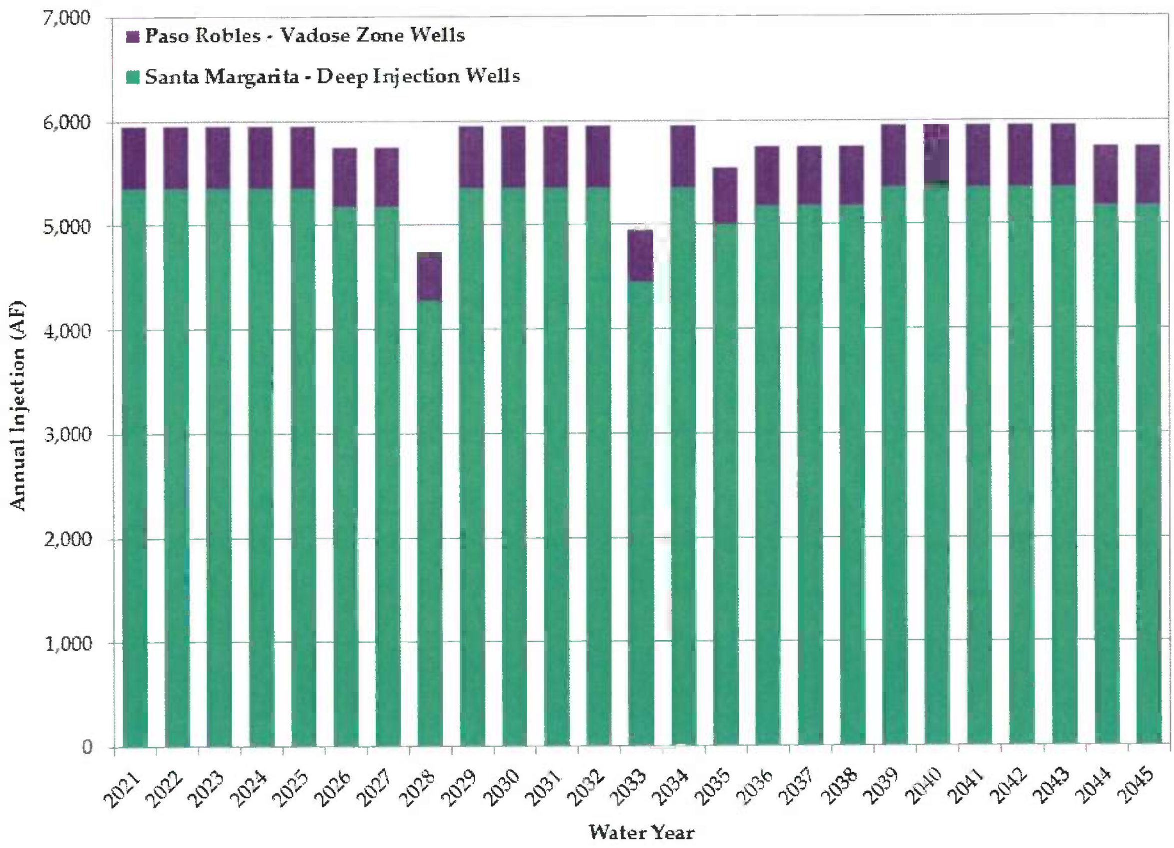

Figure 4 shows the volume of water recharged by the Project for each water year.

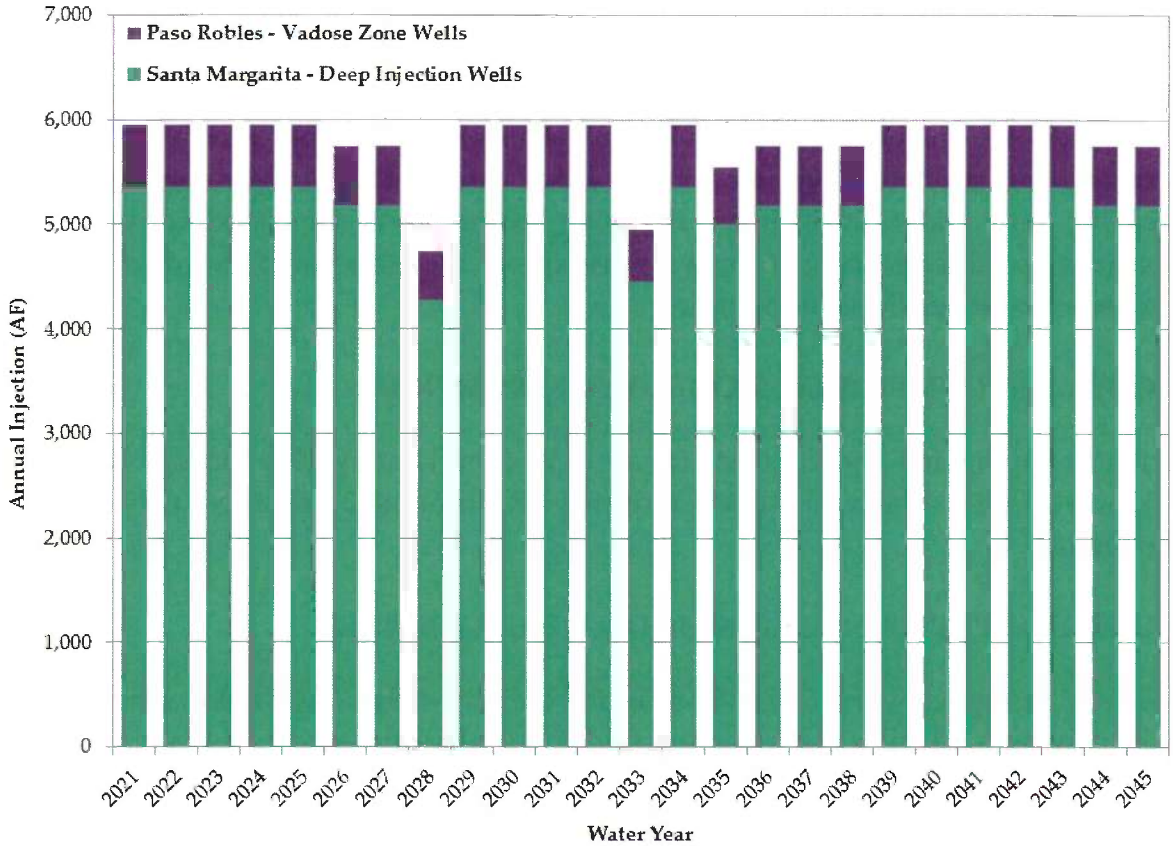

Figure 4: Annual GWR Recharge

Predicted Pumping Assumptions

HydroMetrics WRI made a number of assumptions about future pumping rates by various entities in the Seaside Basin. For the Project expansion simulation, Cal-Am pumping assumptions were developed based on predicted hydrology, pumping capacity, and water availability. Pumping assumptions for standard producers, alternative producers, and golf courses were consistent with assumptions developed for previous modeling efforts in the basin.

MODEL YEAR 1 THROUGH MODEL YEAR 3 PUMPING

Actual pumping and injection data for all wells from January 2009 through December 2012 were used for the pumping input during MY1 through 3, consistent with previous simulations.

MUNICIPAL PUPMPING FROM MODEL YEAR 4 ONWARD

Predicted pumping by the City of Seaside and the City of Sand City follows the triennial reductions prescribed in the Amended Decision (California American Water v. City of Seaside et al., 2007). These pumping reductions are designed to reduce basin-wide pumping to the approximate safe yield of 3,000 acre-feet per year within eight years of implementation.

CAL-AM PUMPING FROM MODEL YEAR 4 ONWARD

A number of assumptions were necessary to estimate Cal-Am's monthly pumping rates and pumping distribution. Cal-Am's predicted pumping constraints and demand are discussed below.

Cal-Am Pumping Constraints

- Predicted Cal-Am pumping comes from the five existing Cal–Am wells, two existing ASR sites, one planned ASR site, and two planned extraction wells. The five existing Cal-Am wells are Luzern #2, Ord Grove #2, Paralta, Playa #3, and Plumas #4. The two existing ASR sites are ASR 1&2 and ASR 3&4. The planned wells are ASR 5&6, EW-1, and EW-2. Although two wells are planned at the ASR5&6 site, only one of the two wells extract water in these simulations due to their close proximity to each other. Planned wells are included in the Project description because the total capacity of the existing Cal-Am wells is not sufficient to meet predicted monthly demand.

- Data supplied by MPWMD indicate that the total pumping capacity of Cal-Am's existing wells is 4,404 gallons per minute, or 19.46 AF/day. Based on information from MPWMD, we assume that only one ASR well extracts water from each ASR well site at a time. This means each ASR well site can produce 1,750 gallons per minute, or 7.7 AF/day. The total extraction capacity from all three ASR sites is 5,250 gallons per minute, or 23.1 AF/day. Both of the planned extraction wells are assumed to be able to produce 1,750 gallons per minute, or 7.7 AF/day.

- Injection of Carmel River water occurs only at sites ASR1&2 and ASR3&4, following the MPWMD schedule discussed in the Predicted Carmel River Flow and Injection section. These two sites are unavailable for extraction during injection months, and for the two months that follow injection. We make this assumption because the wells currently must rest for two months to allow disinfection byproducts formed during injection to degrade. Tests by MPWMD suggest that disinfection byproducts degrade within 45 to 60 days of injection in this basin.

- ASR site 5&6 is unavailable for extraction while water is being injected at either site ASR1&2 or ASR3&4. This is a consequence of Cal-Am's distribution system. Water pumped at site ASR5&6 must go past sites ASR1&2 and ASR3&4 to reach the main distribution system. When water is flowing from the main distribution system to the injection wells, water cannot simultaneously flow from ASR5&6 to the main distribution system.

- Because no injection occurs at site ASR5&6, there is no two-month delay after Carmel River injection to allow disinfection byproducts to degrade. Well site ASR5&6 can be pumped immediately after Carmel River injection ceases.

- For months when the ASR wells are not available, Cal-Am's pumping capacity is set to 34.86 AF/day. For months when only ASR5&6 is available, Cal-Am's pumping capacity is set to 42.56 AF/day. For months when all three ASR sites are available, Cal-Am's pumping capacity is set to 57.96 AF/day.

Cal-Am Water Demand

The scenarios presented here are based on an annual demand of 10,400 acre-feet (AF). The monthly distribution of Cal-Am's annual deliveries, provided by MPWMD, was used to estimate future monthly demand. These values are summarized in Table 1.

Table 1: Cal-Am Estimated Monthly Demand

Month	Percent of Annual Delivery	Estimated Future Monthly Demand (AF)
October	9.1%	950
November	7.5%	778
December	6.7%	702
January	7.9%	819
February	6.8%	702
March	8.3%	863
April	8.2%	852
May	9.0%	933
June	8.9%	923
July	9.5%	983
August	9.5%	986
September	8.7%	907

Cal-Am's monthly groundwater pumping from the Seaside Basin is calculated by subtracting Cal-Am's Table 13 diversion, Carmel Valley extractions for customer service, and Sand City Desal Plant supplies from the monthly demands shown in Table 1. MPWMD supplied monthly Table 13 diversion rates, which are based on projected climate (Appendix A). Carmel Valley extractions for customer service and Sand City Desal Plant flowrates are constant from year to year and are shown in Table 2.

Table 2: Cal-Am Carmel Valley Extraction and Sand City Desal Plant Supply

Month	Carmel Valley Extraction (AF)	Sand City Desal Supply (AF)
October	92	13
November	92	12
December	470	13
January	470	13
February	470	12
March	470	13
April	470	12
May	470	13
June	92	12
July	92	13
August	92	13
September	92	12

Assumptions behind these water sources are as follows:

- Cal-Am will produce only one million gallons per day from the Carmel River for customer service during summer months in order to preserve habitat flows.
- The Sand City Desal Plant supplies 150 AF/year at a constant daily rate.

Figure 5 shows how these water sources meet monthly Cal-Am demand. The purple line represents the total estimated monthly demand. The darkest blue area at the bottom of the graph represents the water supplied by the Sand City Desal plant. The medium blue area in the middle of the graph represents water supplied from Carmel Valley for direct customer service. The light blue area represents Cal-Am's Table 13 diversion. Subtracting these three blue areas from the purple line yields the orange area, which is the remaining demand to be met by Seaside Basin pumping.

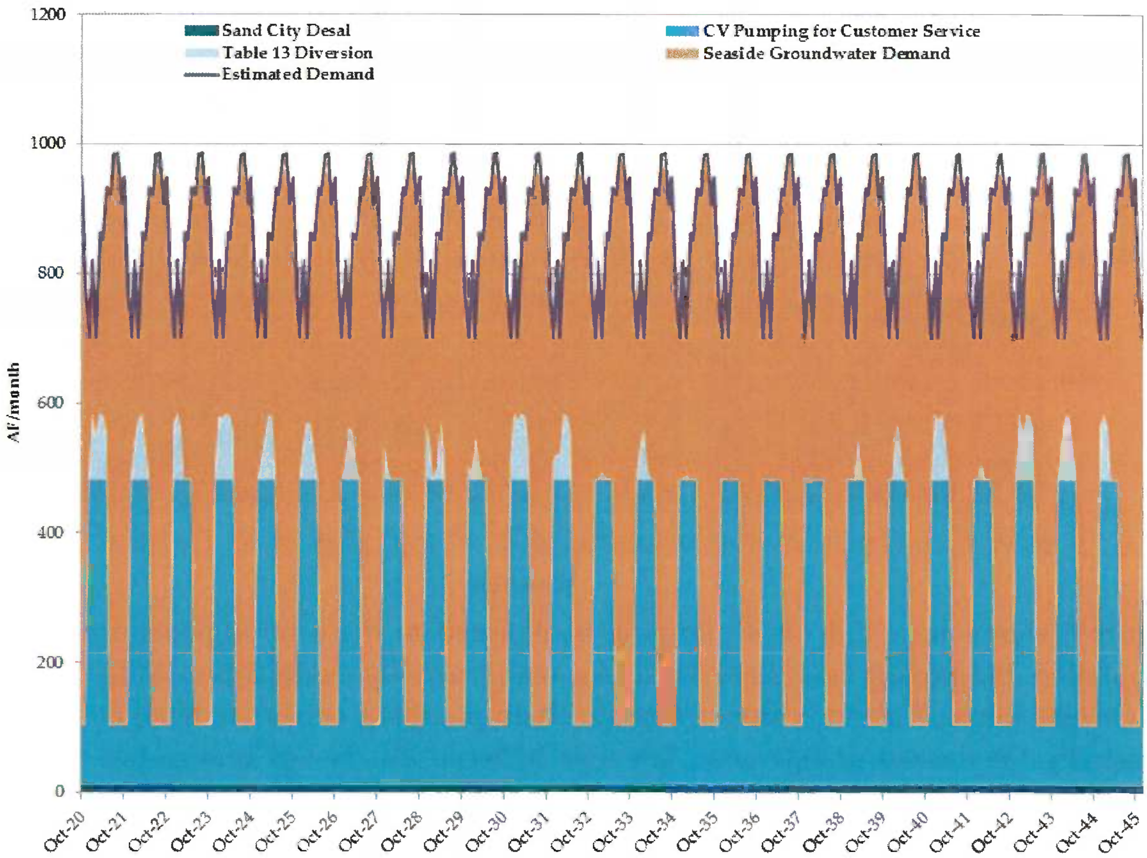

Figure 5: Monthly Demand, Non-Groundwater Sources, and Seaside Pumping Demand

Water available for Cal-Am pumping

Cal-Am's future pumping from the Seaside Basin will be drawn from three pools of water, listed in the order in which they are applied to meet monthly demand:

- Native groundwater
- PWM project water
- ASR water

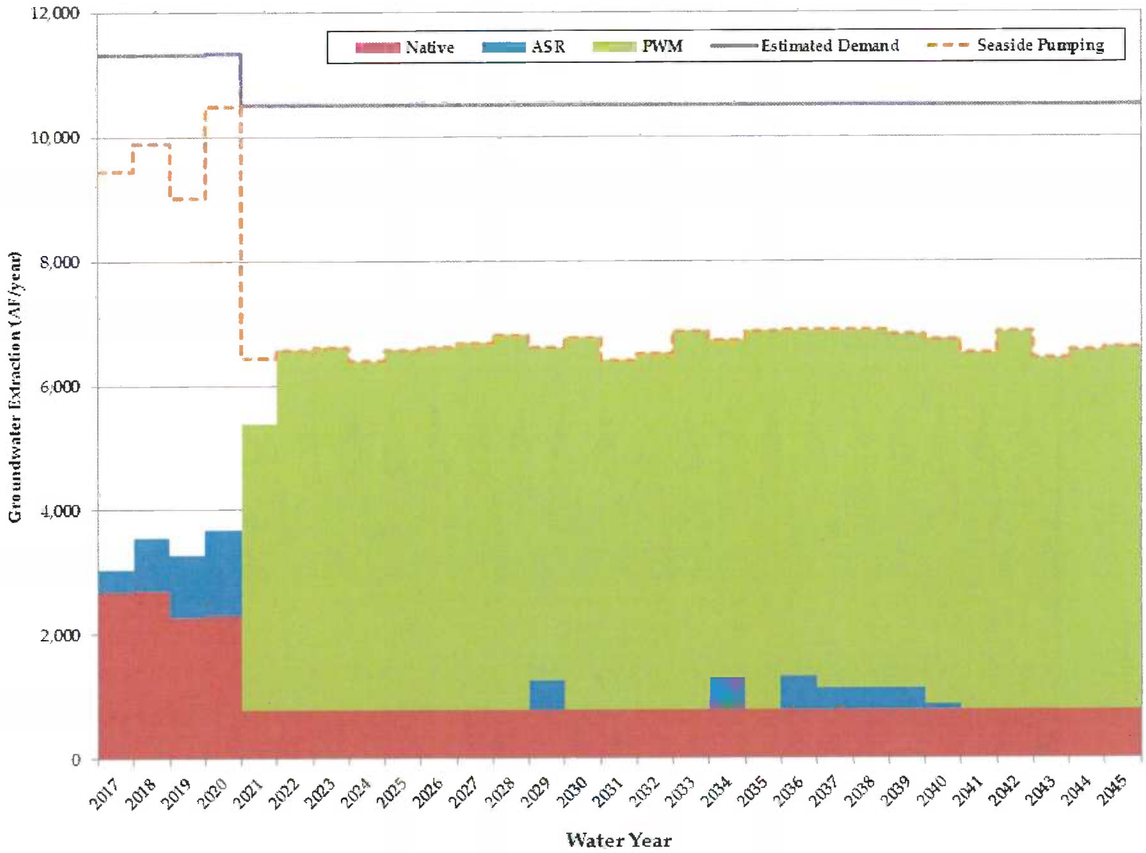

Figure 6 shows how Cal-Am's pumping is allocated to these three pools during the simulation. Pre-project values are consistent with previous model input (MY4 through 7). On this figure, Cal-Am's annual Seaside Basin pumping needed to meet demand is shown by the dashed orange line. The area between the dashed orange line and the purple line represents the demand met by Table 13 water, direct service of Carmel River water, and Sand City Desal water. The amount of water pumped from each of the three pools is represented by the three colored areas under the dashed orange line. From future water year 2022 onward, the allotment from the three water pools is sufficient to supply the requisite pumping. PWM water has the highest priority for pumping; all PWM water is recovered before tapping any of the other three pools. This is because PWM water is sold to Cal-Am by MPWMD at the point of recovery. PWM water is prioritized for paying off PWM debts. Native groundwater has the second highest priority for pumping. Carmel River water has the third highest priority for pumping.

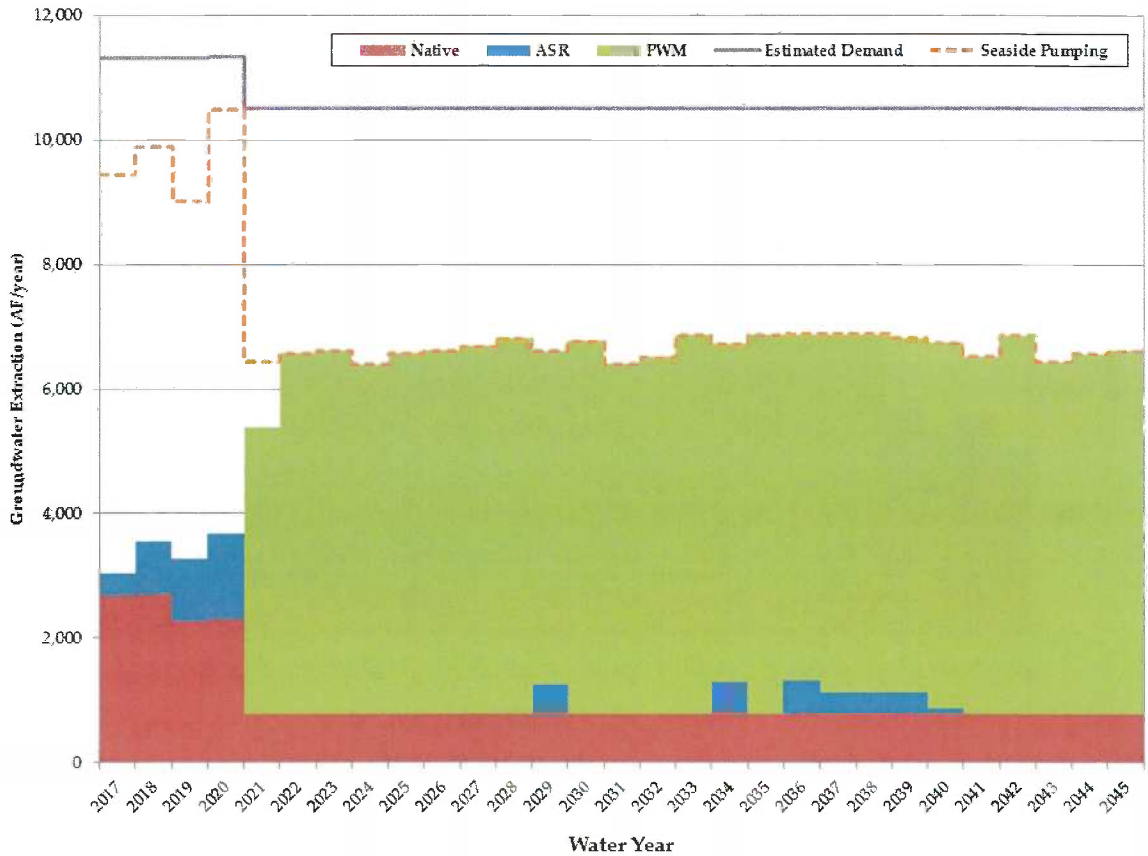

Figure 6: Annual Cal-Am Water Allocation by Water Right Source (Project)

The native groundwater pool is shown by the red area on

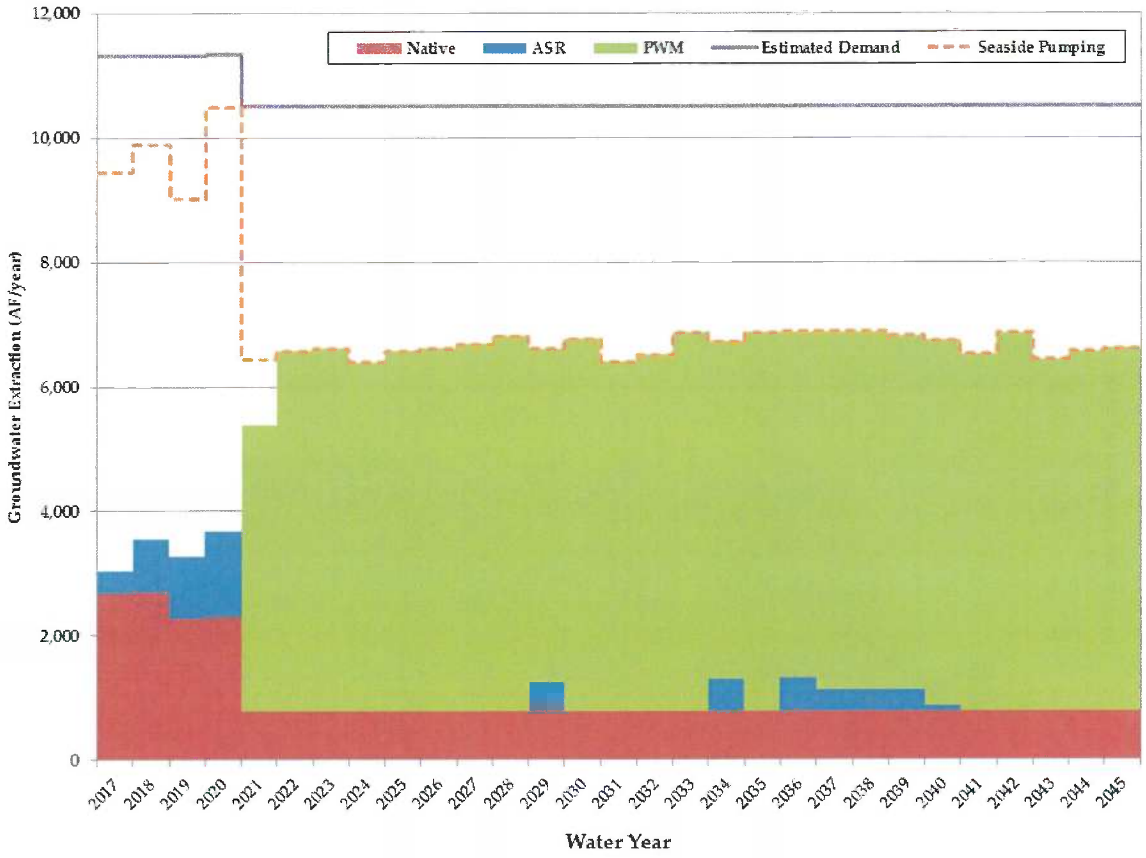

Figure 6. This pool includes pumping for the SNG Development Corporation from MY4 through 7, consistent with previous project models.

Cal-Am forgoes 700 AF of water from the native groundwater pool every year as a replenishment repayment once the CDO is met, which we assume occurs at the start of the Project. Replenishment repayment is water Cal-Am must pay back to the Watermaster because Cal-Am has historically pumped more than their operating safe yield. We therefore assume that Cal-Am pumps only 774 AF/year of its assumed natural safe yield of 1,474 AF/year beginning in October 2020 (MY8). The 700 AF of natural safe yield not pumped over the 25-year period counts as in-lieu recharge, and is Cal-Am's replenishment repayment. Following demand projections from Cal-Am, we assume that native water is pumped at a constant daily rate in agreement with the annual water right.

PWM project water is shown by the green area on

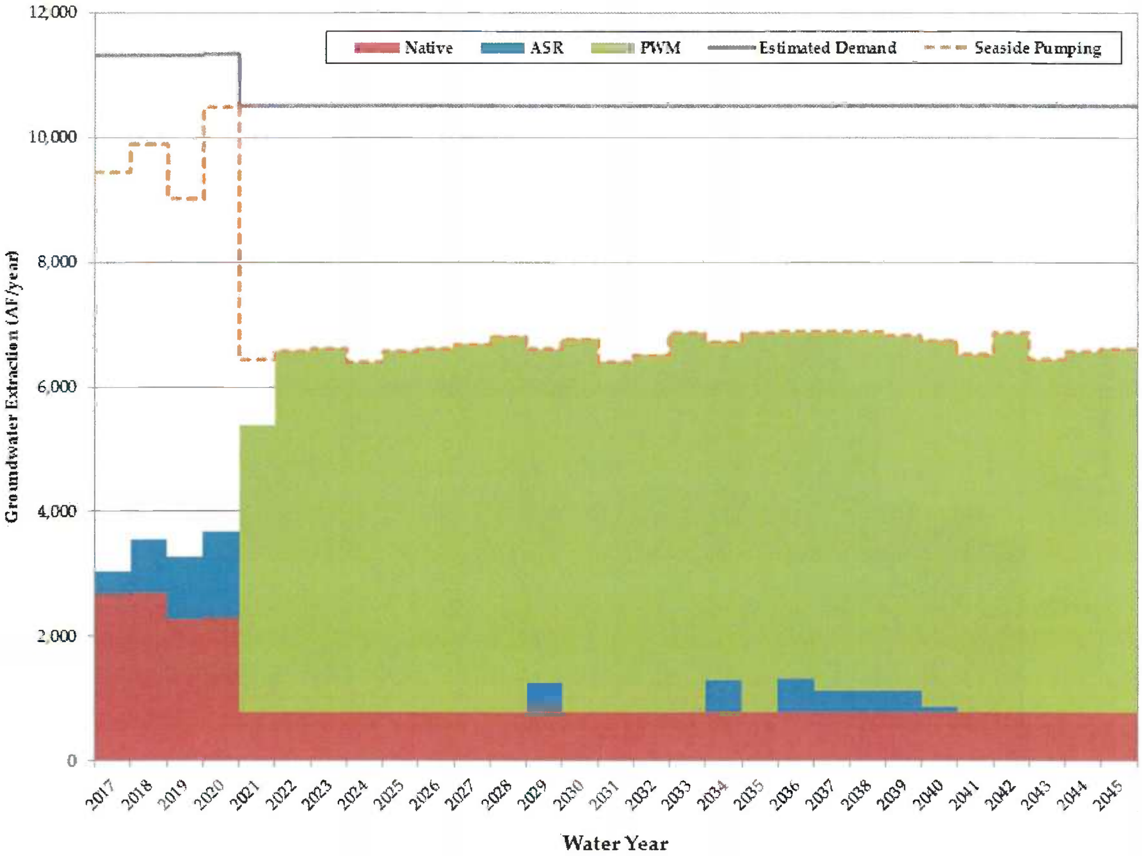

Figure 6. This water is projected to become available in WY2020 (MY8) and supply between 4,750 and 5,950 AF/year, in accordance with the climate-based projected injection schedule developed by M1W and Todd Groundwater (*Revised Seaside Basin Deliveries 6.5* [sic] *MGD 02232018.xlsx*). We assume zero PWM water in storage at the start of the Project. PWM water in storage during the Project is shown by the green line on Figure 7.

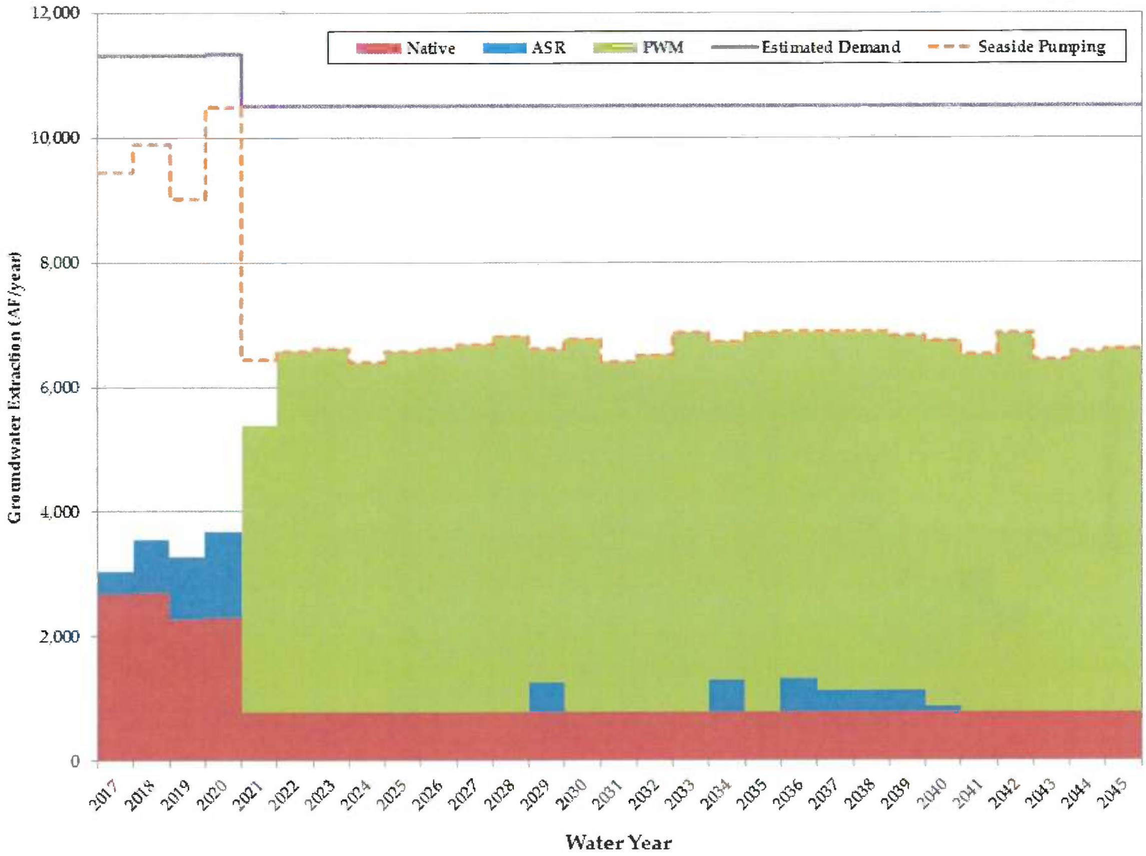

Figure 6. This water's availability is subject to climate conditions. Before Cal-Am has met the CDO (MY1 through 7), the maximum allowed diversion rate of Carmel River water is 20 AF/day, and no ASR water can be stored from year to year. This is consistent with previous PWM models. Once Cal-Am meets the CDO (MY8), the maximum allowed diversion rate increases to 29 AF/day, and ASR water in storage is carried over from year to year. We assume that Cal-Am injects all of the water they are permitted to pump from the Carmel River on a monthly basis, and that ASR extraction is capped by the capacity of the three ASR well sites. The theoretical amount of ASR water in storage during the Project is shown by the blue area on Figure 7. The actual amount of ASR water stored during the Project may be less than what is shown by the blue area on Figure 7 because some water may flow out to the ocean or to adjoining basins.

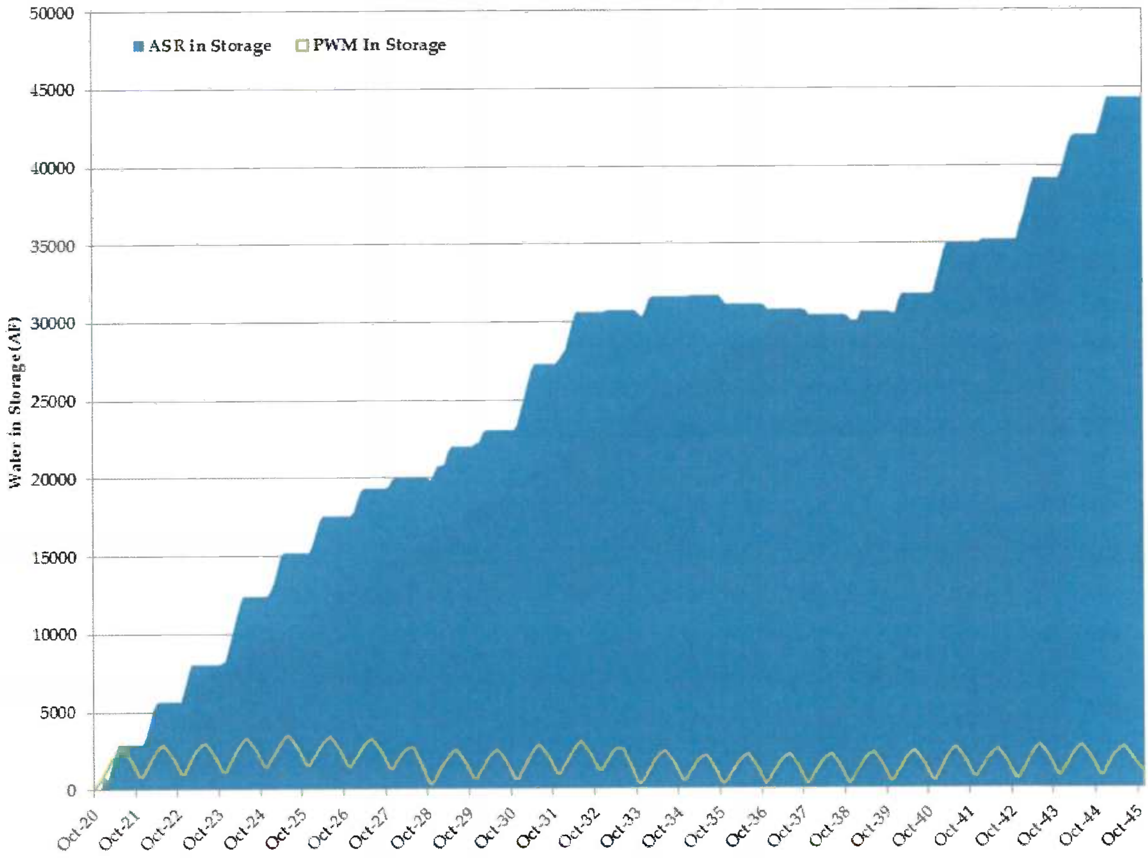

Figure 7: PWM and ASR Water in Storage

During the first year of Project operation, in WY2020, there is not enough stored groundwater to allow Cal-Am to forgo its 700 acre-feet of replenishment repayment and meet all of its demands. To address this issue for 2020, we assume that Cal-Am will meet monthly demands by pumping excess native above its allotment. As ASR water in storage (Figure 7) increases later in WY2020, this credit against native groundwater is transferred to credit against the ASR water in storage, allowing Cal-Am to meet its native groundwater replenishment repayment for WY2020.

Figure 8 shows Cal-Am's estimated native groundwater deficit over the life of the Project, with overdraft (solid red area) and without (cross-hatched area). We assume that Cal-Am has an initial native groundwater deficit of 17,500 AF in October 2020, equivalent to 700 AF/year for 25 years. Native groundwater overdraft in early 2020 has negligible impact on Cal-Am's long-term rate of repayment. Cal-Am will resume pumping at the assumed natural safe yield of 1,474 AF/year once the native groundwater deficit is reduced to zero. This occurs in future month October 2045 (MY33).

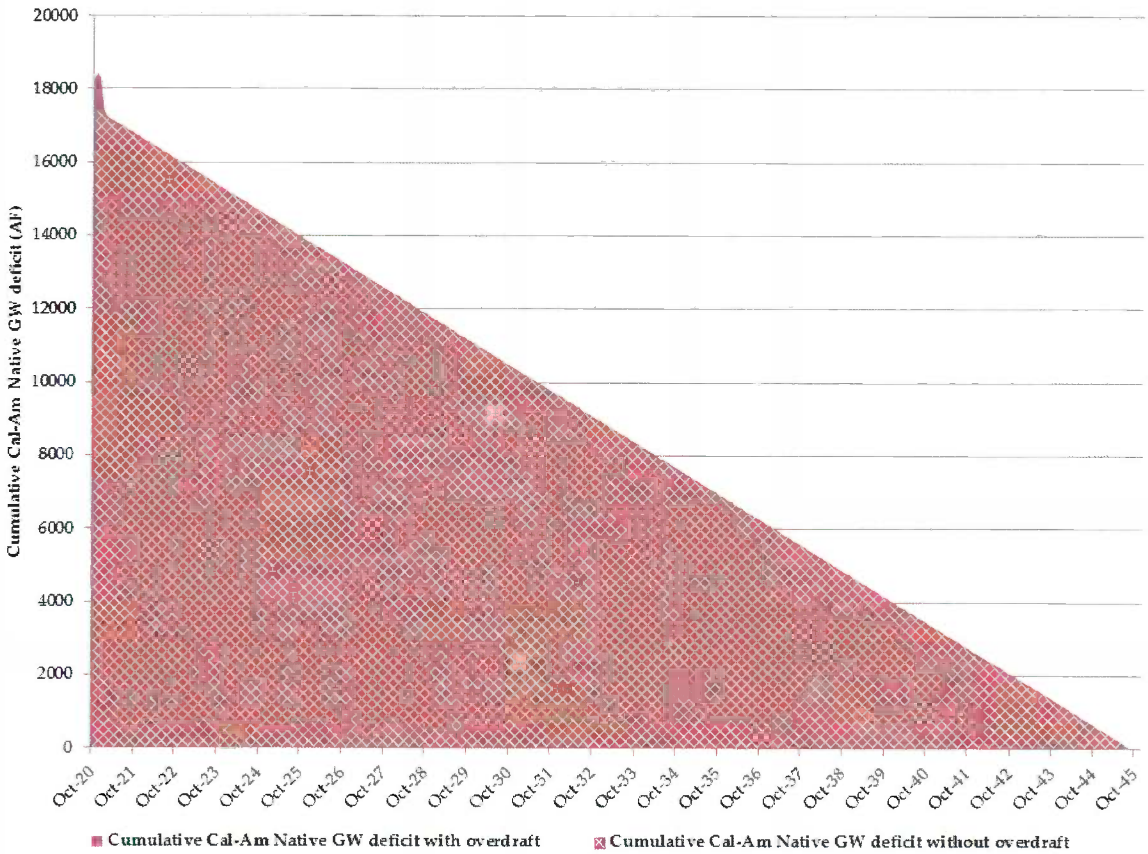

Figure 8: Cal-Am native groundwater deficit during PWM Project

Pumping Allocation by Well

When no ASR water is being extracted, Cal-Am's monthly pumping from the Seaside Basin is allocated among their available wells with the following order of preference:

1. Ord Grove #2
2. Paralta
3. ASR 1&2
4. ASR 3&4
5. ASR 5&6
6. Luzern
7. Playa #3
8. Plumas #4
9. EW-1

Pumping in any month is first allocated to the Ord Grove #2 well up to its capacity. Demand is then allocated to the Paralta well up to its capacity, and so on. The ASR wells are considered unavailable for extraction if they are injecting water or have injected water at any time during the previous 3 months. The projected injection schedule is used to flag months during which the ASR wells would be unavailable. During months when ASR wells are not available for pumping, the order of preference continues directly from the Paralta Well to the Luzern well. This generally occurs during early summer, when total pumping is high and the ASR system has recently injected excess spring Carmel River flows.

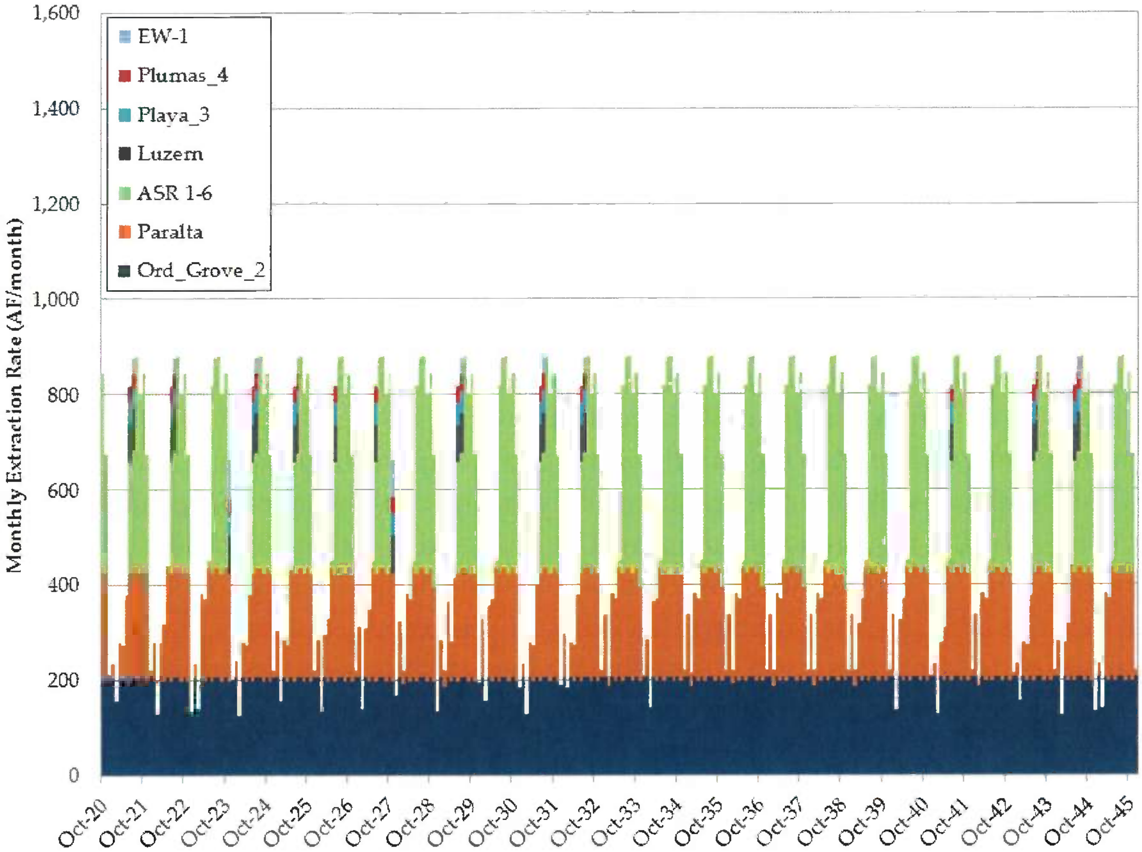

Figure 9 shows monthly pumping by well. With Cal-Am's simulated 10,400 AFY demand, the total capacity of the first nine wells listed above is sufficient for the requisite Seaside Basin pumping; well EW-2 does not pump during the simulation because it is a backup well that exists only to ensure adequate pumping capacity should other wells fail.

When ASR water is being extracted, the ASR wells are preferentially used to extract ASR water. If the ASR wells' capacity is greater than the ASR water allocated during a month, then the ASR wells remain available to extract native and PWM water up to their remaining capacity.

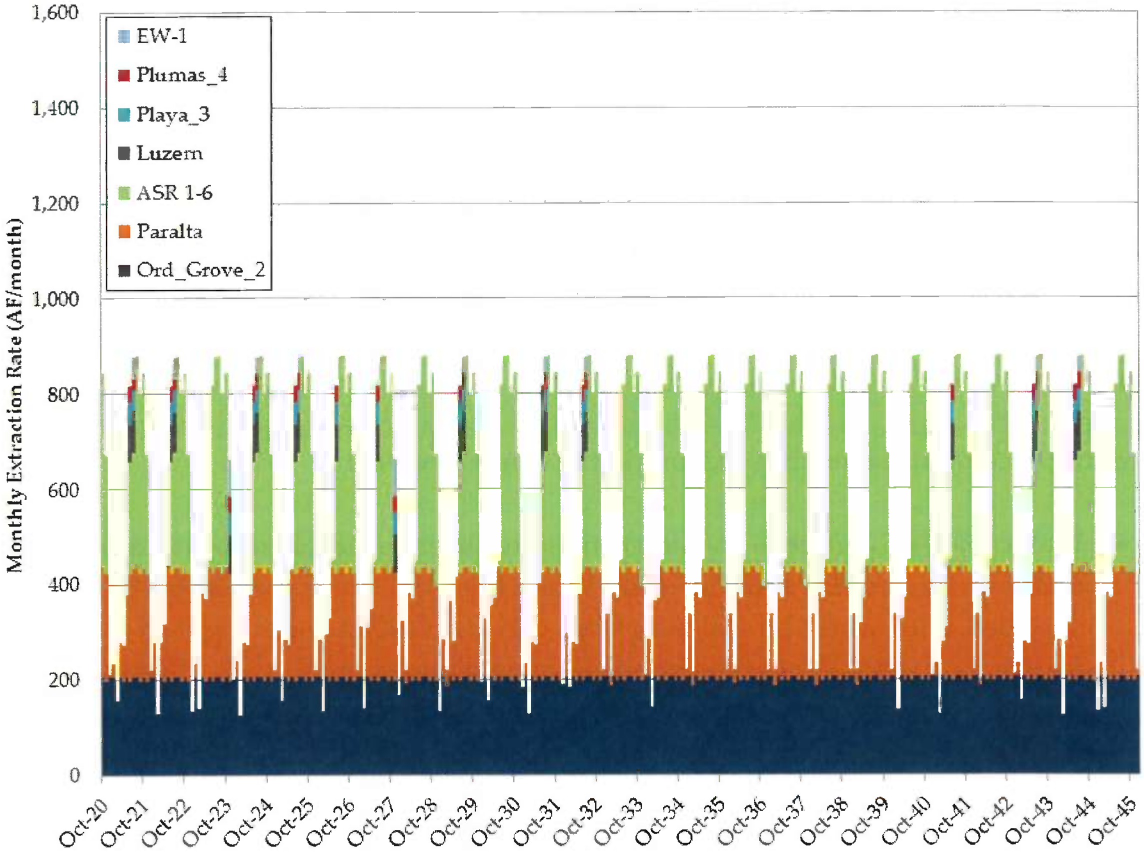

Figure 9: Monthly Pumping Totals by Well

GOLF COURSE PUMPING FROM MODEL YEAR 4 ONWARDS

Predicted golf course pumping is based on the hydrologic year. For example, pumping in January 2019 equals the amount pumped in January 1993, because the simulated 2019 hydrology is based on 1993 hydrology. This ensures that the demand corresponds to the hydrology. If the amount pumped by a golf course pre-adjudication exceeded the golf course's adjudicated right, pumping was capped at the golf course's adjudicated amount.

Additional golf course pumping adjustments accounted for in the simulation are:

- The Bayonet and Blackhorse golf courses pumped no water until September, 2016 based on an in-lieu replenishment agreement with the City of Seaside. In September, 2016 the golf courses resumed pumping from the Coe Avenue and Reservoir wells.

- In 2007, prior to the start of the predictive simulation, Bayonet and Black Horse golf courses had irrigation upgrades that have reduced irrigation demand by approximately 10% from historical amounts.

PREDICTED ALTERNATIVE PRODUCER AND PRIVATE PUMPING

Predicted alternative producer pumping is set at measured Water Year (WY) 2011 volumes from MY4 onward. All other pumpers that are not covered by the Decision, including Cal Water Service and private wells, also pump at WY2011 volumes from MY4 onward.

Pumping exceptions taken into account in the simulation are:

- Water for SNG, which is an Alternative Producer, is supplied from Cal-Am wells under an agreement with Cal-Am. When the SNG site is developed they will be supplied with water by Cal-Am, who will use SNG's water right of 149.7 acre-feet/year. Currently there is no production from the SNG well. Based on input from the property owner, Ed Ghandour, project construction is planned to start in 2018, and use 25 AFY of water. For consistency with previous Seaside modeling, water usage thereafter is estimated to be:
    - MY5 30 AFY
    - MY6 50 AFY
    - MY7 onward – 70 AFY

No-Project Scenario

The No-Project scenario developed for the EIR analysis was also used as a No-Project scenario in the current analysis. The No-Project scenario included all of the assumptions on future hydrology, future municipal pumping, and future alternative producer pumping discussed above. PWM Project injection was not included in the No-Project scenario. The ASR injection and extraction schedule was updated for the Project scenario. The No-Project scenario did not include the assumption that Cal-Am will meet the CDO; ASR water in storage was not carried over from year to year and does not accumulate over the course of the No-Project simulation. The pumping capacities of the existing Cal-Am wells were assumed to be lower under the No-Project scenario. The No-Project scenario did not include planned wells ASR 5&6, EW-1, and EW-2. The annual allocation of Cal-Am pumping by water right source and monthly pumping by well for the No-Project scenario are shown on Figure 10 and Figure 11, respectively.

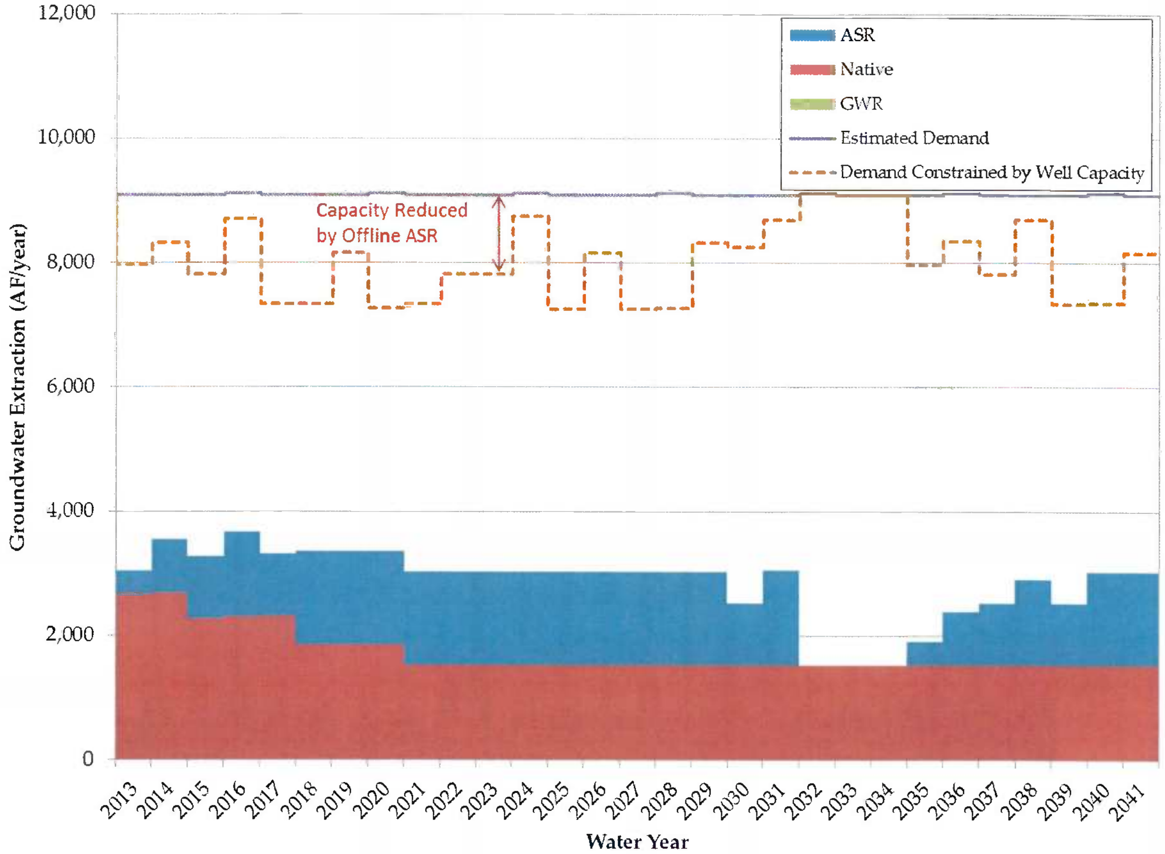

Figure 10: Annual Cal-Am Water Allocation by Water Right Source (No-Project)

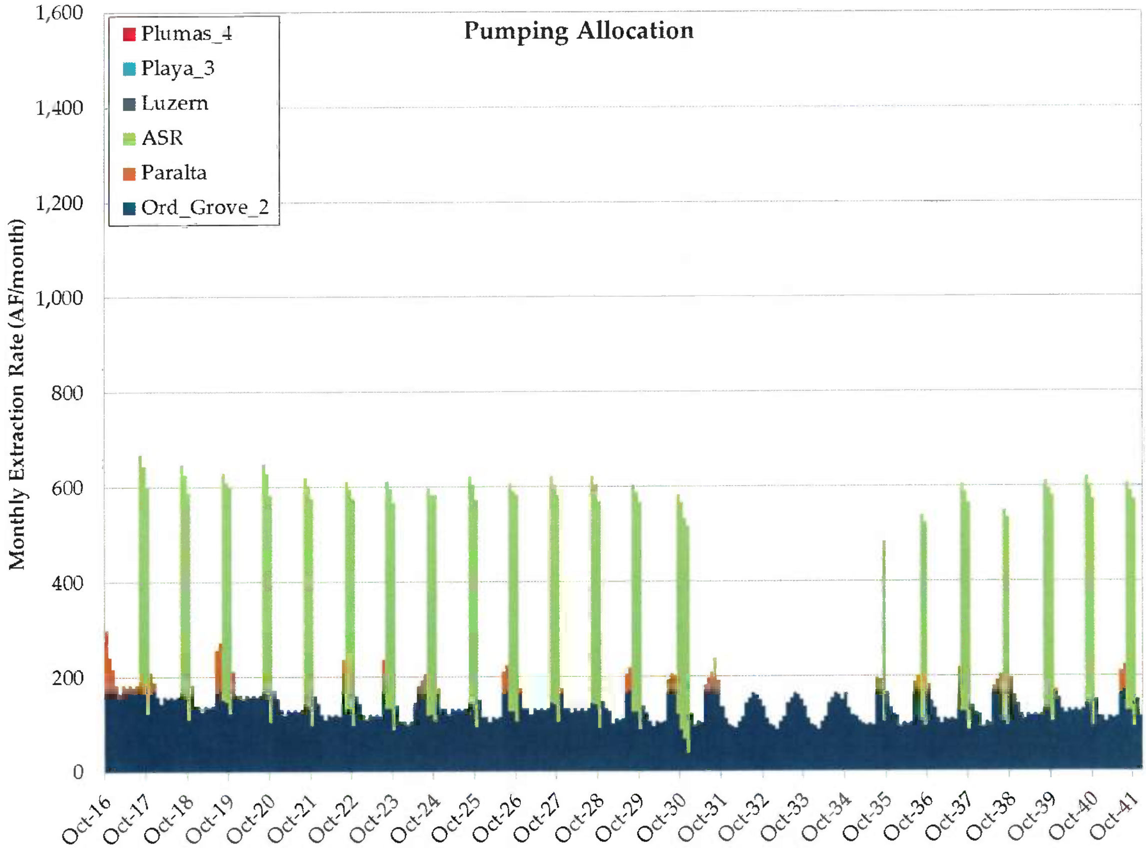

Figure 11: Monthly Pumping Totals by Well for No-Project Scenario

Particle Tracking Approach

Particle tracking was conducted to estimate the fate and transport of injected Project water under the Project Scenario. Particles were first introduced around all six PWM Project injection wells in October 1, 2020. A new set of particles was released into the model at the beginning of every month until the end of the simulation in 2045. Each month, 40 particles were released from each injection well. Each particle was tracked through the model until it terminated at an extraction well, or until the end of the simulation period in 2045. By introducing the particles continuously, we ensured that there were particles introduced and tracked during times when the travel times would be the fastest.

Particles were placed along the edges of each of the model cells that contained the injection and vadose wells. This strategy is necessary to ensure that the particles are carried outward in all directions in the same manner that water would travel radially from a well. Placing many particles at the exact location of the well results in only a single path taken by all particles. While the approach of placing particles around the edge of the model cell gives a more accurate picture of the dispersal pattern of the water from the injection wells, it also places some particles closer to the extraction wells, potentially resulting in faster simulated travel times.

Particles are captured by wells not when they reach the exact location of the extraction wells, but when they reach the edge of the cell that contains an extraction well. This also leads to faster simulated travel times. The results shown below should therefore be considered conservatively fast travel time estimates.

Model Results

GROUNDWATER ELEVATION RESULTS

The impact of the Pure Water Monterey Project on groundwater elevations was determined by comparing results from the Project scenario with results from the No-Project scenario.

Simulated groundwater elevations from the Project scenario were compared at the following seven wells:

- ASR 1&2
- City of Seaside #3 (Seaside Municipal well #3)
- Ord Grove #2
- Paralta
- Luzern
- PCA-West (Shallow)
- PCA-West (Deep)

Figure 12 shows the location of these wells and the Project injection wells. These wells span the area between the Project injection wells and the coast. Several of the major recovery wells for the Project water are included in this set of wells.

Hydrographs for simulated groundwater elevations under the No-Project and Project scenario are shown on Figure 13 through Figure 19. The blue lines represent the simulated static groundwater elevation under the No-Project scenario and the green lines represent the simulated static groundwater elevation under the with-Project scenario. The Project hydrographs show long-term increases in groundwater elevations relative to the No-Project hydrographs. Increased groundwater elevations are apparent within one year of the start of the PWM Project at all observation points.

The wells closest to the ASR and PWM injection sites (ASR 1&2, City of Seaside #3, Ord Grove #2, and Paralta) show long-term groundwater elevation increases of approximately 20-40 feet under the Project. The amplitude of annual groundwater elevation fluctuations is doubled under the Project, a result of higher injection and pumping rates. Project groundwater levels in these wells show a decreasing trend during the drought, compared with a stable or slightly increasing trend in the No-Project scenario. This reflects extraction of PWM and ASR water in storage during the simulated drought.

Project hydrographs also show higher groundwater elevations farther west of the injection sites. At the Luzern well, groundwater elevations rise by over ten feet during the Project. At the PCA-West Shallow well, groundwater elevations rise by two to three feet. These wells are screened in the upper aquifer, so the effect of increased injection in the Santa Margarita on annual variability is somewhat damped.

Comparison of the Project and No-Project hydrographs at the PCA-West wells allows us to evaluate how the Project might impact seawater intrusion in the Seaside Basin. Groundwater elevations at the PCA-West Shallow well are consistently above the protective elevation for the shallow aquifer during the Project, and reach over seven feet above the protective elevation by the end of the simulation. Project groundwater elevations at the PCA-West Deep well do not consistently exceed the protective elevation for the Santa Margarita, but are 5-10 feet higher than No-Project groundwater levels. This indicates that the PWM Project likely lessens the potential for seawater intrusion. Simulations of the existing five MGD PWM project do not show this 5 to 10-foot rise in groundwater levels at the PCA-West Deep well (HydroMetrics WRI, 2016). This indicates that the benefit of lessening the potential for seawater intrusion is a result of the expanded PWM Project, not the existing PWM project.

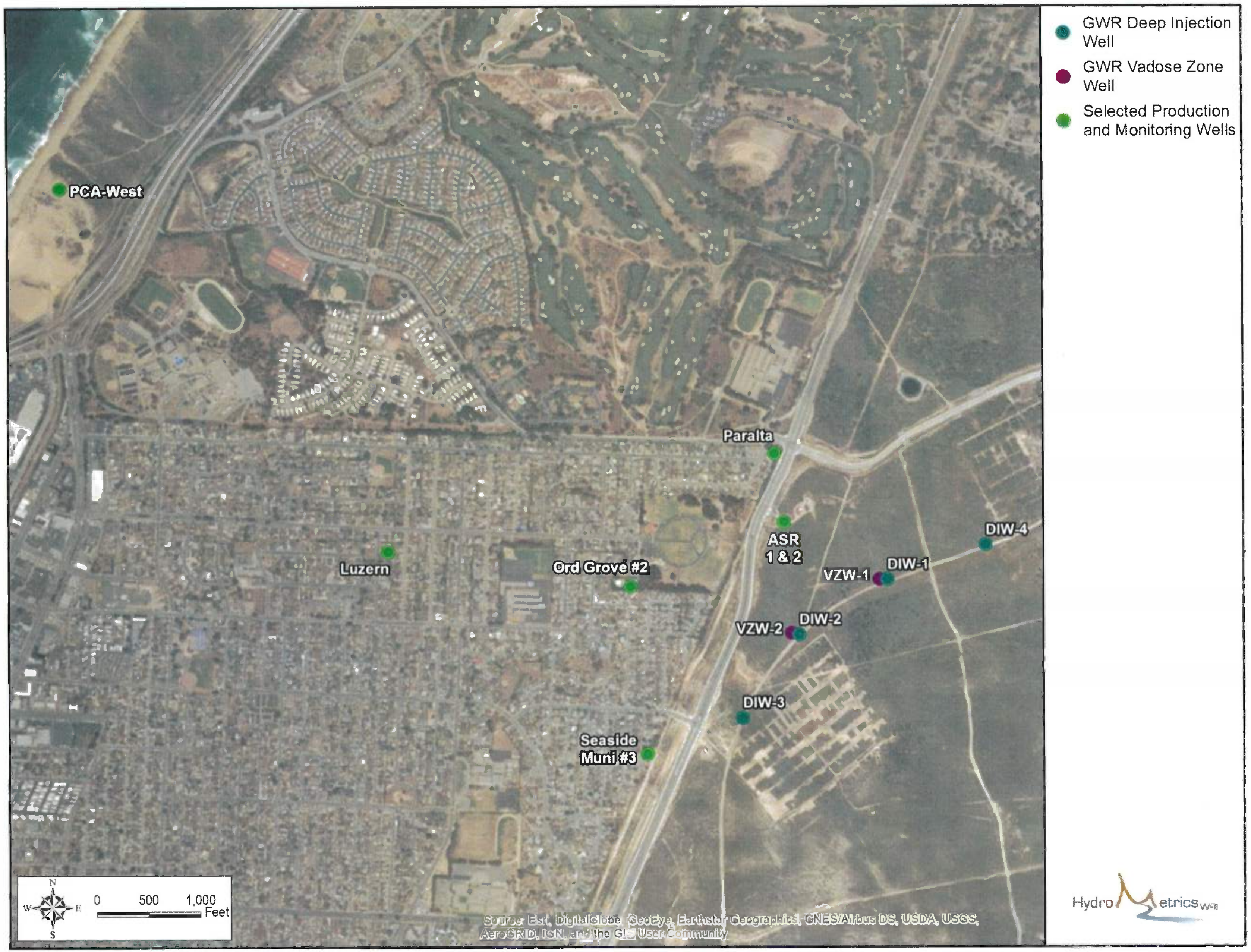

Figure 12: Locations of Wells with Groundwater Elevation Comparisons

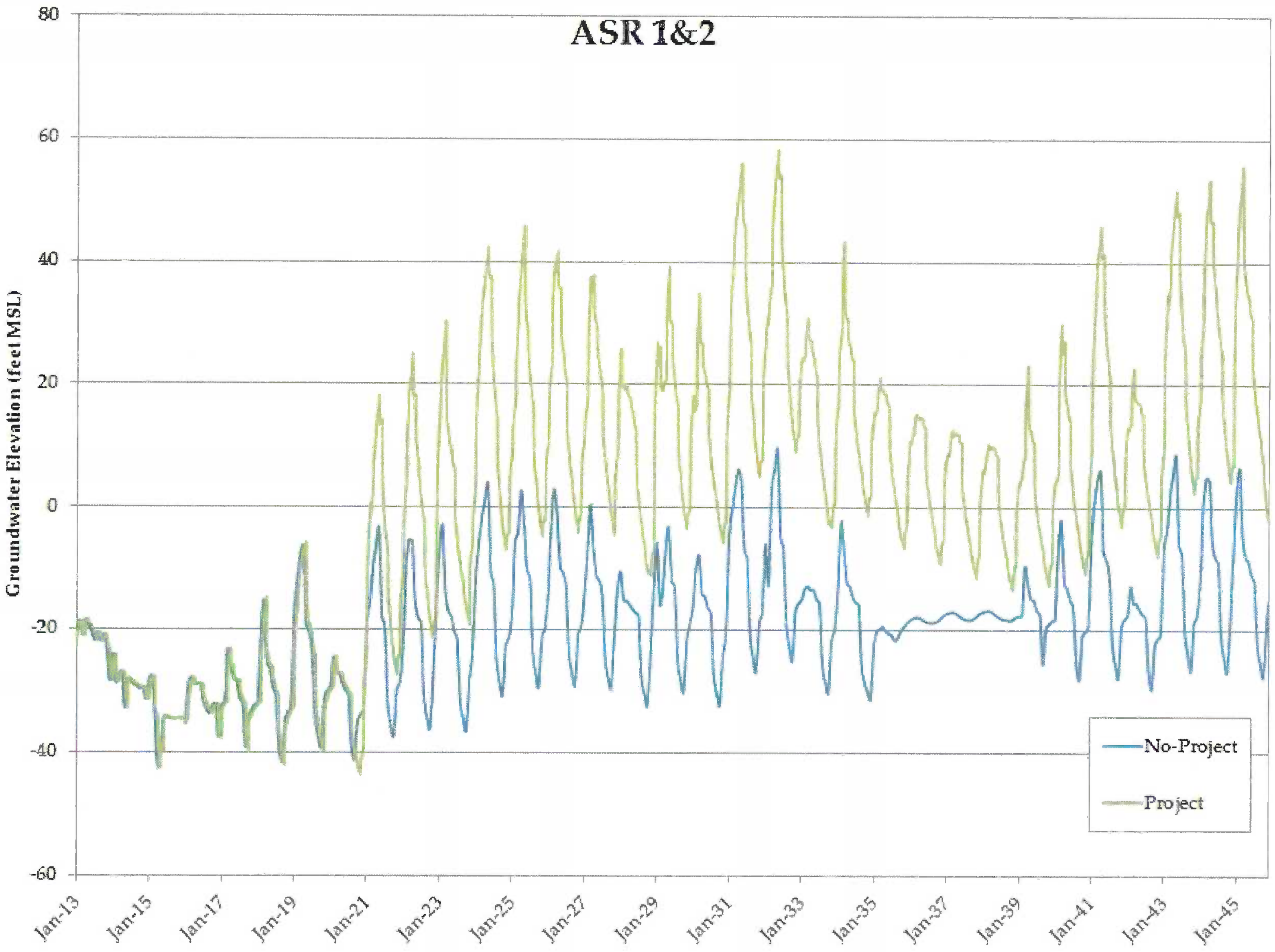

Figure 13: Predicted Static Groundwater Elevations at ASR 1&2 Wells

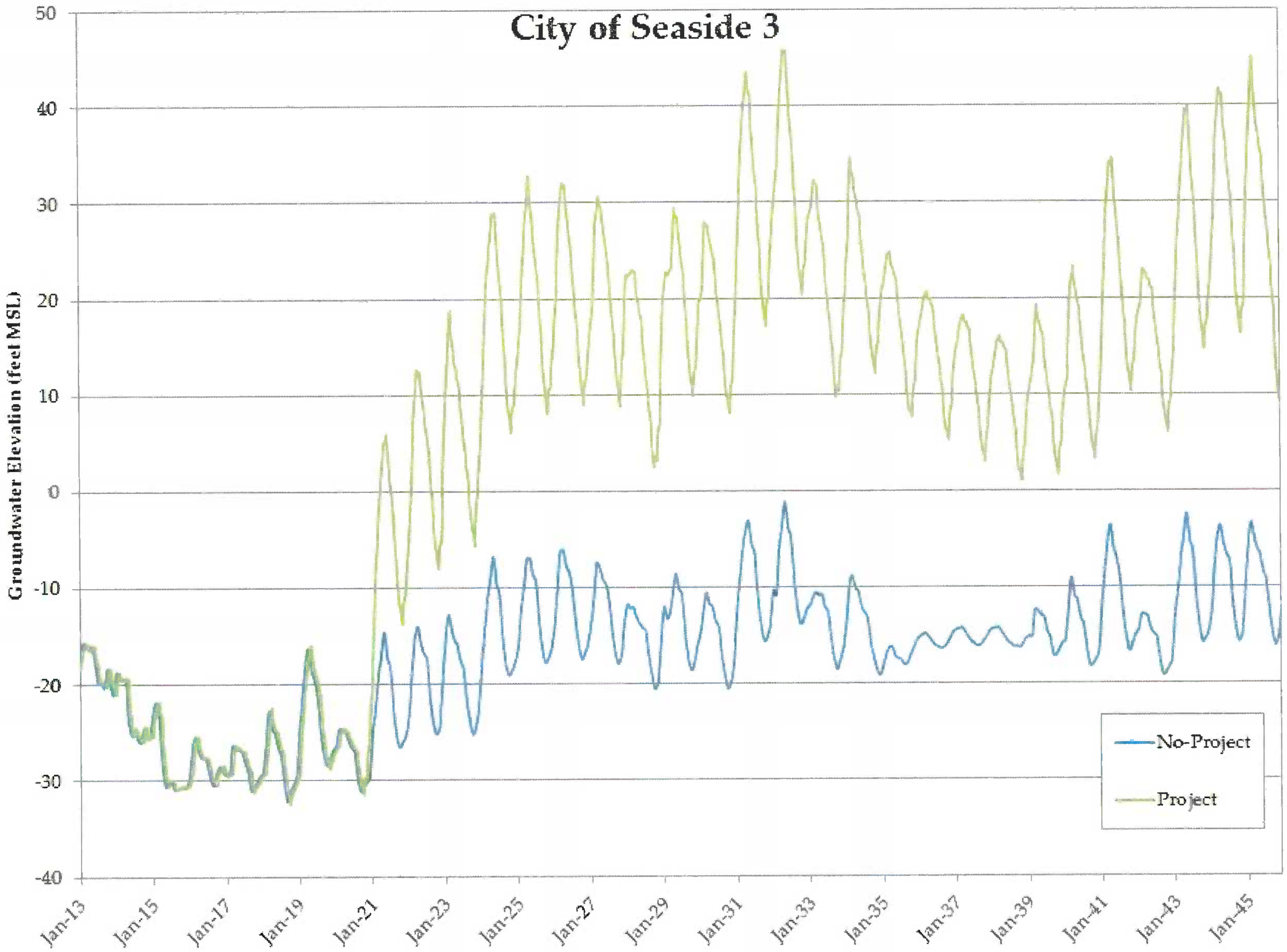

Figure 14: Predicted Static Groundwater Elevations at City of Seaside 3 Well

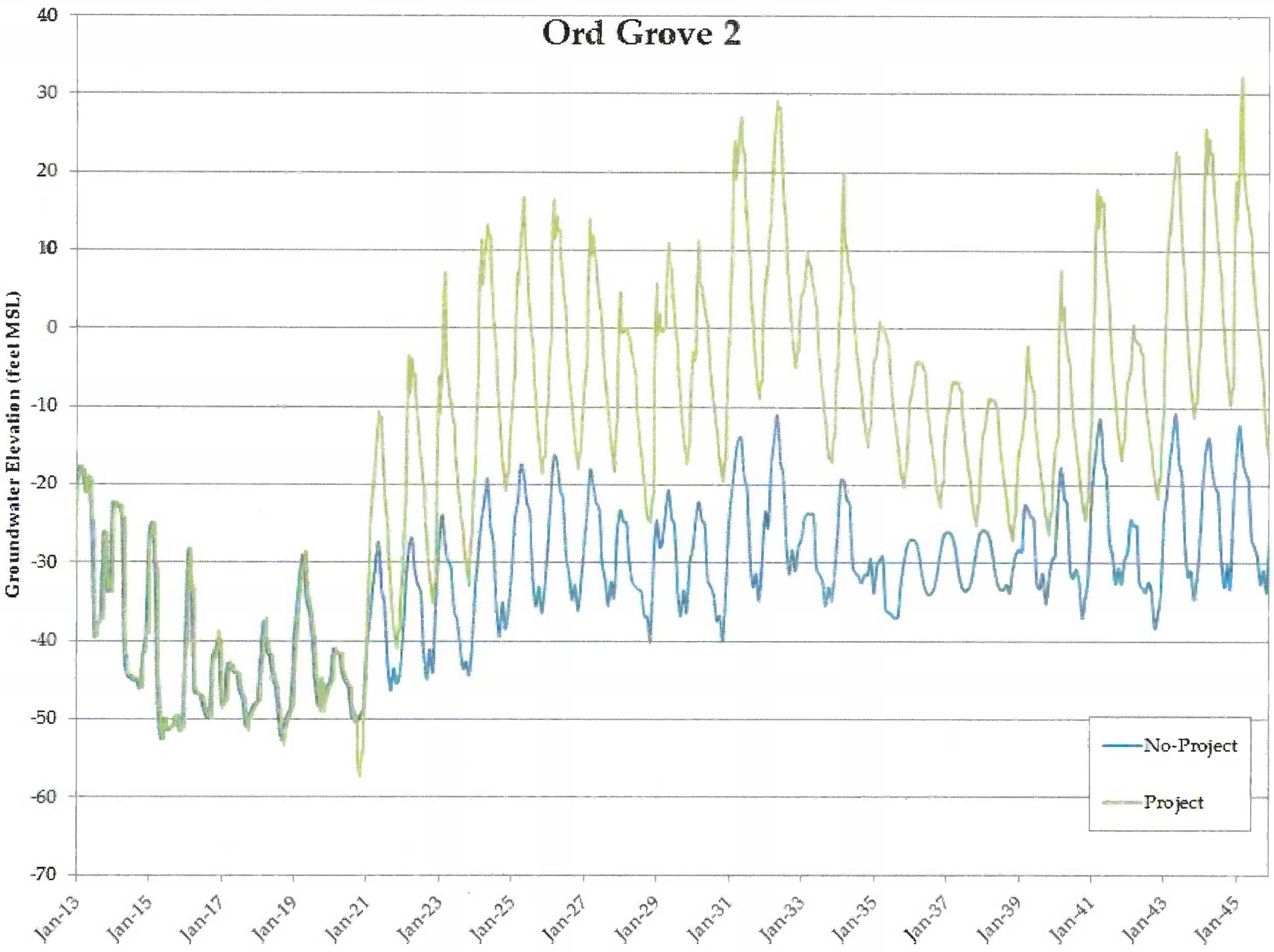

Figure 15: Predicted Static Groundwater Elevations at Ord Grove 2 Well

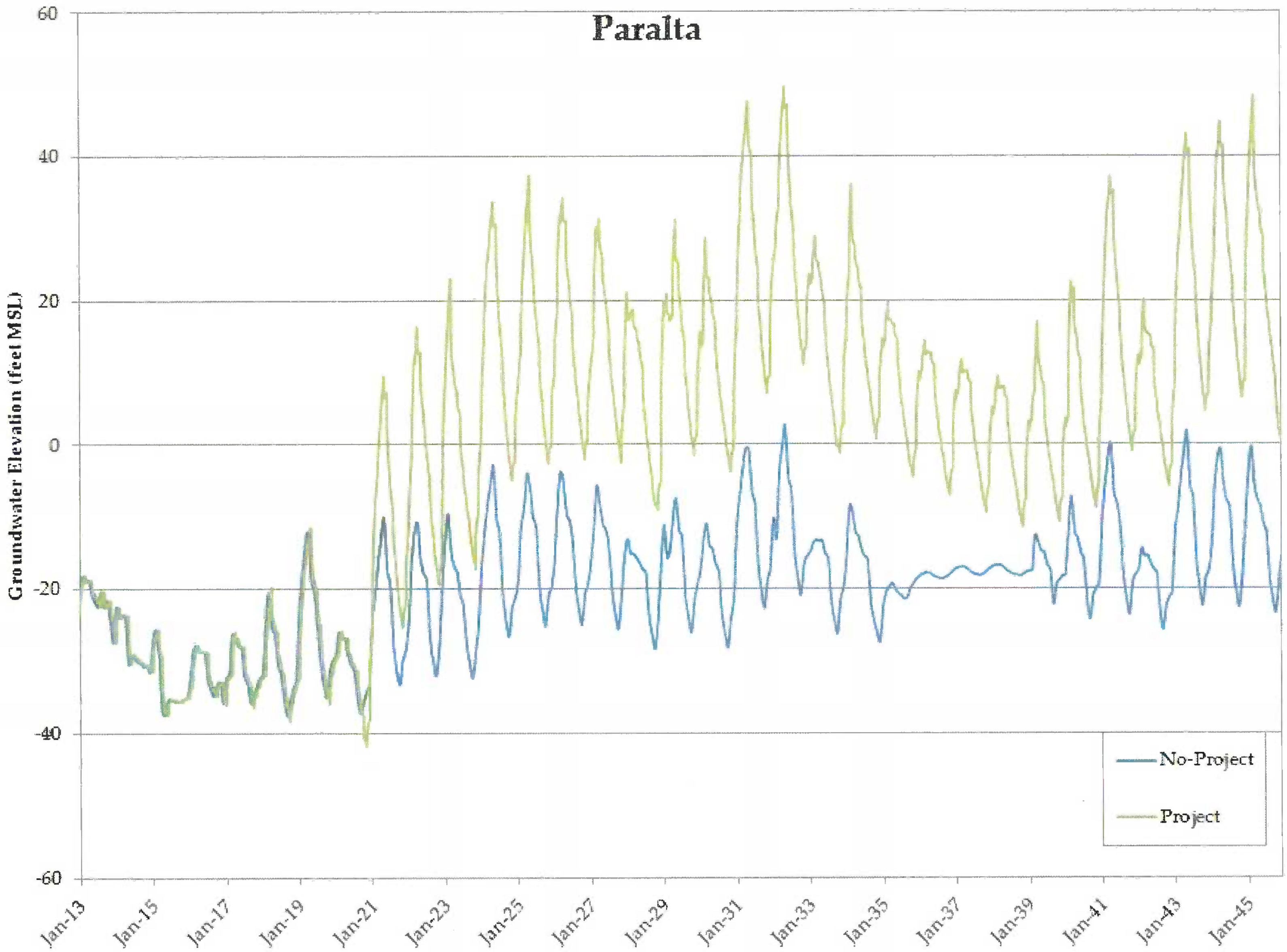

Figure 16: Predicted Static Groundwater Elevations at Paralta Well

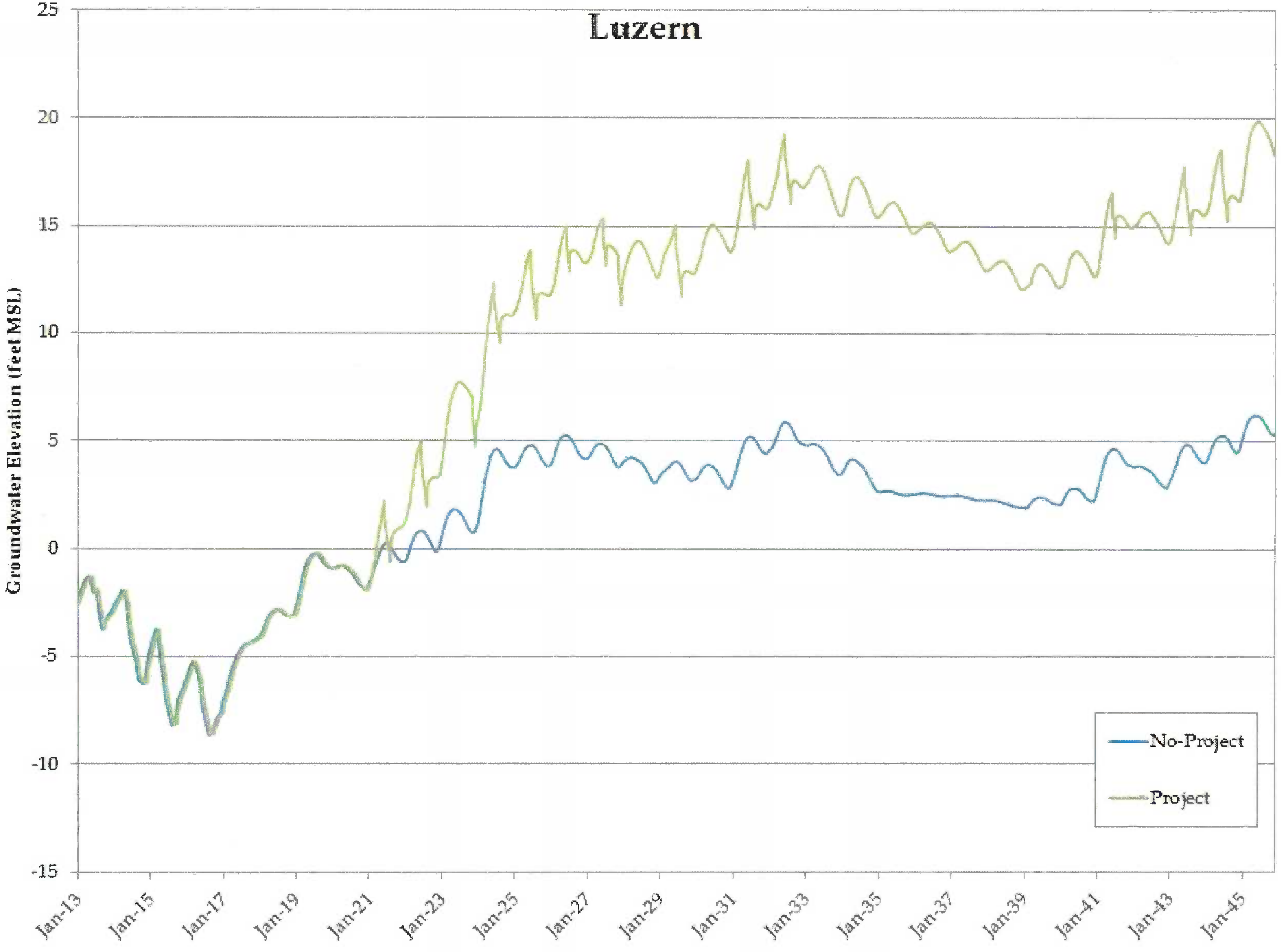

Figure 17: Predicted Static Groundwater Elevations at Luzern Well

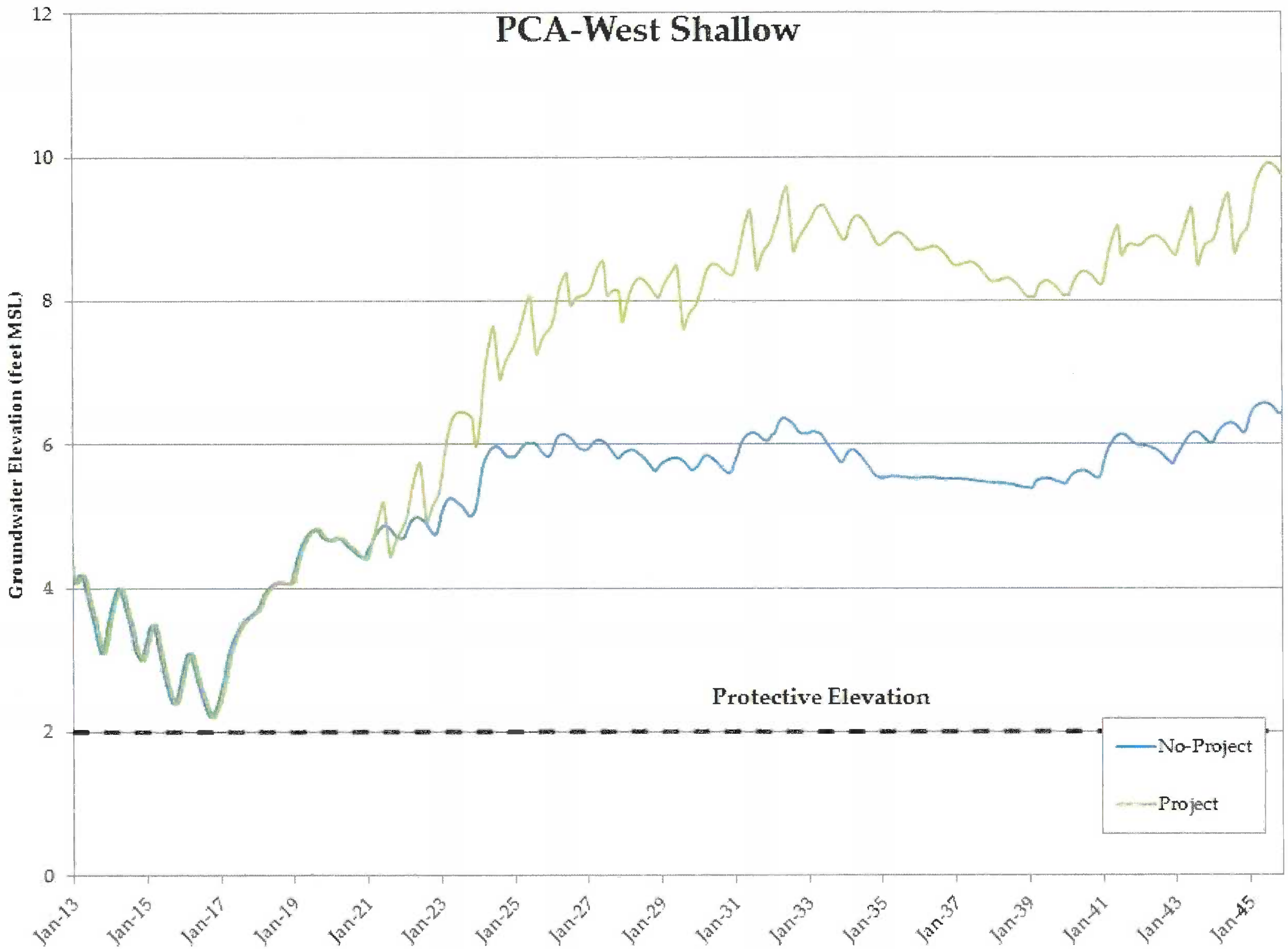

Figure 18: Predicted Static Groundwater Elevations at PCA-West Shallow Well

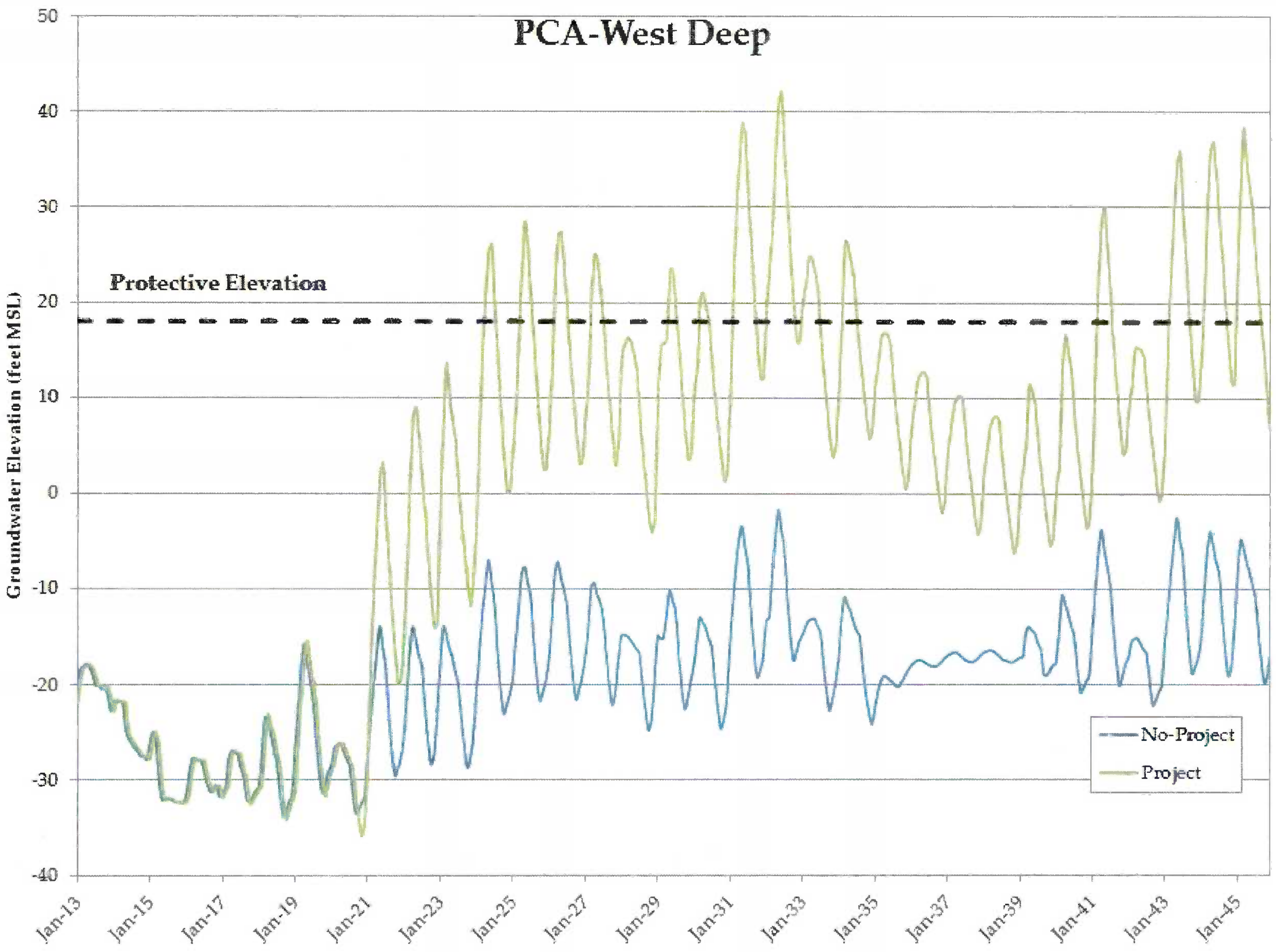

Figure 19: Predicted Static Groundwater Elevations at PCA-West Deep Well

Water Balance Results

Figure 20 shows the cumulative difference in annual water balance for the entire model region between the Project and No-Project scenarios. Positive values indicate increased inflow to the model under the Project scenario, compared with No-Project; negative values indicate increased outflow. The grey bars show the net increase in inflow from PWM deep injection wells and ASR injection during the Project. The green bars show increased inflow from the PWM vadose zone wells, which are incorporated in the model as additional recharge in the uppermost layer. These sources provide over 62,000 acre-feet of water over the course of the Project. The dark blue and orange bars show that approximately 40% of this water is lost as outflow to the adjacent Salinas Valley and offshore. The remaining water, shown by the light blue bars, goes into storage in the model. In total, the Project increases water in storage by approximately 37,000 acre-feet.

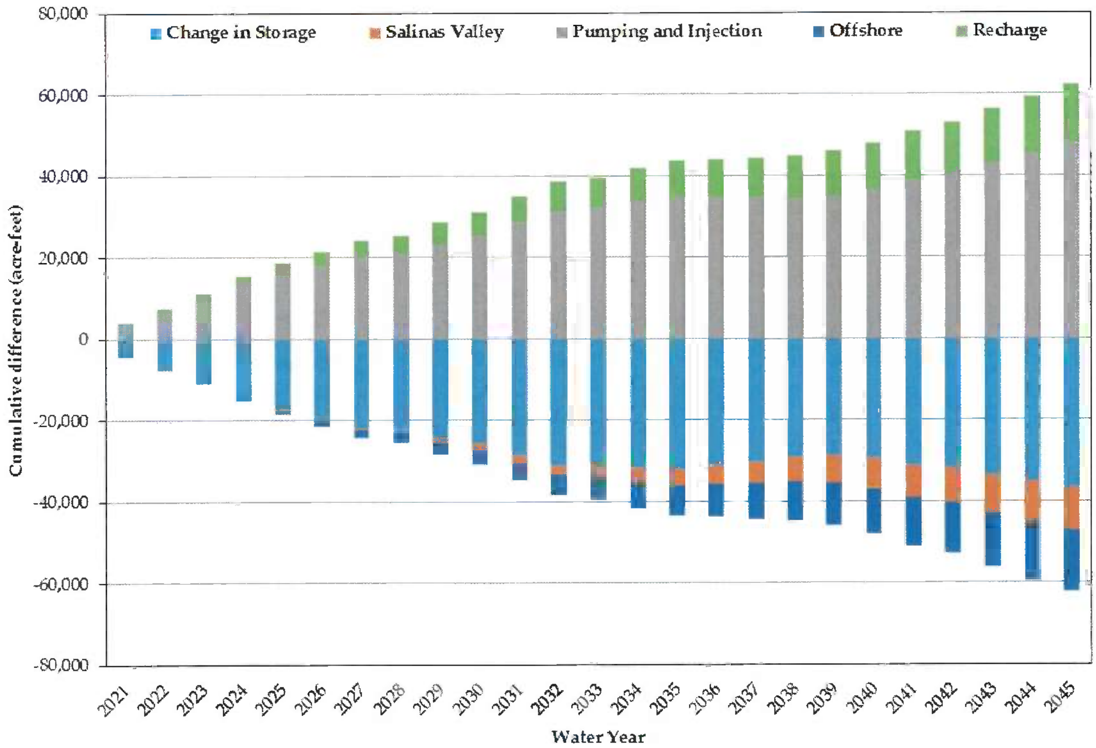

Figure 20: Cumulative Difference in Water Balance Components between Project and No-Project

Particle Tracking Results

Figure 21 shows how travel times between the GWR Project injection wells and the nearest extraction wells vary depending upon time of release. The horizontal axis represents the time at which groups of particles were released from the injection wells and the vertical axis represents time in days it took for the fastest particle to reach an extraction well. Each point represents the time traveled by the fastest particle. The cyan, green, blue, and red points show travel times from the locations of the deep injection wells DIW-1, DIW-2, DIW-3, and DIW-4 respectively. The gold points show travel times from the locations of the vadose zone well VZW-2. No particles from vadose zone well VZW-1 reach an extraction well by the end of the simulation.

The minimum travel time for particles released at the deep injection wells varies seasonally throughout the simulation. These fluctuations are the result of the influence of ASR 1&2 and ASR 3&4 on local groundwater gradients. When the ASR wells inject water, particles tend to be repelled from the ASR sites. When the ASR wells extract water, particles tend to be drawn toward the ASR sites. For example, particles that are released from well DIW-2 in late spring and early summer and captured by wells ASR 1&2 in the late fall and early winter experience the fastest travel times. These particles approach the ASR 1&2 wells during fall pumping season and are captured before wintertime injection creates groundwater gradients that repel particles from the ASR site.

Minimum travel times to an extraction well from DIW-4 vary more significantly with release date than those from the other three deep injection wells. For particles injected during the first 2 years of the Project, travel times exceed 4,800 days. From WY2023 onward, travel times from DIW-4 are between 600 and 2,000 days, with significantly shorter travel times during the drought in 2035-2038. Early in the Project, injection at the ASR sites and the northwestern-directed groundwater flow field drive particles released at DIW-4 away from the extraction wells. After two years of PWM injection, groundwater gradients develop near DIW-4 that facilitate flow to nearby extraction wells.

Particles that approach the ASR wells during the simulated drought of 2035-2038 experience reduced seasonal variation in travel times. During this period, particles encounter no injection of Carmel River water that might repel them from their path.

The vadose zone wells also display variations in minimum travel times throughout the simulation. These particles are initially released at shallow depths, above the influence of the large-capacity injection and extraction wells. The dynamics of the shallow layers in the model are mostly influenced by fluctuations in natural recharge and by the vadose zone injection itself. Variations in these factors can lead to saturation or desaturation of shallow model cells which in turn causes rapid changes in vertical and horizontal gradients in these cells. This type of behavior likely explains the large fluctuations in minimum travel times from VZW-2.

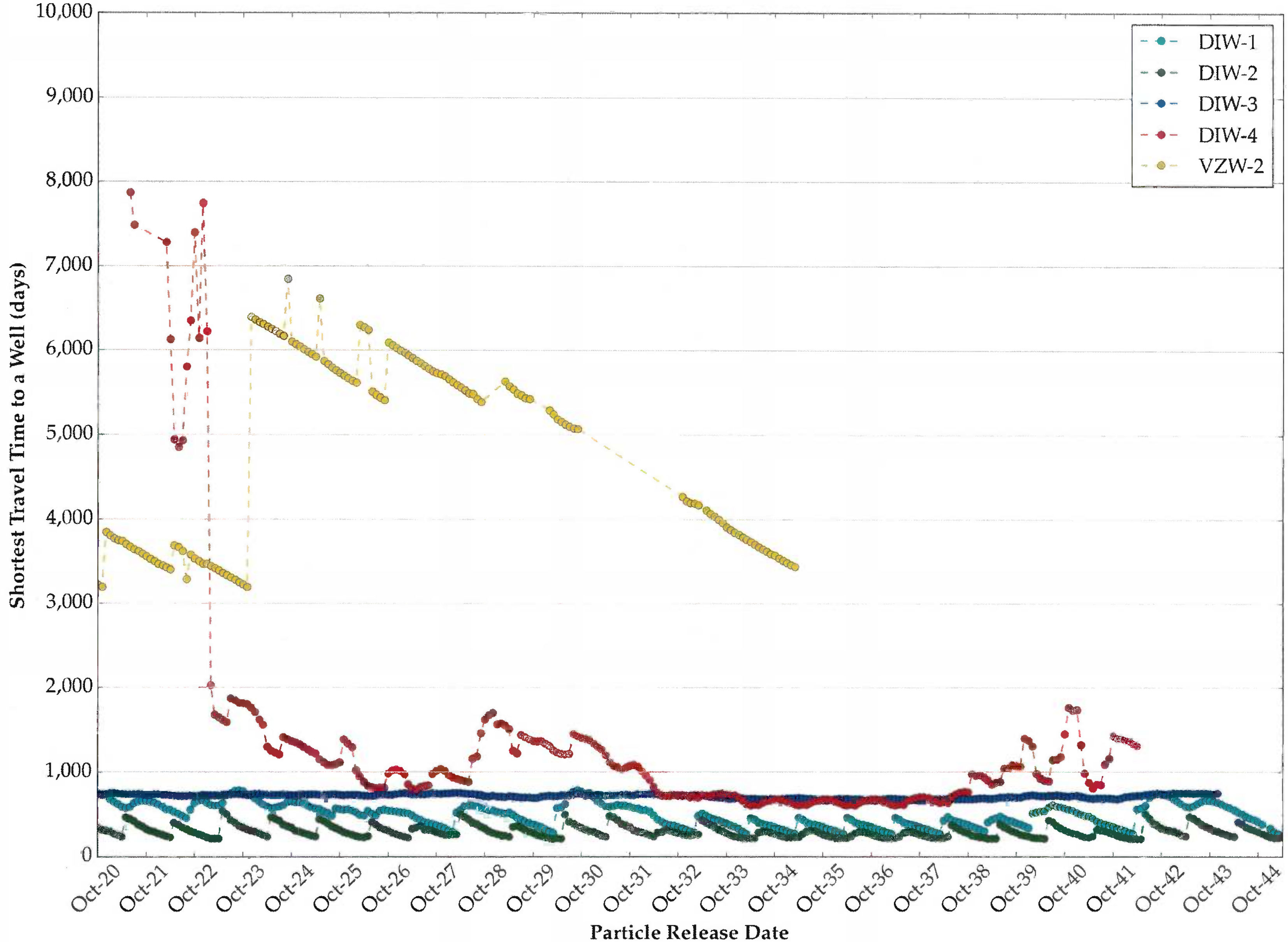

Figure 21: Shortest Travel Times to an Extraction Well

The production wells that capture particles released from the six injection locations are ASR 1&2, ASR 3&4, Seaside Muni #3, Ord Grove #2, Paralta, and Luzern. Table 3 shows the fastest travel times between each injection location and the six extraction wells. A value is not shown if there was no particle travelling between the two wells.

The fastest particles are those released from DIW-2 and captured at the ASR 1&2 Well Site. The fastest time any particle takes to travel from an injection well to a nearby extraction well is approximately 208 days. This is approximately 37% faster than the shortest travel time modeled for the EIR. The second-fastest travel time is 269 days, for a particle released from DIW-1 and captured at ASR 1&2. The fastest particles released at DIW-3 and DIW-4 take more than 1.5 years to reach an extraction well; the fastest particles released at VZW-2 take more than eight years.

Table 3: Fastest Travel Times between Injection and Extraction Wells, in days

Extraction well	Well of Origin					
	DIW-1	DIW-2	DIW-3	DIW-4	VZW-1	VZW-2
ASR 1&2	269	208	1678	-	-	-
ASR 3&4	1392	3506	4180	1063	-	-
Seaside Muni #3	-	-	1788	-	-	-
Luzern	-	-	-	-	-	3192
Ord Grove	2400	546	656	3083	-	-
Paralta	404	658	3185	598	-	-

Note: — = no particle traveling between wells

Table 4 shows the percent of particles injected at each of the injection locations that were captured by each extraction well. This table only shows the fate of the captured particles – not the fate of all particles. As a result, the columns add to 100% for each scenario, even though most of the particles released from the vadose zone wells were not captured by the end of the simulation. The Paralta and Ord Grove 2 wells capture the greatest share of the particles even though it takes considerably longer for particles to travel to these two wells, as shown in Table 3.

Table 4: Percent of Particles Travel between Injection and Extraction Wells

Extraction well	Well of Origin					
	DIW-1	DIW-2	DIW-3	DIW-4	VZW-1	VZW-2

ASR 1&2	23.9%	47.6%	0.6%	-	-	-
ASR 3&4	6.1%	0.6%	3.2%	42.2%	-	-
Seaside Muni #3	-	-	2.9%	-	-	-
Luzern	-	-	-	-	-	100%
Ord Grove	0.7%	46.8%	90.6%	4.6%	-	-
Paralta	69.3%	5.0%	2.7%	53.2%	-	-

Note: — = no particle traveling between wells

We emphasize that the travel times shown in Table 3 are the shortest travel times observed in the simulation and do not represent a typical travel time for the corresponding injection-extraction well pair. Histograms of travel times from DIW-1 and DIW-2 to ASR 1&2 are presented on Figure 22 and show that most of the particles released at these wells take over one year to reach the ASR 1&2 wells. Statistics for these travel times are presented in Table 5; the median travel times for both DIW-1 and DIW-2 are greater than one year and 75% of the particles from both wells take over 300 days to reach ASR 1&2. Approximately 99.8% of the particles released from wells DIW-1 and DIW-2 take more than 250 days before arriving at the ASR &2 wells. And this represents only the fastest moving particles in the model. Other particles take longer to reach an extraction well. Therefore, well over 99.9% of the particles take more than 250 days to reach an extraction well.

Table 5: Statistics for Travel Times from DIW-2 and DIW-1 to ASR 1&2

Well of origin	Percentile of travel time to ASR 1&2 (days)		
	25th	50th	75th
DIW 2	322	458	679
DIW 1	365	417	498

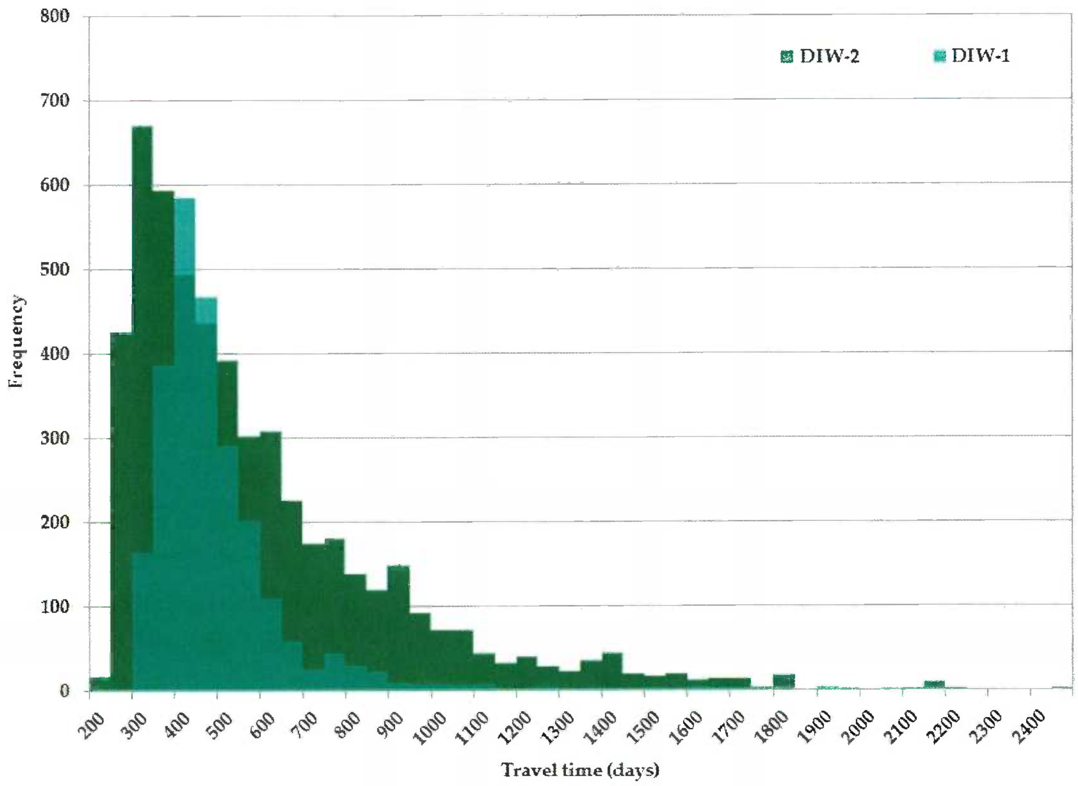

Figure 22: Histograms of Travel Times from DIW-1 and DIW-2 to ASR 1&2

Figure 23 and Figure 24 show the path each particle takes from its initial injection location to either an extraction well or its final location when the simulation ends. Separate maps for paths originating from deep injection wells and paths originating from vadose zone wells are included (Figure 23 and 24, respectively). The particle tracks shown on each figure display the fate of particles that were released in the model period corresponding to May 2039. This date was selected because it is the release period with the fastest travel times.

The particle path figures show that the northwestern-directed groundwater flow field dominates the migration of particles from the vadose zone wells while the local dynamics of the many deep injection and extraction wells dominate the migration of the particles from the deep injection wells. There are several particle paths that fluctuate towards and away from the ASR wells before the particles are captured. These fluctuations are the result of the injection and extraction pattern at the ASR wells.

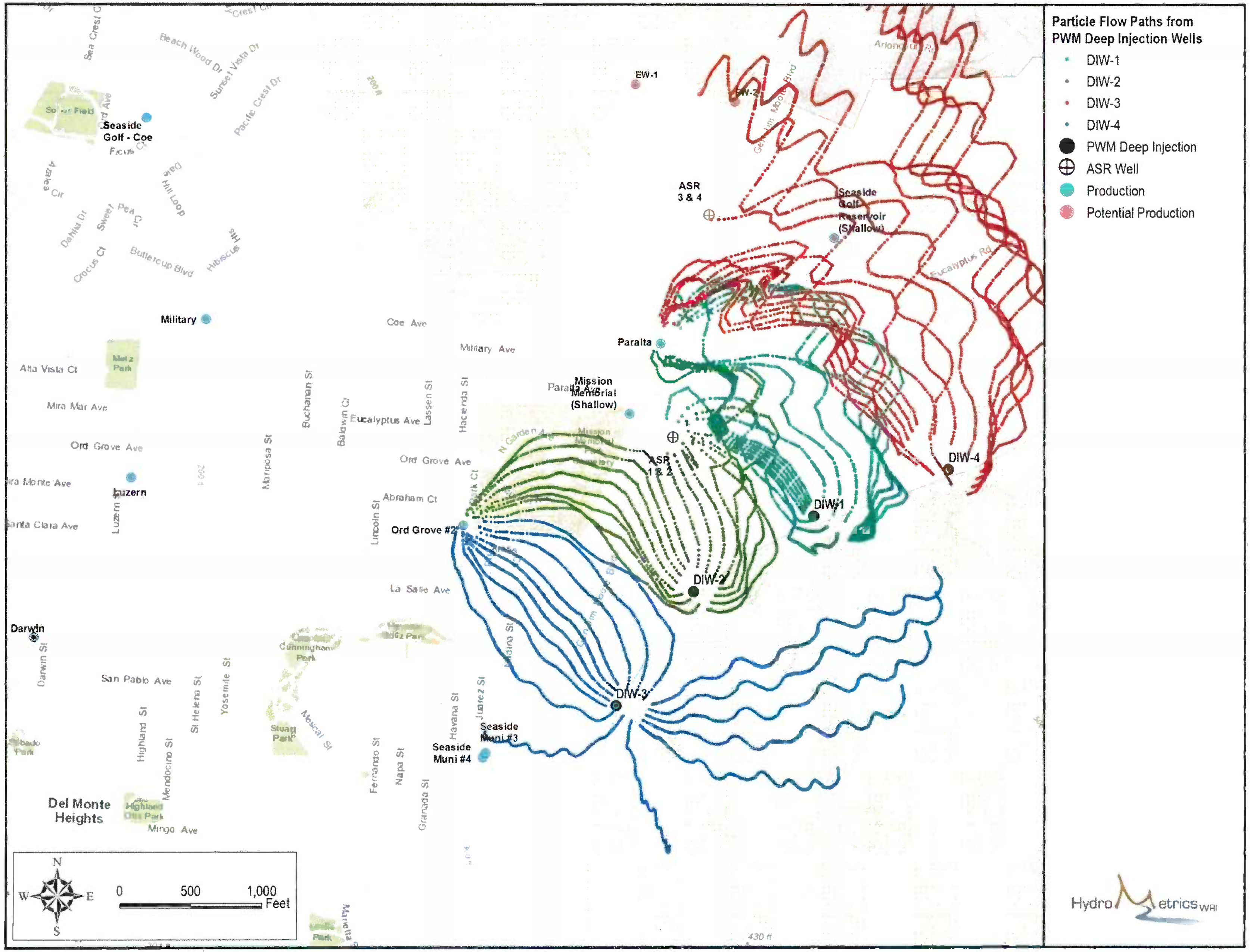

Figure 23: Particle Paths from a Single Release in Deep Injection Wells 1 through 4

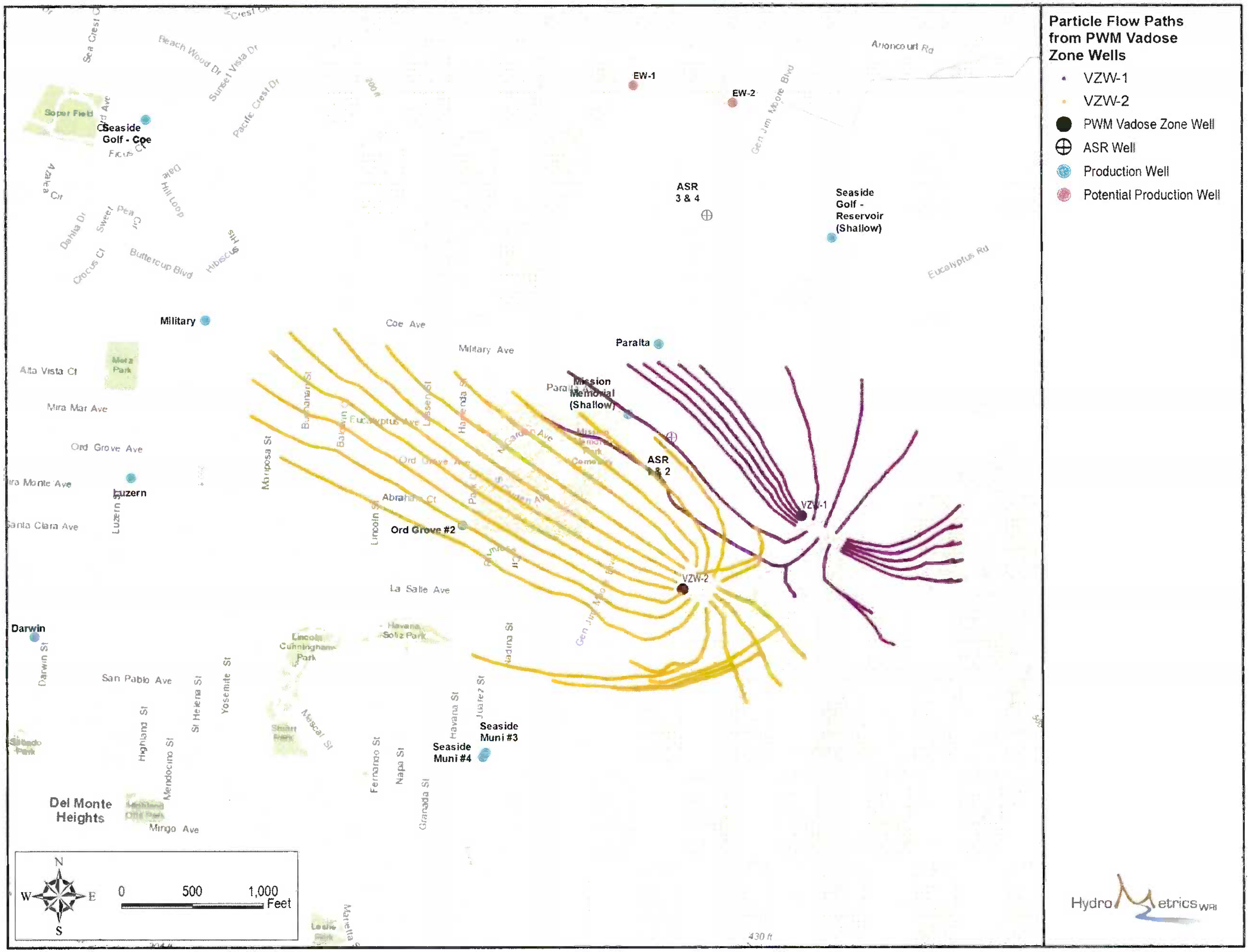

Figure 24: Particle Paths from a Single Release in Vadose Zone Wells 1 and 2

Figure 25 and Figure 26 show the greatest particle extent from each injection location at four separate times. Separate maps for particles originating from deep injection wells and particles originating from vadose zone wells are included (Figure 25 and 26, respectively). Four times are shown: 90 days elapsed since release (yellow), 180 days (red), 270 days (magenta), and 360 days (blue). These contours show the same general spatial pattern as Figure 23 and Figure 24 but represent the extent of all particles at any time rather than individual paths. The third (magenta) and fourth (blue) contours surrounding DIW-1 and DIW-2 intersect the ASR 1&2 site. This indicates that the fastest particles released at DIW-1 and DIW-2 reached the ASR 1&2 site within 270 days of their release.

Figure 25: Travel Time Extents from Deep Injection Wells

Figure 26: Travel Time Extents from Vadose Zone Wells

Discussion of Travel Time Results

The fastest particle, with a travel time of 208 days, was injected at DIW-2 on May 1, 2039 (MY27), the first year after the 2035-2038 drought, and was captured at ASR 1&2 in late November of the same year. The particle was captured at the end of the sixth month of the ASR summer-fall extraction period. Groundwater levels at ASR 1&2 declined during the drought and reached a minimum in mid-2039 (Figure 13).

Changes to injection and extraction well operation, such as preferentially using extraction wells to the north (EW-1, EW-2, and/or ASR 5&6) rather than ASR 1&2, could increase travel times from PWM injection wells. For example, in late fall, when travel times from DIW-1 and DIW-2 are short, some of the PWM injection at DIW-1 and DIW-2 could be shifted to DIW-3 and DIW-4, which are farther away from the central group of extraction wells. Extraction could also be shifted from ASR 1&2 to ASR 5&6, EW-1, and/or EW-2, since these wells pump below their capacities for most of the Project. These changes could also be applied during drought periods, when ASR injection of Carmel River water is reduced.

References

California American Water v. City of Seaside et al. Monterey County Superior Court, Case Number M66343, filed in Monterey County Superior Court on March 27, 2006, amended on February 9, 2007.

HydroMetrics Water Resources Inc. 2009. *Seaside groundwater basin modeling and protective groundwater elevations*, prepared for Seaside basin watermaster, November, 151 p.

Lin, Edwin (Todd Groundwater). 2017. Personal communication re: PWM Phase 1 field data.

Planned 7.0 MGD Expansion Project Water Injection Schedule and CSIP Storage and Delivery Operation

Future Model Simulation Year	Future Water Year	Simulated Historical Climate Water Year	Salinas Station Precip (% of Ave.)	Drought Year Criteria (<75% of Average)	Injection Delivery Schedule	Injection Volume (AF)	Annual Recycled Water to CSIP (AF)	Drought Reserve Change (AF)	Cumulative Drought Reserve (AF)	PWM Injection Delivery Schedule (AFM) (of total monthly amount, 90% to four DIWs and 10% to two VZWs) Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Total
1	2021 (2020-21)	1995	131%		A	5,950	-	200	200	331	563	592	576	525	572	524	511	491	508	467	288	5,950
2	2022	1996	95%		A	5,950	-	200	400	331	563	592	576	525	572	524	511	491	508	467	288	5,950
3	2023	1997	123%		A	5,950	-	200	600	331	563	592	576	525	572	524	511	491	508	467	288	5,950
4	2024	1998	240%		A	5,950	-	200	800	331	563	592	576	525	572	524	511	491	508	467	288	5,950
5	2025	1999	98%		A	5,950	-	200	1,000	331	563	592	576	525	572	524	511	491	508	467	288	5,950
6	2026	2000	114%		B	5,750	-	-	1,000	297	530	558	542	495	538	524	511	491	508	467	288	5,750
7	2027	2001	93%		B	5,750	-	-	1,000	297	530	558	542	495	538	524	511	491	508	467	288	5,750
8	2028	2002	74%	Drought	F	4,750	1,200	(1,000)	-	297	530	558	542	495	538	360	342	327	339	298	124	4,750
9	2029	2003	94%		A	5,950	-	200	200	331	563	592	576	525	572	524	511	491	508	467	288	5,950
10	2030	2004	82%		A	5,950	-	200	400	331	563	592	576	525	572	524	511	491	508	467	288	5,950
11	2031	2005	148%		A	5,950	-	200	600	331	563	592	576	525	572	524	511	491	508	467	288	5,950
12	2032	2006	118%		A	5,950	-	200	800	331	563	592	576	525	572	524	511	491	508	467	288	5,950
13	2033	2007	73%	Drought	C	4,950	1,000	(800)	-	331	563	592	576	525	572	360	342	327	339	298	124	4,950
14	2034	2008	79%		A	5,950	-	200	200	331	563	592	576	525	572	524	511	491	508	467	288	5,950
15	2035	1987	60%	Drought	D	5,550	400	(200)	(0)	331	563	592	576	525	572	458	444	425	441	399	222	5,550
16	2036	1988	40%	Drought	E	5,750	200	-	(0)	331	563	592	576	525	572	491	477	458	474	433	255	5,750
17	2037	1989	63%	Drought	E	5,750	200	-	(0)	331	563	592	576	525	572	491	477	458	474	433	255	5,750
18	2038	1990	57%	Drought	E	5,750	200	-	(0)	331	563	592	576	525	572	491	477	458	474	433	255	5,750
19	2039	1991	88%		A	5,950	-	200	200	331	563	592	576	525	572	524	511	491	508	467	288	5,950
20	2040	1992	90%		A	5,950	-	200	400	331	563	592	576	525	572	524	511	491	508	467	288	5,950
21	2041	1993	140%		A	5,950	-	200	600	331	563	592	576	525	572	524	511	491	508	467	288	5,950
22	2042	1994	83%		A	5,950	-	200	800	331	563	592	576	525	572	524	511	491	508	467	288	5,950
23	2043	1995	131%		A	5,950	-	200	1,000	331	563	592	576	525	572	524	511	491	508	467	288	5,950
24	2044	1996	95%		B	5,750	-	-	1,000	297	530	558	542	495	538	524	511	491	508	467	288	5,750
25	2045	1997	123%		B	5,750	-	-	1,000	297	530	558	542	495	538	524	511	491	508	467	288	5,750

	6.5 MGD Injection Delivery Schedule (AF/month)			Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Total
Bob Scen B12	before drought reserve complete	wet/normal year	A	331	563	592	576	525	572	524	511	491	508	467	288	5,950
Bob Scen B12 (less 200 AF Oct-Mar)	after drought reserve complete	wet/normal year	B	297	530	558	542	495	538	524	511	491	508	467	288	5,750
Bob Scen B12 (less 1,000 AF Apr-Sep)	before drought reserve complete	drought year (1,000 AF to CSIP)	C	331	563	592	576	525	572	360	342	327	339	298	124	4,950
Bob Scen B12 (less 400 AF Apr-Sep)	before drought reserve complete	drought year (400 AF to CSIP)	D	331	563	592	576	525	572	458	444	425	441	399	222	5,550
Bob Scen B12 (less 200 AF Apr-Sep)	before drought reserve complete	drought year (200 AF to CSIP)	E	331	563	592	576	525	572	491	477	458	474	433	255	5,750
3ob Scen B12 (less 200 AF Oct-Mar and 1,000 AF Apr-Sep)	after drought reserve complete	drought year (1,000 AF to CSIP)	F	297	530	558	542	495	538	360	342	327	339	298	124	4,750

Appendix A

Table A-1: Monthly Cal-Am Table 13 Diversion

Model Date	Table 13 Diversion (AF)
Oct-16	0
Nov-16	0
Dec-16	0
Jan-17	103.2
Feb-17	94.6
Mar-17	124.7
Apr-17	129
May-17	133.3
Jun-17	0
Jul-17	0
Aug-17	0
Sep-17	0
Oct-17	0
Nov-17	0
Dec-17	0
Jan-18	38.7
Feb-18	124.7
Mar-18	133.3
Apr-18	103.2
May-18	12.9
Jun-18	0
Jul-18	0
Aug-18	0
Sep-18	0
Oct-18	0
Nov-18	0
Dec-18	77.4
Jan-19	133.3
Feb-19	120.4
Mar-19	21.5
Apr-19	0

Model Date	Table 13 Diversion (AF)
May-19	0
Jun-19	0
Jul-19	0
Aug-19	0
Sep-19	0
Oct-19	0
Nov-19	0
Dec-19	25.8
Jan-20	107.5
Feb-20	120.4
Mar-20	133.3
Apr-20	129
May-20	133.3
Jun-20	0
Jul-20	0
Aug-20	0
Sep-20	0
Oct-20	0
Nov-20	0
Dec-20	0
Jan-21	21.5
Feb-21	103.2
Mar-21	94.6
Apr-21	129
May-21	64.5
Jun-21	0
Jul-21	0
Aug-21	0
Sep-21	0
Oct-21	0
Nov-21	0

Model Date	Table 13 Diversion (AF)
Dec-21	0
Jan-22	38.7
Feb-22	111.8
Mar-22	133.3
Apr-22	68.8
May-22	0
Jun-22	0
Jul-22	0
Aug-22	0
Sep-22	0
Oct-22	0
Nov-22	0
Dec-22	0
Jan-23	30.1
Feb-23	73.1
Mar-23	120.4
Apr-23	38.7
May-23	0
Jun-23	0
Jul-23	0
Aug-23	0
Sep-23	0
Oct-23	0
Nov-23	0
Dec-23	47.3
Jan-24	51.6
Feb-24	0
Mar-24	0
Apr-24	0
May-24	0
Jun-24	0

Model Date	Table 13 Diversion (AF)
Jul-24	0
Aug-24	0
Sep-24	0
Oct-24	0
Nov-24	0
Dec-24	73.1
Jan-25	107.5
Feb-25	0
Mar-25	21.5
Apr-25	77.4
May-25	86
Jun-25	0
Jul-25	0
Aug-25	0
Sep-25	0
Oct-25	0
Nov-25	0
Dec-25	8.6
Jan-26	21.5
Feb-26	60.2
Mar-26	64.5
Apr-26	0
May-26	0
Jun-26	0
Jul-26	0
Aug-26	0
Sep-26	0
Oct-26	0
Nov-26	0
Dec-26	12.9
Jan-27	133.3
Feb-27	120.4
Mar-27	133.3
Apr-27	129
May-27	98.9

Model Date	Table 13 Diversion (AF)
Jun-27	0
Jul-27	0
Aug-27	0
Sep-27	0
Oct-27	0
Nov-27	0
Dec-27	4.3
Jan-28	86
Feb-28	8.6
Mar-28	133.3
Apr-28	129
May-28	133.3
Jun-28	0
Jul-28	0
Aug-28	0
Sep-28	0
Oct-28	0
Nov-28	0
Dec-28	0
Jan-29	0
Feb-29	8.6
Mar-29	8.6
Apr-29	0
May-29	0
Jun-29	0
Jul-29	0
Aug-29	0
Sep-29	0
Oct-29	0
Nov-29	0
Dec-29	0
Jan-30	43
Feb-30	107.5
Mar-30	55.9
Apr-30	0

Model Date	Table 13 Diversion (AF)
May-30	0
Jun-30	0
Jul-30	0
Aug-30	0
Sep-30	0
Oct-30	0
Nov-30	0
Dec-30	0
Jan-31	0
Feb-31	8.6
Mar-31	0
Apr-31	0
May-31	0
Jun-31	0
Jul-31	0
Aug-31	0
Sep-31	0
Oct-31	0
Nov-31	0
Dec-31	0
Jan-32	0
Feb-32	0
Mar-32	0
Apr-32	0
May-32	0
Jun-32	0
Jul-32	0
Aug-32	0
Sep-32	0
Oct-32	0
Nov-32	0
Dec-32	0
Jan-33	0
Feb-33	0
Mar-33	0

Model Date	Table 13 Diversio n (AF)
Apr-33	0
May-33	0
Jun-33	0
Jul-33	0
Aug-33	0
Sep-33	0
Oct-33	0
Nov-33	0
Dec-33	0
Jan-34	0
Feb-34	0
Mar-34	0
Apr-34	0
May-34	0
Jun-34	0
Jul-34	0
Aug-34	0
Sep-34	0
Oct-34	0
Nov-34	0
Dec-34	0
Jan-35	0
Feb-35	0
Mar-35	60.2
Apr-35	21.5
May-35	0
Jun-35	0
Jul-35	0
Aug-35	0
Sep-35	0
Oct-35	0
Nov-35	0
Dec-35	0
Jan-36	0
Feb-36	81.7

Model Date	Table 13 Diversio n (AF)
Mar-36	103.2
Apr-36	0
May-36	0
Jun-36	0
Jul-36	0
Aug-36	0
Sep-36	0
Oct-36	0
Nov-36	0
Dec-36	0
Jan-37	111.8
Feb-37	120.4
Mar-37	133.3
Apr-37	116.1
May-37	0
Jun-37	0
Jul-37	0
Aug-37	0
Sep-37	0
Oct-37	0
Nov-37	0
Dec-37	0
Jan-38	0
Feb-38	30.1
Mar-38	0
Apr-38	0
May-38	0
Jun-38	0
Jul-38	0
Aug-38	0
Sep-38	0
Oct-38	0
Nov-38	0
Dec-38	0
Jan-39	103.2

Model Date	Table 13 Diversio n (AF)
Feb-39	94.6
Mar-39	124.7
Apr-39	129
May-39	133.3
Jun-39	0
Jul-39	0
Aug-39	0
Sep-39	0
Oct-39	0
Nov-39	0
Dec-39	0
Jan-40	38.7
Feb-40	124.7
Mar-40	133.3
Apr-40	103.2
May-40	12.9
Jun-40	0
Jul-40	0
Aug-40	0
Sep-40	0
Oct-40	0
Nov-40	0
Dec-40	77.4
Jan-41	133.3
Feb-41	120.4
Mar-41	21.5
Apr-41	0
May-41	0
Jun-41	0
Jul-41	0
Aug-41	0
Sep-41	0
Oct-41	0
Nov-41	0
Dec-41	25.8

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Appendix B

Conveyance and Reservoir Operations Evaluation TM

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3 April 2018

Technical Memorandum

To: Mr. Bob Holden, Monterey One Water

From: Craig Lichty, Project Director
Rod Houser, Conveyance/Injection System Hydraulics Leader
Chantelle Garvin, Hydraulic Modeler

Subject: Conveyance and Reservoir Operations Evaluation
K/J 1668001*61

Introduction

As part of Monterey One Water (M1W) Request for Service No. 2018-05, Kennedy/Jenks Consultants is helping (M1W) explore the expansion of the Pure Water Monterey Groundwater Replenishment Program (PWMGWR). The primary objective of this Conveyance and Reservoir Operations Evaluation is to understand if the facilities currently under construction will experience operational constraints in maintaining adequate storage volume and service pressure during multi-day simulations of various operating scenarios. If, operational constraints are observed, mitigation strategies are identified for consideration by M1W.

Facilities Overview

The facilities involved in this evaluation include the:

- Advance Water Purification Facility (AWPF) – this facility generates 7 MGD of purified water.
- Product Water Pump Station (PWPS) – this facility pumps 7 MGD of purified water from the AWPF into the Conveyance System.
- Conveyance System – this system includes the Conveyance Pipeline and Storage Reservoir:
    - The Conveyance Pipeline includes new and existing pipelines. The majority of the 9-mile long pipeline is new 24-inch diameter pipe. However, several sections of pipe exist and range in size from 14 to 20-inches in diameter. The evaluation will explore if the smaller existing pipe sections create a hydraulic constraint.
    - The Storage Reservoir is a 2 MG above ground steel tank, located at the high point in the system.
    - The conveyance system serves two functions. First, it provides purified water for groundwater injection. Second, it provides Marina Coast Water District (MCWD) with irrigation water in accordance with an inter-agency Agreement between MCWD and M1W. The irrigation demand is seasonal and varies from essentially zero during wet weather to a peak demand of 1.31 MGD (910 gpm) during the

months of June and July.

- Injection Facilities – the injection facilities will include 4 deep injection wells and 2 shallow vadose zone wells, associated backwash pumps and a percolation basin for backwash water disposal (percolation into the vadose zone). In order to avoid water column separation in the wells during injection, a minimum pressure of 5 psi is required at the well head. The 4 well sites vary in ground surface elevation. Well Site 1 is the highest at elevation 460 feet and Well Site 4 is the lowest at elevation 310 feet. The evaluation will explore if there are challenges in maintaining the 5 psi minimum pressure requirement at any of the wells, especially Well Site 1.

Modeling Scenarios

Hydraulic modeling is being performed using Bentley WaterCAD CONNECT software. Design drawings for the conveyance pipeline and Blackhorse tank were used as the basis for pipe diameters and tank geometry[i]. Performance criteria and modelling assumptions are described under each scenario description.

Three modeling scenarios are examined assuming 7 MGD is pumped into the conveyance system by the PWPS, and each scenario considers operations with zero irrigation and peak day irrigation demands.

Scenario 1 Winter – determines if the conveyance system can adequately convey 7 MGD to the injection wells and maintain a minimum pressure of 5 psi at each wellhead.

Scenario 1 Summer - determines if the conveyance system can convey 7 MGD, meet MCWD's 1.31 MGD Peak Day Irrigation Demand, and deliver 5.69 MGD to the injection wells while maintaining a minimum pressure of 5 psi at each wellhead.

Scenario 2 Winter and Summer – These scenarios will evaluate the improvement in system performance under Scenario 1 winter and summer conditions, assuming all of the existing segments of the conveyance pipeline between the Blackhorse Reservoir and the injection well field (7,466 lf) are reconstructed/upsized to 24-inches in diameter.

Scenario 3 Winter and Summer – These scenarios optimize system performance by upsizing the minimum number of existing pipeline sections to 24-inches in diameter.

Summary of Results

Scenario 1 – shows the system does not meet minimum pressure requirements at Well Site #1 (negative pressures) and the pressure at Well Site #2 are marginal. This indicates that the existing sections of pipe in the Conveyance Pipeline are creating too much headloss. Two options can be considered to increase pressure. One option is to upsize existing sections of the conveyance pipeline to 24-inches in diameter, and this will be explored under Scenarios 2 and 3. Another option would be to provide a booster pump station just upstream of Well Site #2 to improve pressure performance and provide operating flexibility to maintain minimum pressures at Well Sites #1 and #2. The booster pump station would be sized for the maximum operating condition, which would be during the winter when either Well Site #3 or #4 was in backwash mode. Under this condition, the 7-mgd (4861 gpm) injection rate could be redistributed to the remaining 3 deep injection wells in operation. Each of the three operating wells would be injecting 1,620 gpm (4861 gpm/3 wells = 1620 gpm/well). So, the booster pump station would need to convey approximately 1620 gpm X 2 wells = 3,200 gpm and require approximately 100 HP. The size and capacity of the facility would need to be confirmed following operation of the conveyance system to confirm/calibrate pressures with the model.

Scenario 2 shows that all performance requirements can be met by upsizing all sections of existing pipe in the Conveyance System. This would provide the greatest operating flexibility for future capacity expansions, but would require significant capital expenditures in comparison to the booster pump station option under Scenario 1.

Scenario 3 demonstrates that the performance requirements of the system can be met, by upsizing 5,908 lf of existing pipe to 24-inch diameter, or by installing a new booster pump station in the well field. The sections of upgraded pipe are shown on Attachment C. This option would also require significant capital expenditures in comparison to the booster pump station option under Scenario 1.

Factor of Safety – this evaluation provides for a modest factor of safety on the model results. The initial reservoir level was assumed to be mid-point of operating range. If the starting elevation were 75% or 100% of operating range, the pressure values at the well site might increase 2-4 psi.

General Recommendation - The actual C Factor of the new and existing pipelines may differ from those in the model assumption. It is suggested that the model be calibrated following start-up of the system, to validate pressure expectations at Well Site #1 and #2. If pressures are greater than shown in this evaluation, it might be possible to downsize the booster pump station or eliminate or defer the replacement of all or part of the existing 20" pipeline replacement.

A summary of results is presented in Table 1.

Table 1: Summary of Modeling Results

	Scenario 1 Summer	Scenario 2 Summer	Scenario 3 Summer
Production [MGD]	7.0	7.0	7.0
Irrigation Demands (MDD) [MGD]	1.31	1.31	1.31
Injection Rate (164 hrs/wk) [gpm/Well Site]	987	987	987
Injection Rate (4 hrs/wk) [gpm/Well Site]	1,316	1,316	1,316
Pipe Upgrades [LF]	NA	7,466[1]	5,908[2]
Tank Level Range (0 to 31) [ft]	7 to 20	7 to 20	7 to 20
Pressure (Well Site #1) [psi]	-12 to -3	8 to 14	5 to 13
Pressure (Well Site #2) [psi]	9 to 17	28 to 35	25 to 33
	Scenario 1 Winter	**Scenario 2 Winter**	**Scenario 3 Winter**
Production [MGD]	7.0	7.0	7.0
Irrigation Demands (MDD)[MGD]	0	0	0
Injection Rate (164 hrs/wk/well site) [gpm/well site]	1,215	1,215	1,215
Injection Rate (4 hrs/wk/well site) [gpm/well site]	1,620	1,620	1,620
Pipe Upgrades [LF]	NA	7,466[1]	5,908[2]
Tank Level (0 to 31) [ft]	17	17	17
Pressure (Well Site #1) [psi]	-16 to -14	9 to 12	7 to 10
Pressure (Well Site #2) [psi]	4 to 6	30 to 32	28 to 30

Notes:
[1] (e) RW piping replaced: 387 lf of 14" PVC, 3,906 lf of 16" PVC, and 3,173 lf of 20" PVC
[2] (e) RW piping replaced: 387 lf of 14" PVC, 3,906 lf of 16" PVC, and 1,615 lf of 20" PVC

Scenario 1 Information, Criteria and Assumptions

The following information, criteria and assumptions were used in evaluating Scenario 1.

Conveyance Pipeline

The conveyance pipeline will be modeled using actual inside diameters for PVC and ductile iron pipe, using a Hazen-Williams C factor of C=140 and C=130, for new and existing pipelines, respectively.

Site Plan

The general location of conveyance pipeline, reservoir and injection facilities included in this evaluation, along with the turnout locations for MCWD's irrigation system, are depicted on the Site Plan (Attachment A).

Reservoir

The 2 MG Blackhorse Reservoir will be modeled using a floor elevation of 485' and overflow elevation of 516'. These elevations were provided on design drawings prepared by Carollo Engineers (Attachment B). The centerline of the inlet/outlet nozzle is located 3'-4" above the tank floor, so we have assumed that the bottom four feet of the tank is 'dead storage'. The modeling scenario arbitrarily assumes a beginning reservoir water surface elevation of 502', which corresponds to the water level being at half the usable storage volume between elevation 489' (485' + 4' dead storage) and overflow elevation 516'. It is suggested M1W and Carollo Engineers confirm these assumptions are appropriate for how the reservoir is designed and planned to be operated.

Injection Wells

Well Sites #1, 2, 3 and 4 are assumed to have the elevations depicted on the hydraulic profile (Attachment C). In order to prevent water column separation during injection, the pressure at the wellhead must be 5 psi or more. The injection rate (3,948 gpm during the summer, and 4,860 gpm during the winter) is equally divided between the four wells. Each well is assumed to require 4 hours of backwashing weekly, and for purposes of this evaluation backwash is assumed to occur during irrigation periods and when the cost of power is lowest. During the 4-hour backwashing period, the flow from the backwashing well is redistributed to the other 3 wells in operation. The backwash schedule is assumed to be Monday, Tuesday, Thursday and Friday, between the hours of 12 am and 4 am, at a rate of 2,700 gpm. The backwash duration and rate information was provided by Todd Groundwater.

Infiltration Basin

Although not evaluated by the hydraulic model, the infiltration basin is anticipated to be designed to fill and percolate over a 24-hour period. The design for the Phase 1 Injection Facilities is being provided by Schaff and Wheeler, and they have determined the infiltration rate will range from approximately 5" per hour when the basin is full to approximately 4" per hour when it is partially full. The final backwash operational strategy and adequacy of the percolation basins to accept backwash water and drain before the next backwash cycle, needs to be reviewed for a 7.0 MGD/4-well configuration, during preliminary design of the expanded well field.

Irrigation Demands

The irrigation demands used in this evaluation were provided by the MCWD in 2016, and are included as Attachment D. The projected 2020 irrigation demands are 608 AF annually, and have a peak hour demand of 1.31 MGD that occurs over a 9-hour period between 9 pm and 6 am, daily. The diurnal curve for irrigation is shown as Attachment E. The dominant 2020 irrigation demand (1.07 MGD) is associated with the Bayonet and Blackhorse Golf Courses. For Winter scenarios, irrigation demands are assumed to be zero.

Model Timeline

The extended period simulation models operation of the system over 720 consecutive hours (30 days), assuming 7.0 MGD continuous production of purified water with time zero being set at 12 am.

Scenario 1 – Summer: Modeling Results

The scenario shows that there is adequate storage to serve the 2020 irrigation demands, however there is inadequate pressure at Well Site #1 (Attachment F). Model results are presented in Table 2.

Scenario 1 – Winter: Modeling Results

This scenario shows that there is adequate storage for 7.0 MGD production and zero irrigation demands, however there is inadequate pressure at Well Sites #1 and #2 (Attachment G). Model results are presented in Table 2.

Scenario 2 – Summer: Information, Criteria and Assumptions

This scenario uses the same information, criteria and assumptions as Scenario 1 - Summer, with the exception that the existing sections of conveyance pipeline between the Blackhorse Reservoir and the injection well field are assumed to be replaced with 24-inch diameter ductile iron pipe. The sections of existing and upgraded pipe are shown on Attachment C.

Scenario 2 – Summer: Modeling Results

This scenario shows that there is adequate storage to serve the 2020 irrigation demands and adequate pressure at Well Site #1 (Attachment H). Model results are presented in Table 2.

Scenario 2 – Winter: Information, Criteria and Assumptions

This scenario uses the same information, criteria and assumptions as Scenario 1 - Winter, with the exception that the existing sections of conveyance pipeline between the Blackhorse Reservoir and the injection well field (7,466 lf) are assumed to be replaced with 24-inch diameter ductile iron pipe. The sections of existing and upgraded pipe are shown on Attachment C.

Scenario 2 – Winter: Modeling Results

This scenario shows that there is adequate storage for 7.0 MGD production and zero irrigation demands, and adequate pressure at Well Sites #1 and #2 (Attachment I). Model results are presented in Table 2.

Scenario 3 – Summer: Information, Criteria and Assumptions

This scenario uses the same information, criteria and assumptions as Scenario 1 - Summer, with the exception that 5,908 lf of conveyance pipeline between the Blackhorse Reservoir and the injection well field are assumed to be replaced with 24-inch diameter ductile iron pipe (minimum pipe upgrades required to meet the criteria). The sections of existing and upgraded pipe are shown on Attachment C.

Scenario 3 – Summer: Modeling Results

This scenario shows that there is adequate storage to serve the 2020 irrigation demands, and adequate pressure at Well Site #1. Although pressure at Well Site #1 is greater than 5 psi (Attachment J), this EPS model does not include irrigation demands anticipated after 2020. Although they have not been quantified at this time, additional irrigation demands could reduce pressure at the well fields. To plan for additional irrigation demands, a 10 psi residual is recommended in leu of the 5 psi recommended in the current design (the current design considers anticipated demands beyond 2020, however, only Well Sites #2 and #3 are in operation).

Scenario 3 – Winter: Information, Criteria and Assumptions

This scenario uses the same information, criteria and assumptions as Scenario 1 - Winter, with the exception that 5,908 lf of conveyance pipeline between the Blackhorse Reservoir and the injection well field are assumed to be replaced with 24-inch diameter ductile iron pipe (minimum pipe upgrades required to meet the criteria). The sections of existing and upgraded pipe are shown on Attachment C.

Scenario 3 – Winter: Modeling Results

This scenario shows that there is adequate storage for 7.0 MGD production and zero irrigation demands, and adequate pressure at Well Sites #1 and #2 (Attachment K). Model results are presented in Table 2.

Table 2: Modeling Results

	Scenario 1- Summer	Scenario 1 - Winter	Scenario 2 - Summer	Scenario 2 - Winter	Scenario 3 - Summer	Scenario 3 - Winter
PWPS Production [MGD]	7.0	7.0	7.0	7.0	7.0	7.0
Blackhorse Reservoir [% full] (usable storage)	13 to 60	50	13 to 60	50	13 to 60	50
Pressure Range at Well Site #1 [psi]	-12 to -3	-16 to -14	8 to 14	9 to 12	5 to 13	7 to 10
Pressure Range at Well Site #2 [psi]	9 to 17	4 to 6	28 to 36	30 to 32	25 to 33	28 to 30
Pressure Range at Well Site #3 [psi]	32 to 41	28 to 30	52 to 58	54 to 55	49 to 57	52 to 53
Pressure Range at Well Site #4 [psi]	55 to 63	52	74 to 81	78	71 to 79	76
Pressure Range at Location C [psi]	129 to 136	135	129 to 136	135	129 to 136	135
Pressure Range at Location E [psi]	165 to 172	170	165 to 172	170	165 to 172	170
Pressure Range at Location H [psi]	115 to 121	120	115 to 121	120	115 to 121	120
Pressure Range at Location I [psi]	130 to 136	135	130 to 136	135	130 to 136	135
Pressure Range at Location N [psi]	57 to 66	63	61 to 68	66	58 to 66	64
Pressure Range at Location O [psi]	52 to 61	55	62 to 68	66	59 to 67	64
Average Injection Volume [MGD/gpm]	5.69/3,948	7.0/4,860	5.69/3,948	7.0/4,860	5.69/3,948	7.0/4,860
Average Injection Volume per Well Site [gpm]	987	1215	987	1215	987	1215

Enclosures:

Attachment A – Plan View
Attachment B – Carollo Tank Drawings
Attachment C – Hydraulic Profile
Attachment D – Irrigation Demands
Attachment E – Irrigation Diurnal Curve
Attachment F – Scenario 1 Summer – Well Head Pressure and Tank Level Graphs
Attachment G – Scenario 1 Winter – Well Head Pressure and Tank Level Graphs
Attachment H – Scenario 2 Summer – Well Head Pressure and Tank Level Graphs
Attachment I – Scenario 2 Winter – Well Head Pressure and Tank Level Graphs
Attachment J – Scenario 3 Summer – Well Head Pressure and Tank Level Graphs
Attachment K – Scenario 3 Winter – Well Head Pressure and Tank Level Graphs

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[i] Regional Urban Water Augmentation Project – Recycled Water Pipeline and Blackhorse Reservoir, Carollo Engineers, Volume No. 2, Addendum No. 1, May 19, 2017.

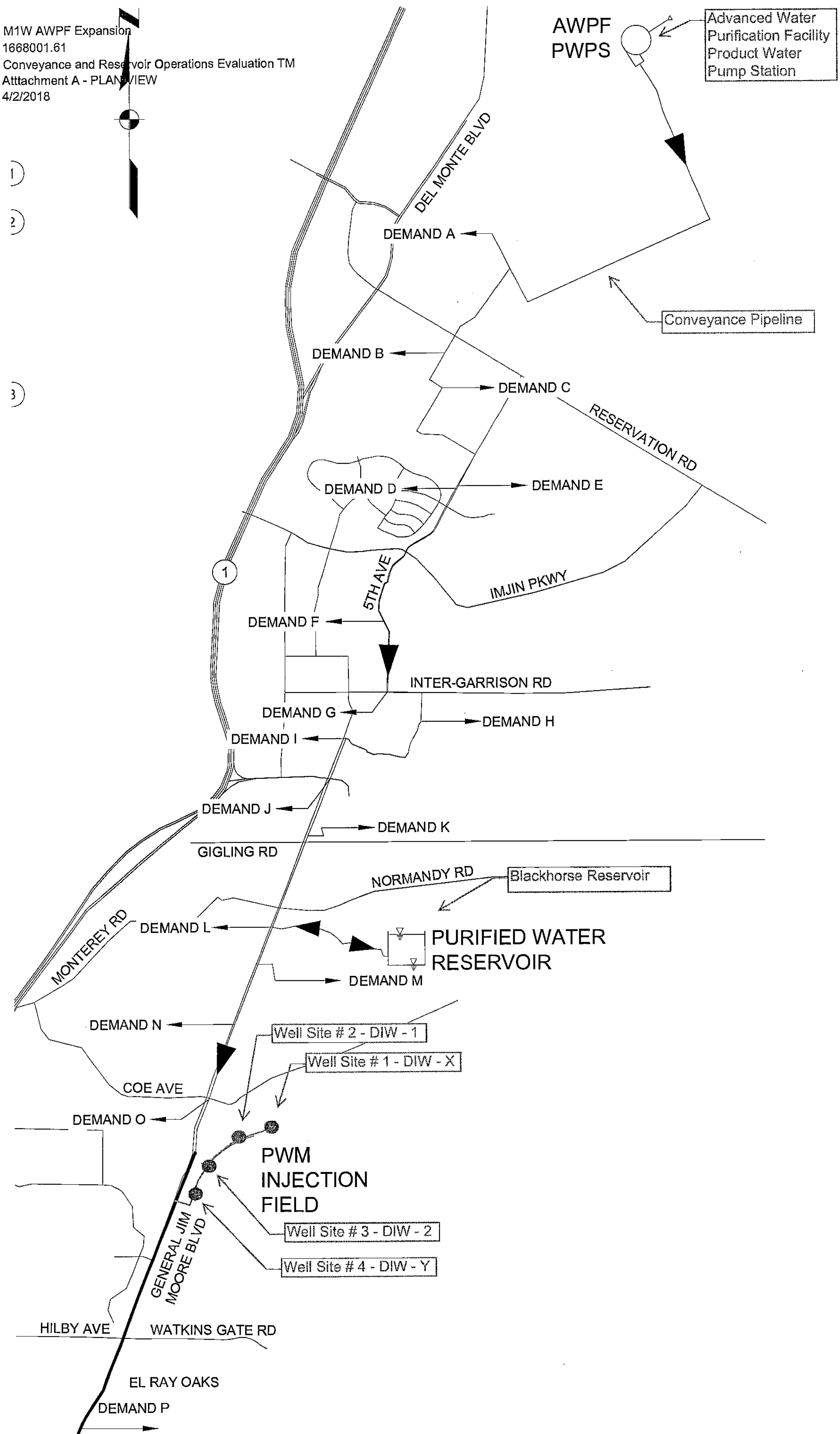
M1W AWPF Expansion

Conveyance and Reservoir Operations Evaluation TM

ATTACHMENT A

Plan View

M1W AWPF Expansion
1668001.61
Conveyance and Reservoir Operations Evaluation TM
Atttachment A - PLAN VIEW
4/2/2018

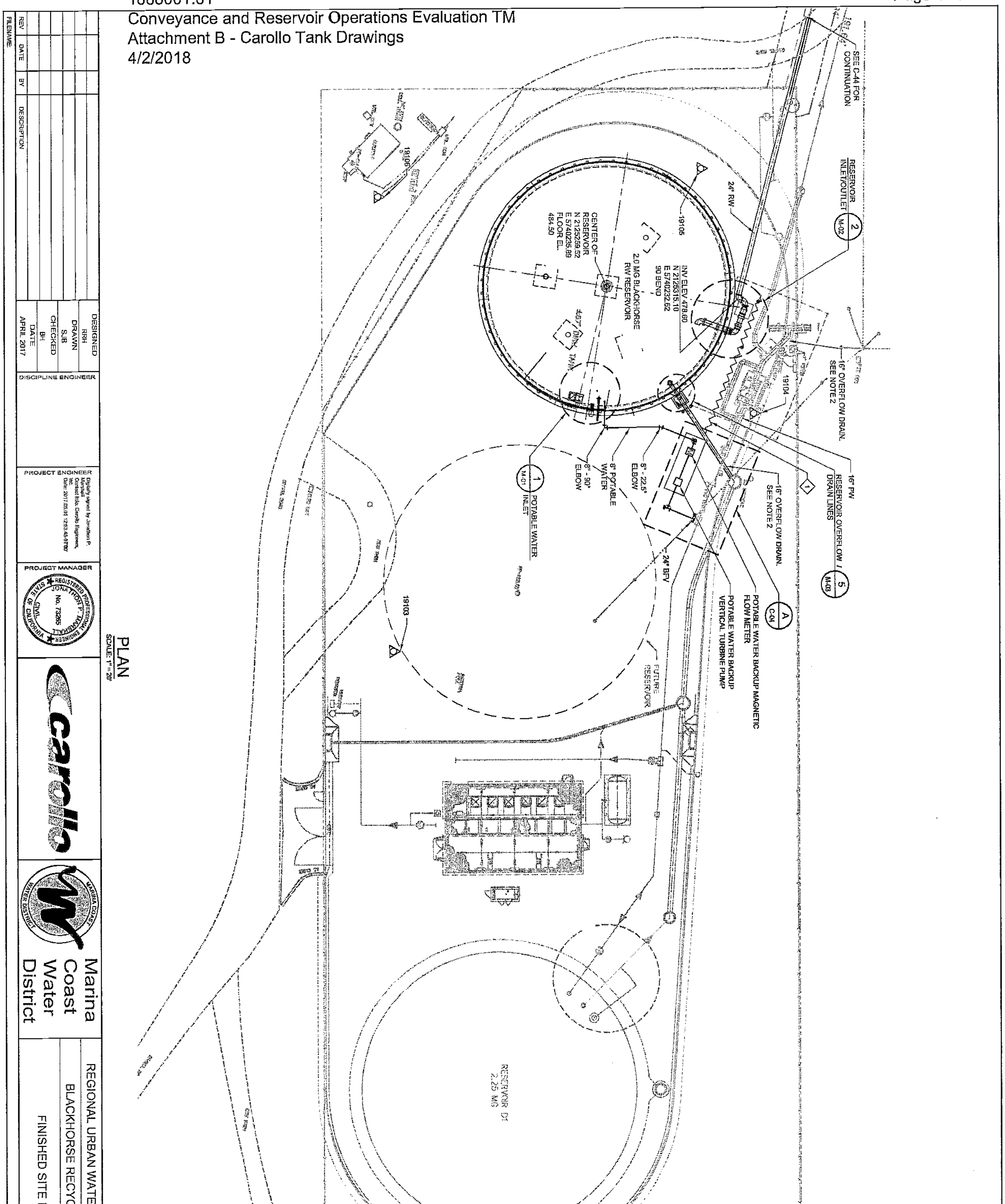


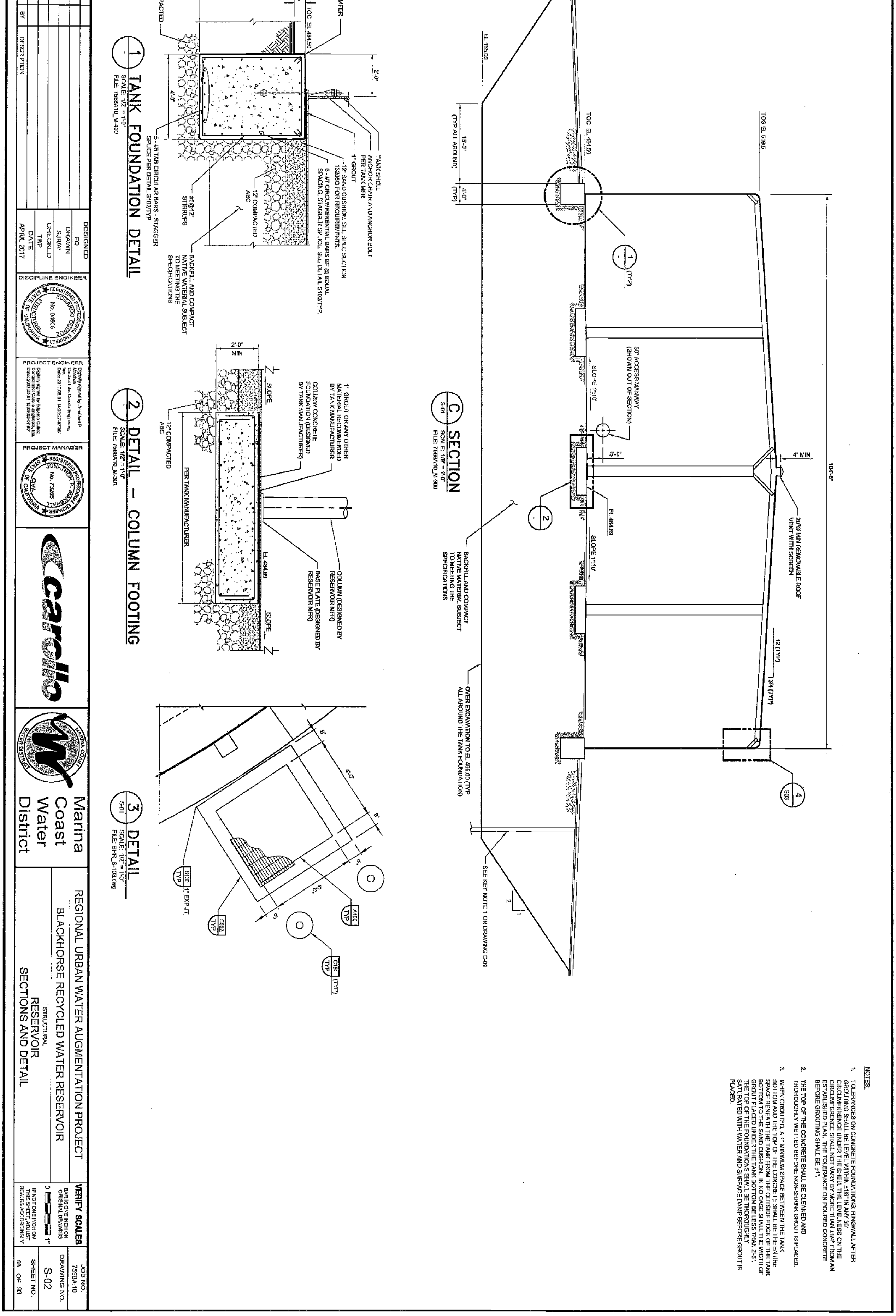
M1W AWPF Expansion

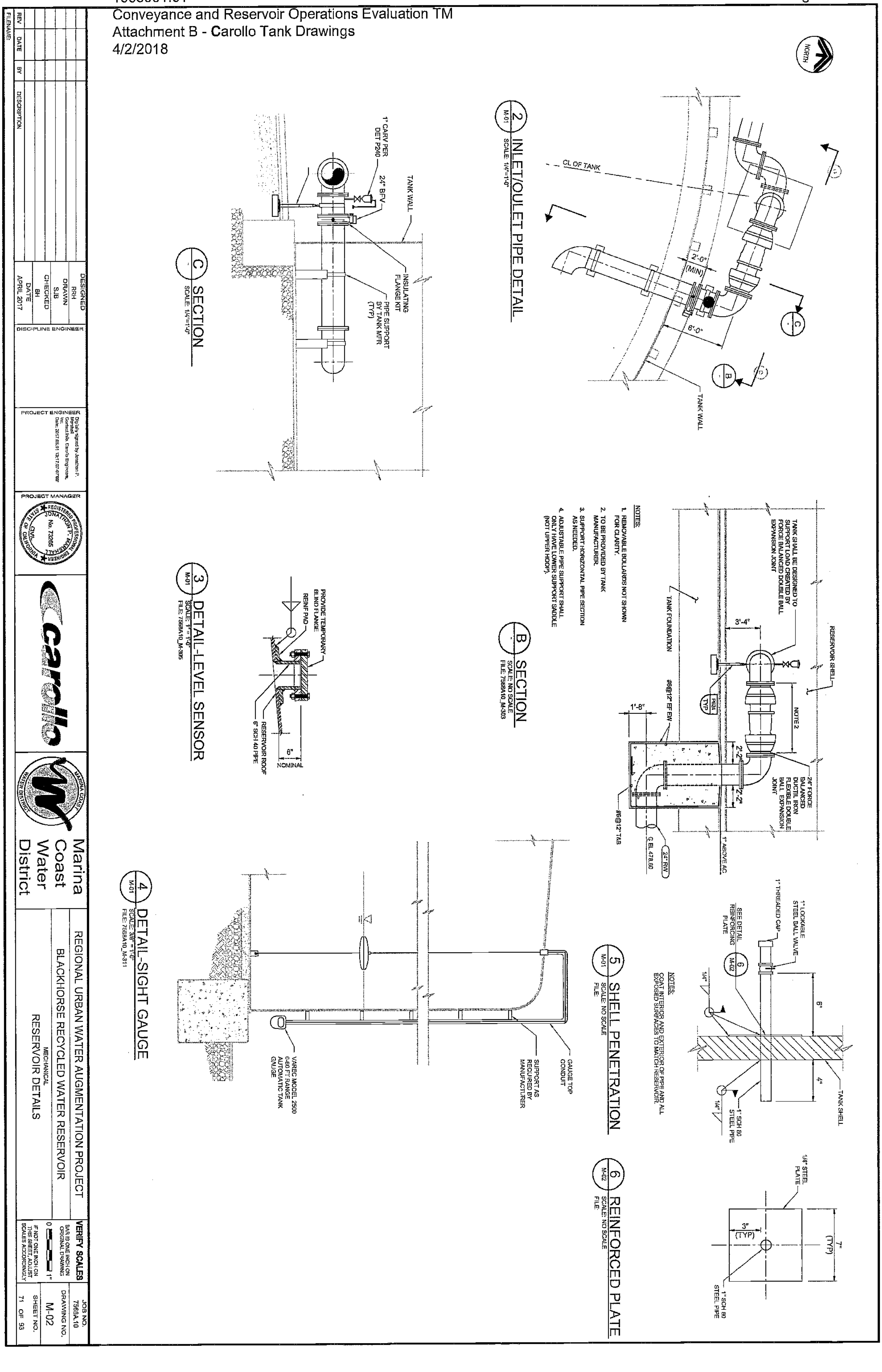
Conveyance and Reservoir Operations Evaluation TM

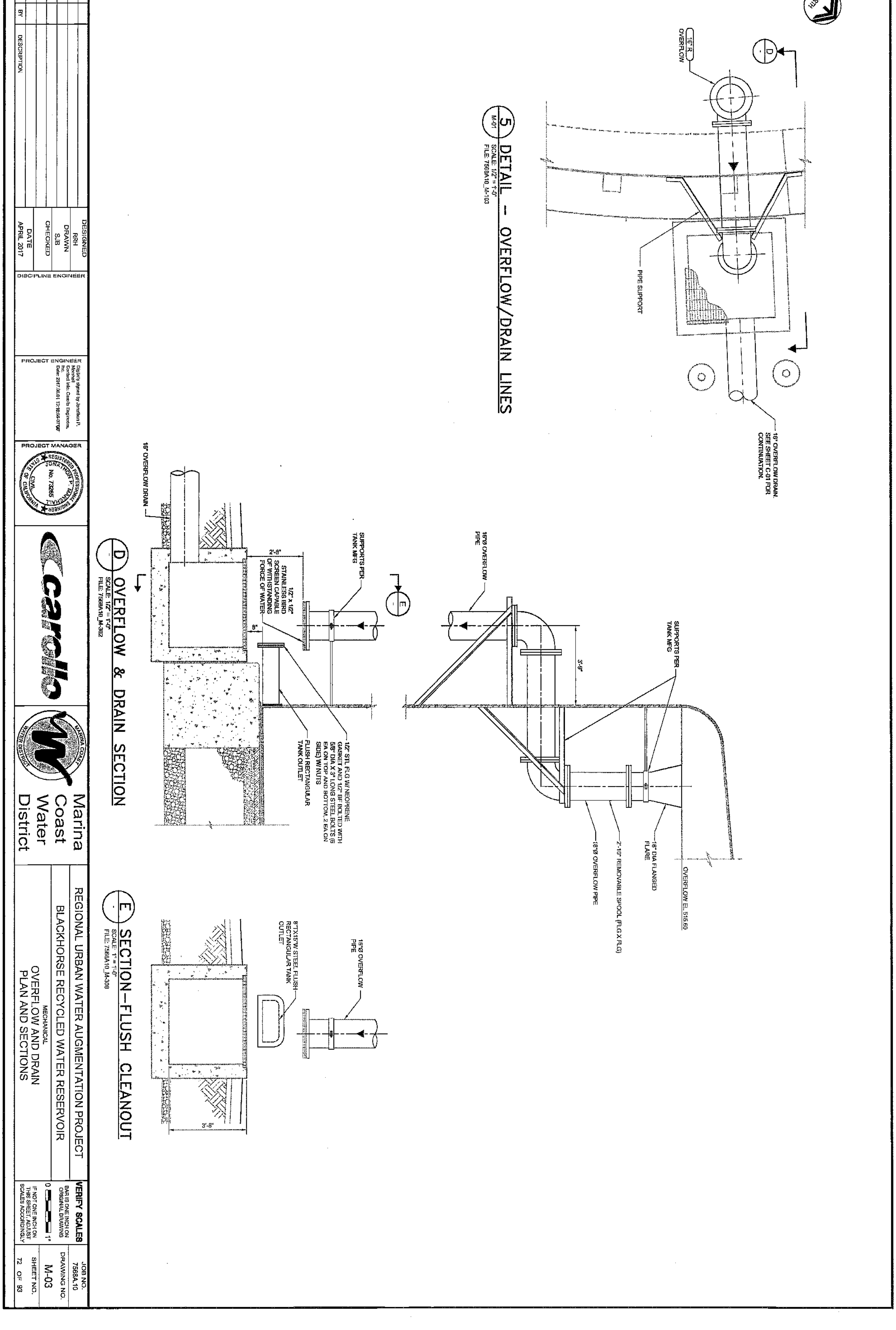
ATTACHMENT B

Carollo Tank Drawings


PLAN
SCALE: 1" = 20'
GENERAL NOTES
1. CONTRACTOR SHALL FIELD VERIFY ELEVATION OF ALL EXISTING PIPING AND ELECTRICAL DIRECT BURIED CABLES PRIOR TO CONSTRUCTION. PIPING AND UNDERGROUND INFRASTRUCTURE SHALL REMAIN IN SERVICE AT ALL TIMES. PROVIDE SHORING AS REQUIRED AND PROTECT ALL EXISTING UNDERGROUND INFRASTRUCTURE FROM DAMAGE DURING CONSTRUCTION.
2. SLOPE 16" OVERFLOW/DRAIN PIPE SUCH THAT IT PASSES BELOW THE 24" POTABLE WATER PIPING WITH A MINIMUM OF 12" OF CLEARANCE.
KEY NOTES
1 PROVIDE TEMPORARY SHORING AS REQUIRED TO PROTECT EXISTING UTILITIES DURING DEMOLITION OF EXISTING TANK AND DURING EXCAVATION FOR NEW TANK SUB-GRADE. SEE DRAWING S-02 FOR NEW TANK SUB-GRADE REQUIREMENTS. SHORING SHALL BE IN ACCORDANCE WITH SECTION 02260.
SEE C-44 FOR CONTINUATION
RESERVOIR INLET/OUTLET
24" RW
16" OVERFLOW DRAIN. SEE NOTE 2
16" PW
RESERVOIR OVERFLOW DRAIN LINES
16" OVERFLOW DRAIN. SEE NOTE 2
POTABLE WATER BACKUP MAGNETIC FLOW METER
POTABLE WATER BACKUP VERTICAL TURBINE PUMP
24" BFV
FUTURE RESERVOIR
INV ELEV 478.60
N 2125315.10
E 5740232.62
90 BEND
2.0 MG BLACKHORSE RW RESERVOIR
CENTER OF RESERVOIR
N 2125259.52
E 5740235.89
FLOOR EL. 484.50
8" POTABLE WATER
8" - 90° ELBOW
8" - 22.5° ELBOW
POTABLE WATER INLET
RESERVOIR D1
2.25 MG
NORTH
Marina Coast Water District
carollo
REGIONAL URBAN WATER AUGMENTATION PROJECT
BLACKHORSE RECYCLED WATER RESERVOIR
CIVIL
FINISHED SITE PLAN & YARD PIPING
VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY
JOB NO. 7568A.10
DRAWING NO. C-01
SHEET NO. 61 OF 93
DESIGNED RRH
DRAWN SJB
CHECKED BH
DATE APRIL 2017
DISCIPLINE ENGINEER
PROJECT ENGINEER
PROJECT MANAGER
REV DATE BY DESCRIPTION
FILENAME:


1 TANK FOUNDATION DETAIL
SCALE: 1/2" = 1'-0"
2 DETAIL – COLUMN FOOTING
SCALE: 1/2" = 1'-0"
3 DETAIL
SCALE: 1/2" = 1'-0"
C SECTION
SCALE: 1/8" = 1'-0"
TOC EL 484.50
TOS EL 519.5
EL 485.00
EL 484.89
30" ACCESS MANWAY (SHOWN OUT OF SECTION)
20"Ø MIN REMOVABLE ROOF VENT WITH SCREEN
BACKFILL AND COMPACT NATIVE MATERIAL SUBJECT TO MEETING THE SPECIFICATIONS
OVER EXCAVATION TO EL 485.00 (TYP ALL AROUND THE TANK FOUNDATION)
SEE KEY NOTE 1 ON DRAWING C-01
TANK SHELL
ANCHOR CHAIR AND ANCHOR BOLT PER TANK MFR
1" GROUT
12" COMPACTED ABC
COLUMN (DESIGNED BY RESERVOIR MFR)
BASE PLATE (DESIGNED BY RESERVOIR MFR)
PER TANK MANUFACTURER
NOTES:
1. TOLERANCES ON CONCRETE FOUNDATIONS, RINGWALL AFTER GROUTING SHALL BE LEVEL WITHIN ±1/8" IN ANY 30' CIRCUMFERENCE UNDER THE SHELL.
2. THE TOP OF THE CONCRETE SHALL BE CLEANED AND THOROUGHLY WETTED BEFORE NON-SHRINK GROUT IS PLACED.
3. WHEN GROUTED, A 1" MINIMUM SPACE BETWEEN THE TANK BOTTOM AND THE TOP OF THE CONCRETE SHALL BE THE ENTIRE SPACE BENEATH THE TANK FROM THE OUTSIDE EDGE OF THE TANK BOTTOM TO THE SAND CUSHION.
Marina Coast Water District
carollo
REGIONAL URBAN WATER AUGMENTATION PROJECT
BLACKHORSE RECYCLED WATER RESERVOIR
STRUCTURAL
RESERVOIR
SECTIONS AND DETAIL
VERIFY SCALES
JOB NO. 7569A.10
DRAWING NO. S-02
SHEET NO. 68 OF 93
DESIGNED
DRAWN
CHECKED
DATE APRIL 2017
REV DATE BY DESCRIPTION
FILENAME


INLET/OULET PIPE DETAIL
SCALE: 1/4"=1'-0"
SECTION
SCALE: 1/4"=1'-0"
SECTION
SCALE: NO SCALE
DETAIL-LEVEL SENSOR
DETAIL-SIGHT GAUGE
SHELL PENETRATION
SCALE: NO SCALE
REINFORCED PLATE
SCALE: NO SCALE
CL OF TANK
TANK WALL
2'-0" (MIN)
6'-0"
24" BFV
1" CARV PER DET P240
INSULATING FLANGE KIT
PIPE SUPPORT BY TANK MFR (TYP)
NOTES:
1. REMOVABLE BOLLARDS NOT SHOWN FOR CLARITY.
2. TO BE PROVIDED BY TANK MANUFACTURER.
3. SUPPORT HORIZONTAL PIPE SECTION AS NEEDED.
4. ADJUSTABLE PIPE SUPPORT SHALL ONLY HAVE LOWER SUPPORT SADDLE (NOT UPPER HOOP).
TANK SHELL SHALL BE DESIGNED TO SUPPORT LOAD CREATED BY FORCE BALANCED DOUBLE BALL EXPANSION JOINT
RESERVOIR SHELL
TANK FOUNDATION
3'-4"
1'-8"
24" FORCE BALANCED DUCTILE IRON FLEXIBLE DOUBLE BALL EXPANSION JOINT
1' ABOVE AC
PROVIDE TEMPORARY BLIND FLANGE
REINF PAD
RESERVOIR ROOF
6" SCH 40 PIPE
6" NOMINAL
GAUGE TOP CONDUIT
SUPPORT AS REQUIRED BY MANUFACTURER
VAREC MODEL 2500 0-60 FT RANGE AUTOMATIC TANK GAUGE
1" LOCKABLE STEEL BALL VALVE
1" THREADED CAP
SEE DETAIL REINFORCING PLATE
TANK SHELL
1" SCH 80 STEEL PIPE
NOTES:
COAT INTERIOR AND EXTERIOR OF PIPE AND ALL EXPOSED SURFACES TO MATCH RESERVOIR.
1/4" STEEL PLATE
3" (TYP)
7" (TYP)
NORTH
DESIGNED RRH
DRAWN SJB
CHECKED BI
DATE APRIL 2017
Marina Coast Water District
REGIONAL URBAN WATER AUGMENTATION PROJECT
BLACKHORSE RECYCLED WATER RESERVOIR
MECHANICAL
RESERVOIR DETAILS
VERIFY SCALES
JOB NO. 7565A.10
DRAWING NO. M-02
SHEET NO. 71 OF 93


DETAIL - OVERFLOW/DRAIN LINES
PIPE SUPPORT
16" OVERFLOW DRAIN. SEE SHEET C-01 FOR CONTINUATION.
OVERFLOW & DRAIN SECTION
SECTION-FLUSH CLEANOUT
Marina Coast Water District
REGIONAL URBAN WATER AUGMENTATION PROJECT
BLACKHORSE RECYCLED WATER RESERVOIR
MECHANICAL
OVERFLOW AND DRAIN PLAN AND SECTIONS
VERIFY SCALES
M-03

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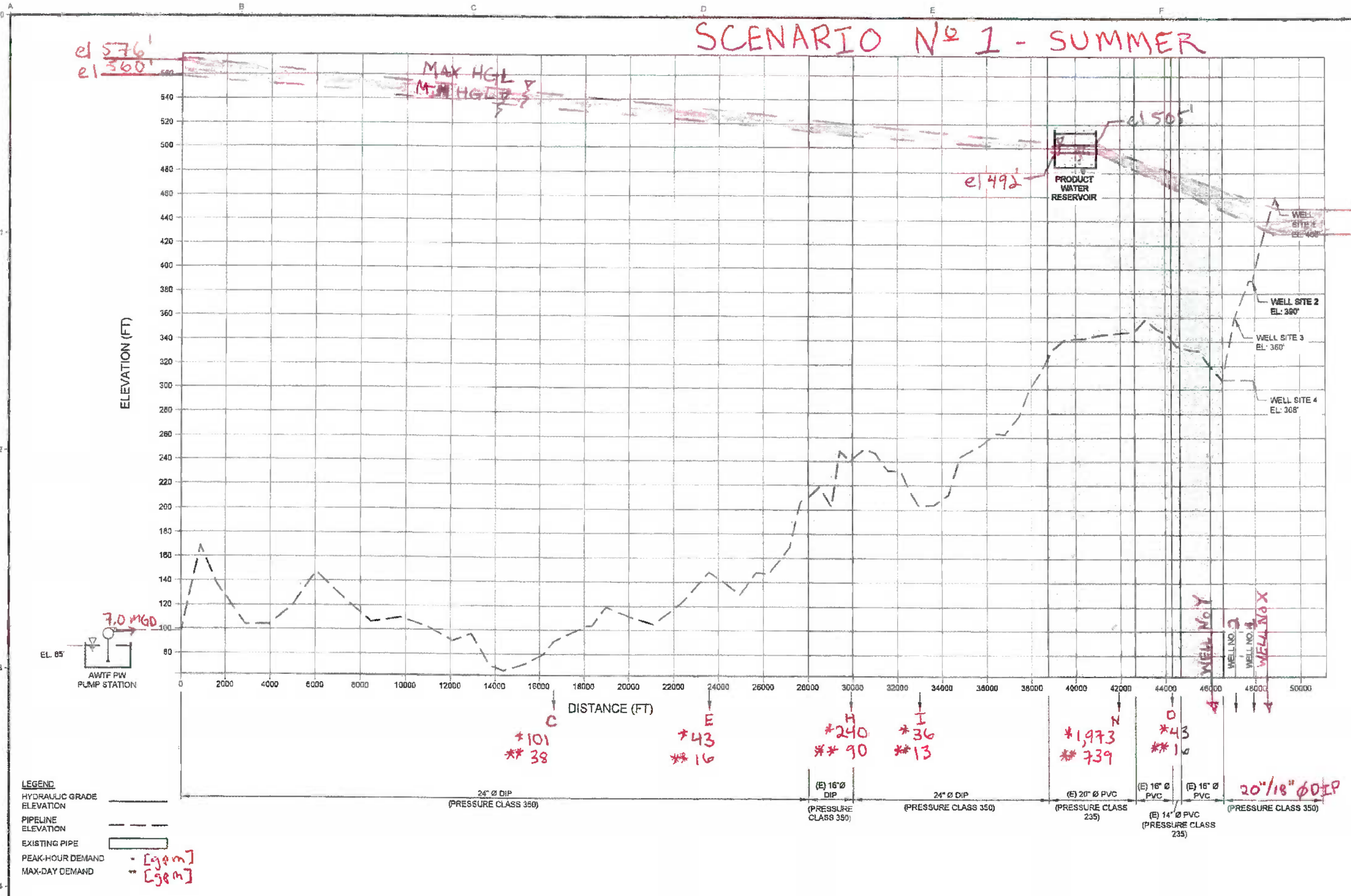
ATTACHMENT C

Hydraulic Profile

M1W Expansion
1668001.61
Conveyance and Reservoir Operations Evaluation TM
Attachment C - Hydraulic Profile
4/2/2018
Page 1 of 6

SCENARIO № 1 - SUMMER



SCENARIO:
- 7.0 MGD production
- 2020 irrigation demands
- no upgrades to existing pipe

USE OF DOCUMENTS THIS DOCUMENT, INCLUDING THE INCORPORATED DESIGNS, IS AN INSTRUMENT OF SERVICE FOR THIS PROJECT AND SHALL NOT BE USED FOR ANY OTHER PROJECT WITHOUT THE WRITTEN AUTHORIZATION OF KENNEDY/JENKS CONSULTANTS	NO / REVISION / DATE / BY	SCALES IF THIS BAR IS NOT DIMENSION SHOWN ADJUST SCALES ACCORDINGLY
DESIGNED RRH DRAWN CLG KVC CHECKED TKR	MONTEREY REGIONAL WATER POLLUTION CONTROL AGENCY MONTEREY, CA PURE WATER MONTEREY GROUNDWATER REPLENISHMENT PROJECT Kennedy/Jenks Consultants 303 2nd Street, Suite 300 South Tower, San Francisco, CA 94107	ADVANCED WATER TREATMENT FACILITY AND PRODUCT WATER PUMP STATION PRODUCT WATER CONVEYANCE HYDRAULIC PROFILE
FILE NAME 1668001-G-1_7.DWG	JOB NO 1668001*00	DATE APRIL 2016
SHEET G-1.7		

30 MARCH 2018

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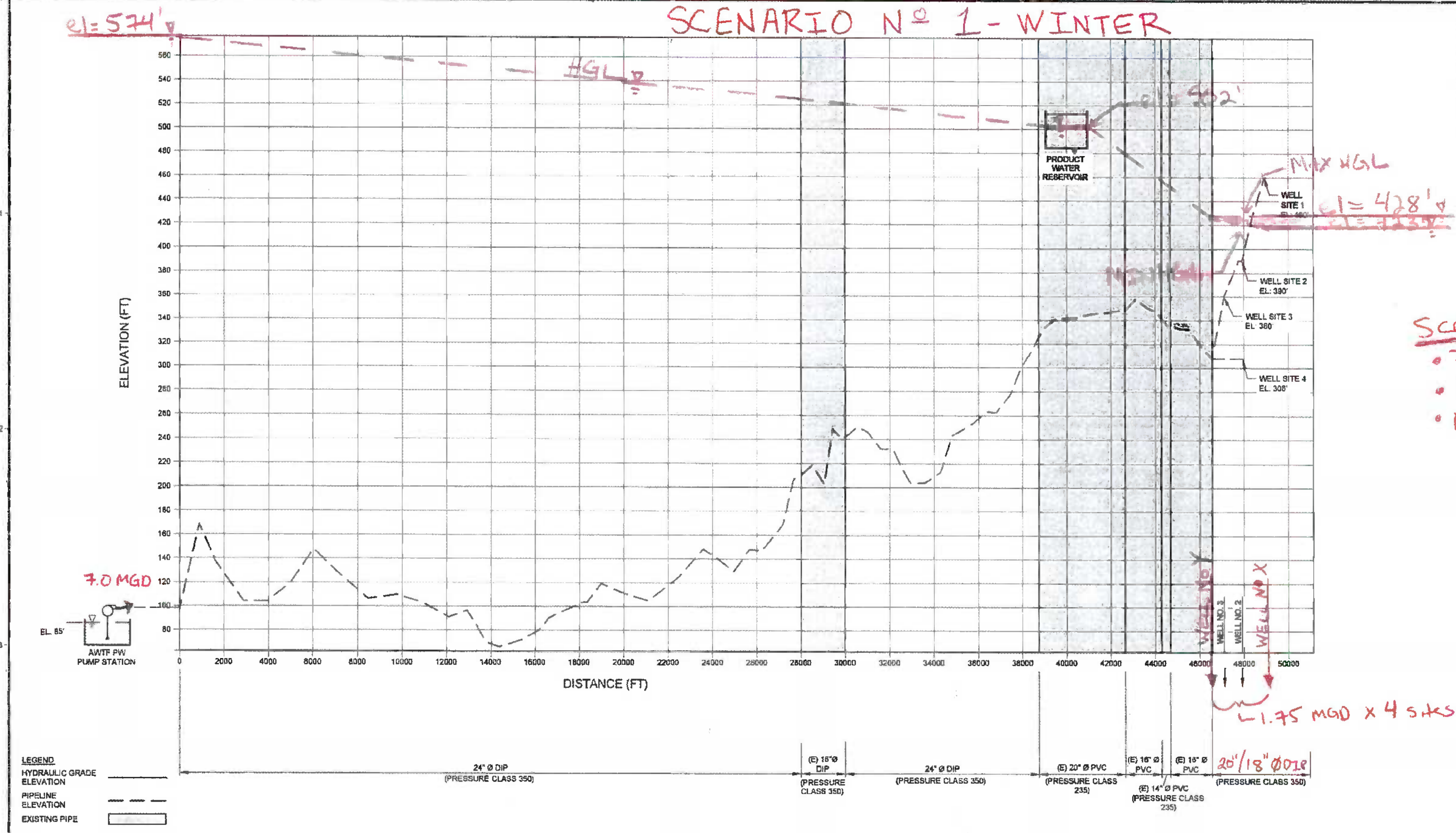
SCENARIO Nº 1 - WINTER



SCENARIO:
- 7.0 MGD Production
- No upgrades to (e) pipe
- No irrigation demands (winter)

USE OF DOCUMENTS	THIS DOCUMENT, INCLUDING THE INCORPORATED DESIGNS, IS AN INSTRUMENT OF SERVICE FOR THIS PROJECT AND SHALL NOT BE USED FOR ANY OTHER PROJECT WITHOUT THE WRITTEN AUTHORIZATION OF KENNEDY/JENKS CONSULTANTS
SCALES	IF THIS BAR IS NOT DIMENSION SHOWN, ADJUST SCALES ACCORDINGLY
DESIGNED	RRH
DRAWN	CLG KVC
CHECKED	TKR
MONTEREY REGIONAL WATER POLLUTION CONTROL AGENCY, MONTEREY, CA	PURE WATER MONTEREY GROUNDWATER REPLENISHMENT PROJECT
Kennedy/Jenks Consultants	303 2nd Street, Suite 300 South Tower, San Francisco, CA 94107
ADVANCED WATER TREATMENT FACILITY AND PRODUCT WATER PUMP STATION	PRODUCT WATER CONVEYANCE HYDRAULIC PROFILE
FILE NAME	1668001-G-1_7.DWG
JOB NO	1668001*00
DATE	APRIL 2018
SHEET	G-1.7

30 MARCH 2018

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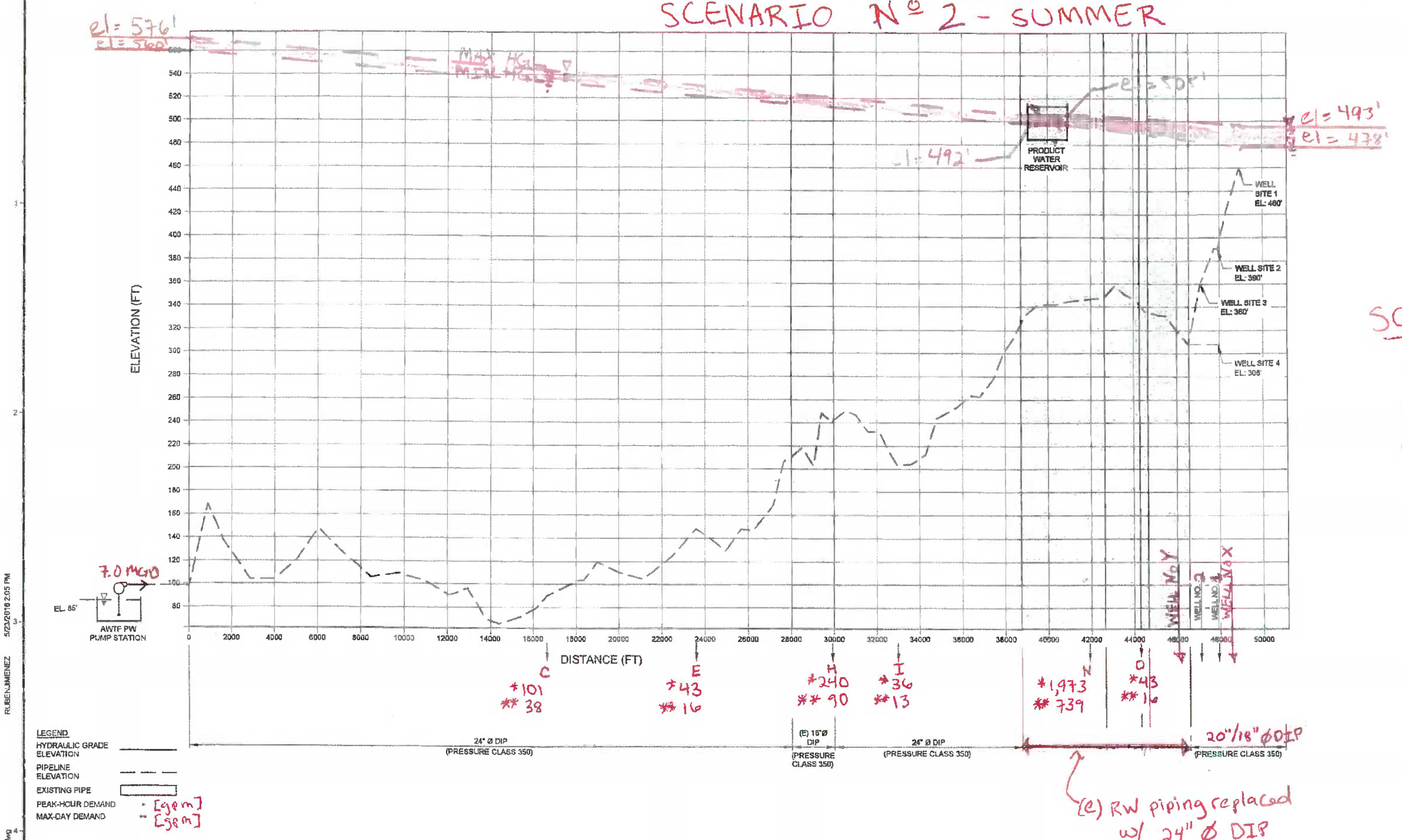
SCENARIO Nº 2 - SUMMER



SCENARIO:

- 7.0 MGD production
- 2020 irrigation demands
- 7,466 LF (e) RW piping replaced w/ 24" Ø DIP
  - 387' of 14" piping replaced
  - 3,906' of 16" piping replaced
  - 3,173' of 20" piping replaced

LEGEND
HYDRAULIC GRADE ELEVATION
PIPELINE ELEVATION
EXISTING PIPE
PEAK-HOUR DEMAND * [gpm]
MAX-DAY DEMAND ** [gpm]

NO.	REVISION	DATE	BY

SCALES
0 — 1"
0 — 25mm
IF THIS BAR IS NOT DIMENSION SHOWN, ADJUST SCALES ACCORDINGLY

DESIGNED RRH
DRAWN KVC CLG
CHECKED TKR

30 MARCH 2018

MONTEREY REGIONAL WATER POLLUTION CONTROL AGENCY
MONTEREY, CA
PURE WATER MONTEREY
GROUNDWATER REPLENISHMENT PROJECT
Kennedy/Jenks Consultants
303 2nd Street, Suite 300 South Tower, San Francisco, CA 94107

ADVANCED WATER TREATMENT FACILITY AND PRODUCT WATER PUMP STATION

PRODUCT WATER CONVEYANCE HYDRAULIC PROFILE

FILE NAME 1668001-G-1_7.DWG
JOB NO. 1668001*00
DATE APRIL 2016
SHEET G-1.7

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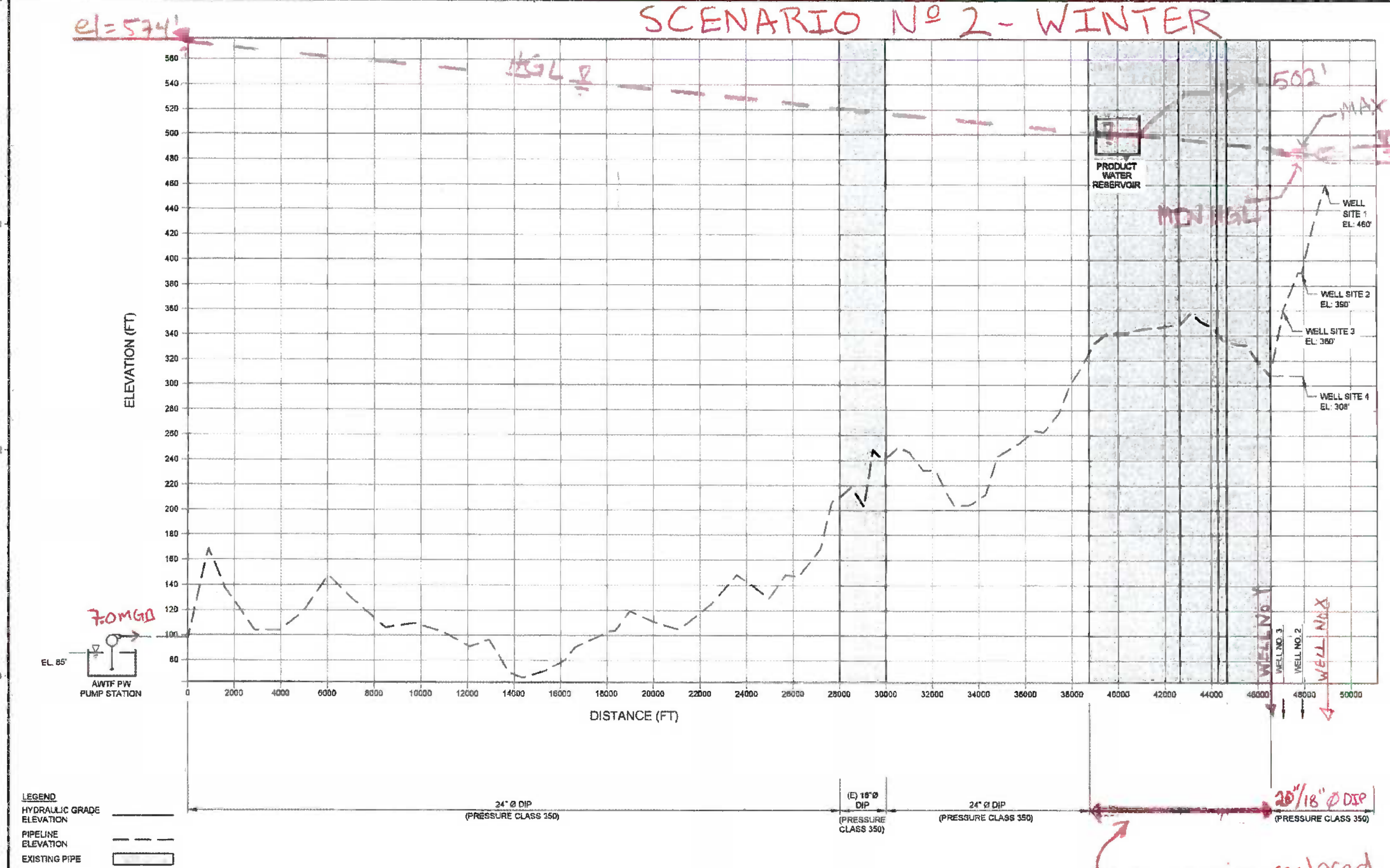
SCENARIO Nº 2 - WINTER



SCENARIO:

- 7.0 MGD production
- No irrigation demands (winter)
- 7,466' (e) RW piping replaced w/ 24" Ø DIP
  - 387' of 14" piping replaced
  - 3,906' of 16" piping replaced
  - 3,173' of 20" piping replaced

USE OF DOCUMENTS
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NO.	REVISION	DATE	BY

SCALES
0 — 1"
0 — 25mm
IF THIS BAR IS NOT DIMENSION SHOWN, ADJUST SCALES ACCORDINGLY

REGISTERED PROFESSIONAL ENGINEER — RODMAN R. HOUSER — No. C54215 — Exp. 12/31/17 — CIVIL — STATE OF CALIFORNIA

DESIGNED RRH
DRAWN LG KVC
CHECKED TKR

MRWPCA
MONTEREY REGIONAL WATER POLLUTION CONTROL AGENCY
MONTEREY, CA
PURE WATER MONTEREY
GROUNDWATER REPLENISHMENT PROJECT
Kennedy/Jenks Consultants
303 2nd Street, Suite 300 South Tower, San Francisco, CA 94107

ADVANCED WATER TREATMENT FACILITY AND PRODUCT WATER PUMP STATION

PRODUCT WATER CONVEYANCE HYDRAULIC PROFILE

FILE NAME 1668001-G-1_7.DWG
JOB NO. 1668001*00
DATE APRIL 2016
SHEET G-1.7

30 MARCH 2018

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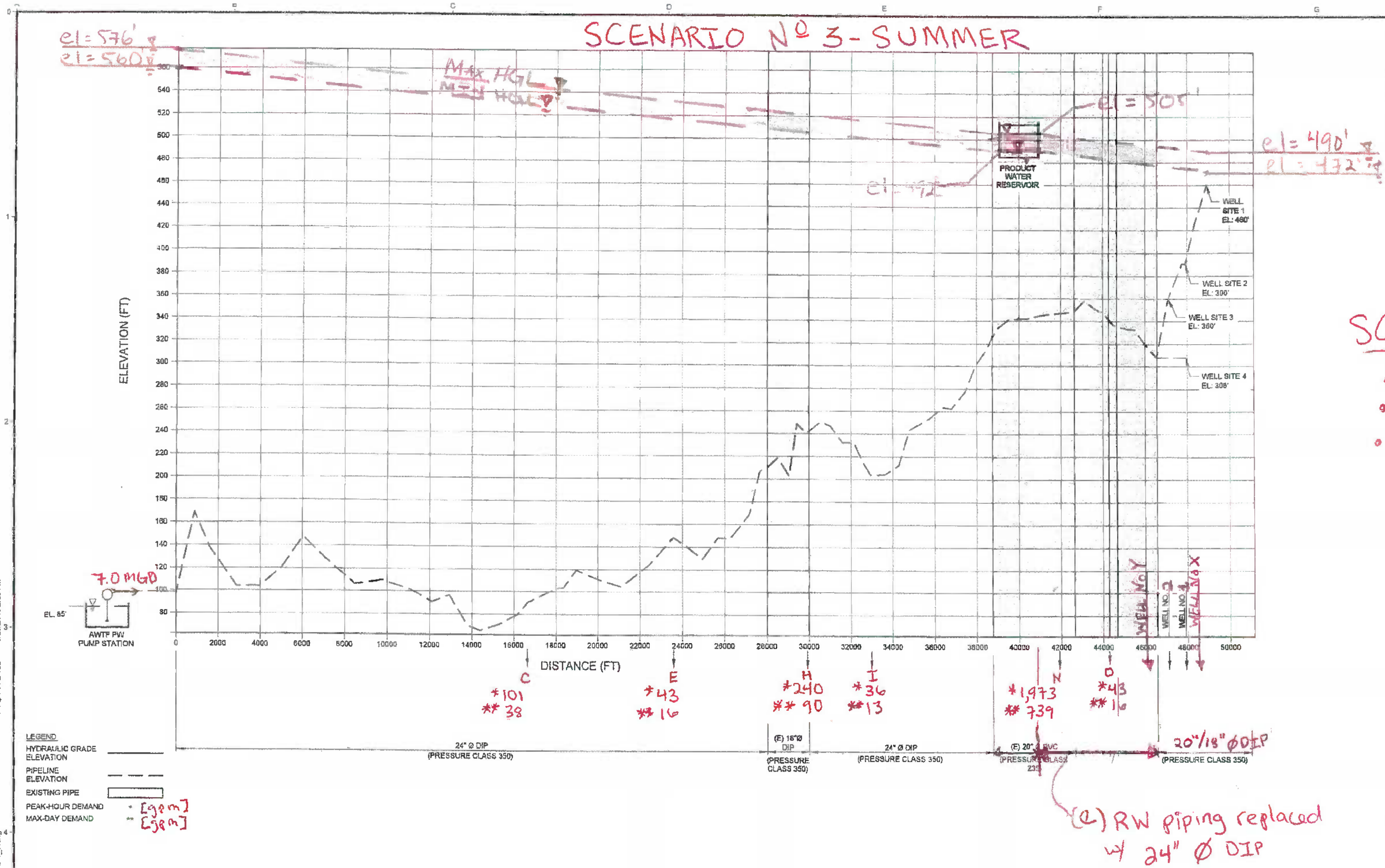
SCENARIO Nº 3 - SUMMER



SCENARIO:
- 7.0 MGD Production
- 2020 irrigation demands
- 5,908 LF (E) RW piping replaced w/ 24" Ø DIP
  - 387' of 14" piping replaced
  - 3,906' of 16" piping replaced
  - 1,615' of 20" piping replaced

USE OF DOCUMENTS

THIS DOCUMENT, INCLUDING THE INCORPORATED DESIGNS, IS AN INSTRUMENT OF SERVICE FOR THIS PROJECT AND SHALL NOT BE USED FOR ANY OTHER PROJECT WITHOUT THE WRITTEN AUTHORIZATION OF KENNEDY/JENKS CONSULTANTS

NO	REVISION	DATE	BY

SCALES

IF THIS BAR IS NOT DIMENSION SHOWN, ADJUST SCALES ACCORDINGLY

DESIGNED RRH
DRAWN CLG KVC
CHECKED TKR

30 MARCH 2018

MONTEREY REGIONAL WATER POLLUTION CONTROL AGENCY
MONTEREY, CA
PURE WATER MONTEREY
GROUNDWATER REPLENISHMENT PROJECT

Kennedy/Jenks Consultants
303 2nd Street Suite 300 South Tower, San Francisco, CA 94107

ADVANCED WATER TREATMENT FACILITY AND PRODUCT WATER PUMP STATION

PRODUCT WATER CONVEYANCE HYDRAULIC PROFILE

FILE NAME 1668001-G-1_7.DWG
JOB NO 1668001*00
DATE APRIL 2018
SHEET G-1.7

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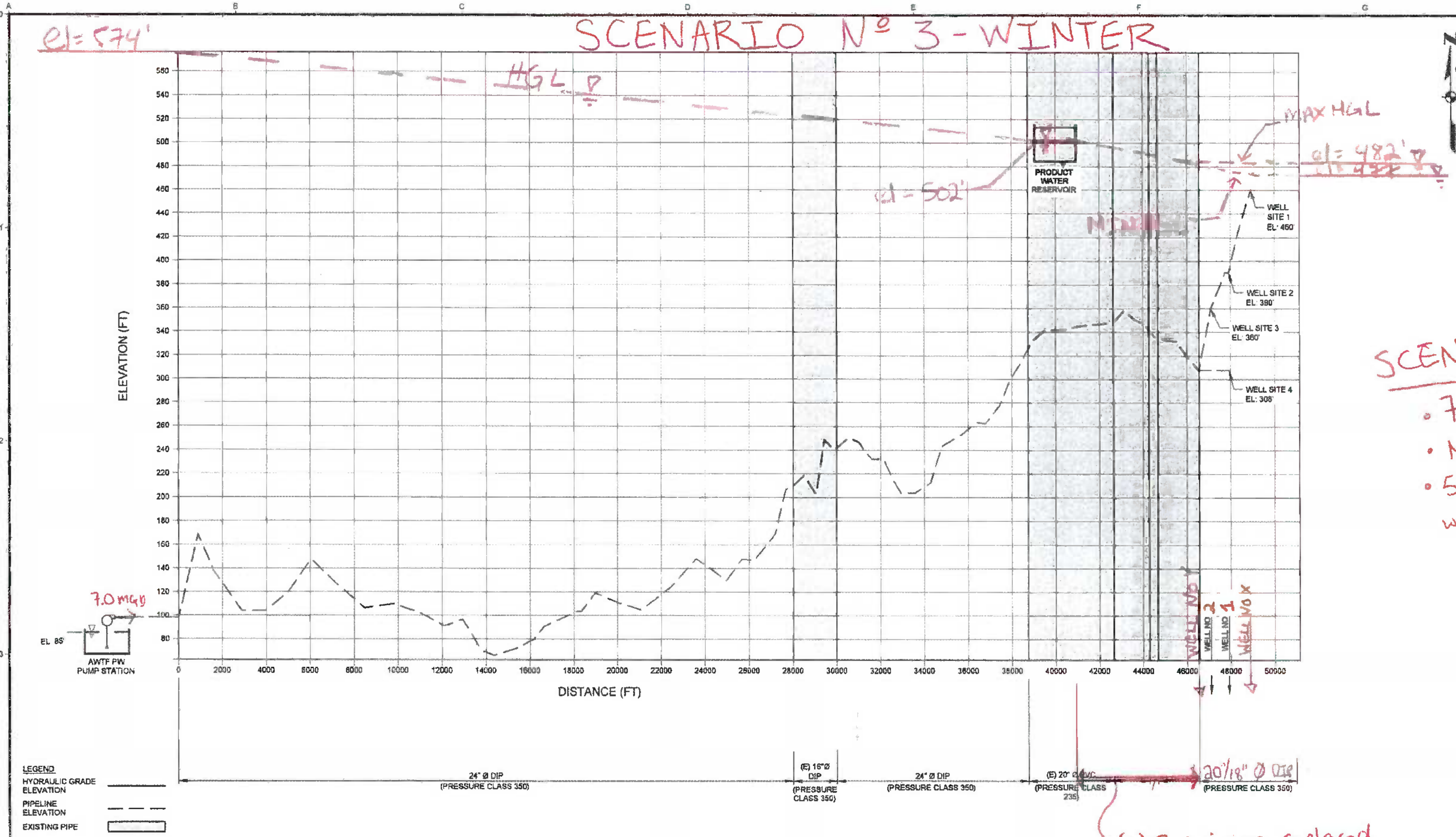
SCENARIO № 3 - WINTER



SCENARIO:

- 7.0 MGD Production
- No irrigation demands (winter)
- 5,908 LF (e) RW piping replaced w/ 24" Ø DIP
  - 387' of 14" piping replaced
  - 3,906' of 16" piping replaced
  - 1,615' of 20" piping replaced

USE OF DOCUMENTS

NO	REVISION	DATE	BY

SCALES
0 — 1"
0 — 25mm
IF THIS BAR IS NOT DIMENSION SHOWN, ADJUST SCALES ACCORDINGLY

DESIGNED RRH
DRAWN CLG KVC
CHECKED TKR

MONTEREY REGIONAL WATER POLLUTION CONTROL AGENCY
MONTEREY, CA
PURE WATER MONTEREY
GROUNDWATER REPLENISHMENT PROJECT
Kennedy/Jenks Consultants
303 2nd Street Suite 300 South Tower, San Francisco, CA 94107

ADVANCED WATER TREATMENT FACILITY AND PRODUCT WATER PUMP STATION

PRODUCT WATER CONVEYANCE HYDRAULIC PROFILE

FILE NAME 1668001-G-1_7.DWG
JOB NO. 1668001*00
DATE APRIL 2016
SHEET G-1.7

30 MARCH 2018

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M1W AWPF Expansion

Conveyance and Reservoir Operations Evaluation TM

ATTACHMENT D

Irrigation Demands

Irrigation Demands

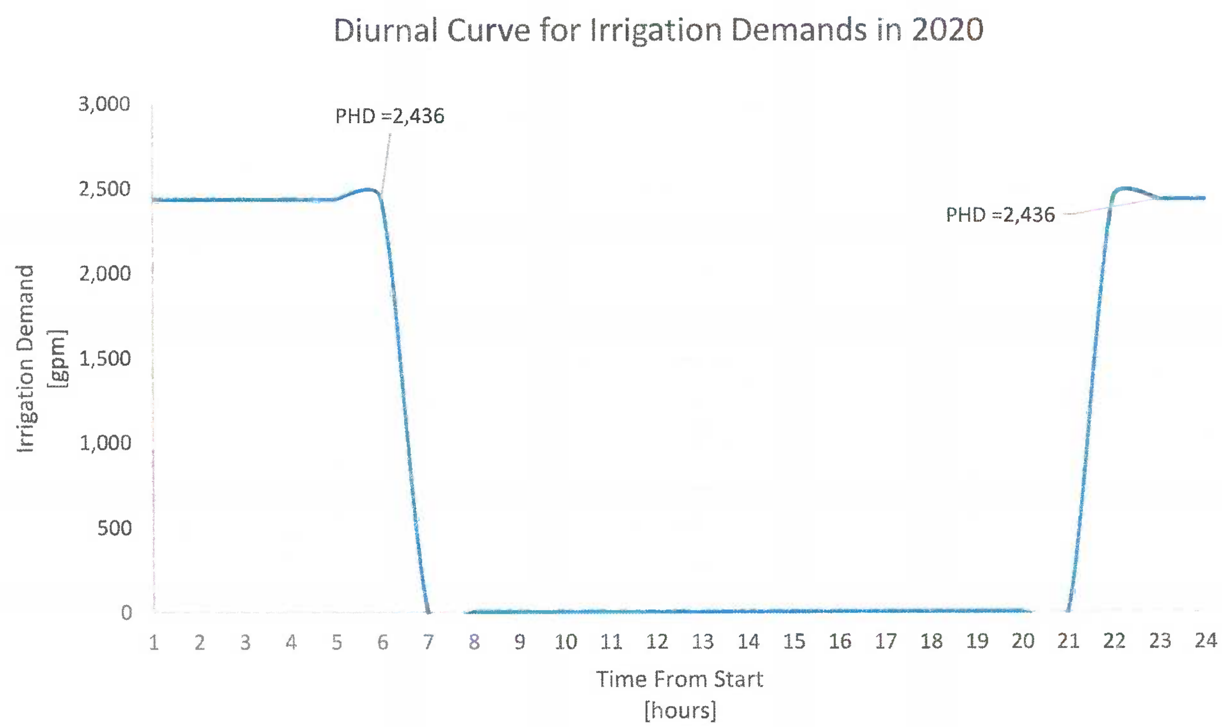
Location	Description	2020		
		Yearly Demand	Max Day Demand[1]	Peak Hour Demand[2]
		AFY	gpm	gpm
A	Beach and DeForest	0	0	0
B	Reservation and DeForest	0	0	0
C	Central and Crecent	26	38	101
D	California and 3rd Ave	0	0	0
E	California and Imjin	10	16	43
F	California and 5th Ave	0	0	0
G	5th Ave and 3rd St	0	0	0
H	3rd St East of 5th Ave	61	90	240
I	"Engineer Road" and General Jim Moore Blvd	9	13	36
J	General Jim Moore Blvd and Lightfigher Dr	0	0	0
K	General Jim Moore Blvd and Gigling Rd	0	0	0
L	General Jim Moore Blvd and Normandy Rd	0	0	0
M	General Jim Moore Blvd and Ardennes Cr	0	0	0
N	General Jim Moore Blvd and CmClure Wy	491	739	1,973
O	General Jim Moore Blvd and Coe Ave	11	16	43
P	Del Ray Oaks	0	0	0
	Totals	608	912	2,436
	subtotal demand [mgd]	**0.88**	**1.31**	**3.51**

Notes:
1: Max Day Demand is demand over a 24-hr period
2: Peak Hour Demand is the conveyance flow rate over the 9-hour irrigation period
3: Demands in each year are estimated cumulative demands (not incremental demand increases)
4: See map for corresponding demand location

ATTACHMENT E

Irrigation Diurnal Curve

M1W AWPF Expansion
1668001.61
Conveyance and Reservoir Operations Evaluation TM
Attachment E – Irrigation Diurnal Curve
4/2/2018



Max Day Demand = Area Under the Curve:

$$\left(6\ \frac{hr}{day} \times 2{,}436\ gpm\right) + \left(3\ \frac{hr}{day} \times 2{,}436\ gpm\right) \times \frac{60min}{hr} = \ 1.315\ mgd$$

M1W AWPF Expansion

Conveyance and Reservoir Operations Evaluation TM

Scenario 1 - Summer

ATTACHMENT F

Well Head Pressure

and

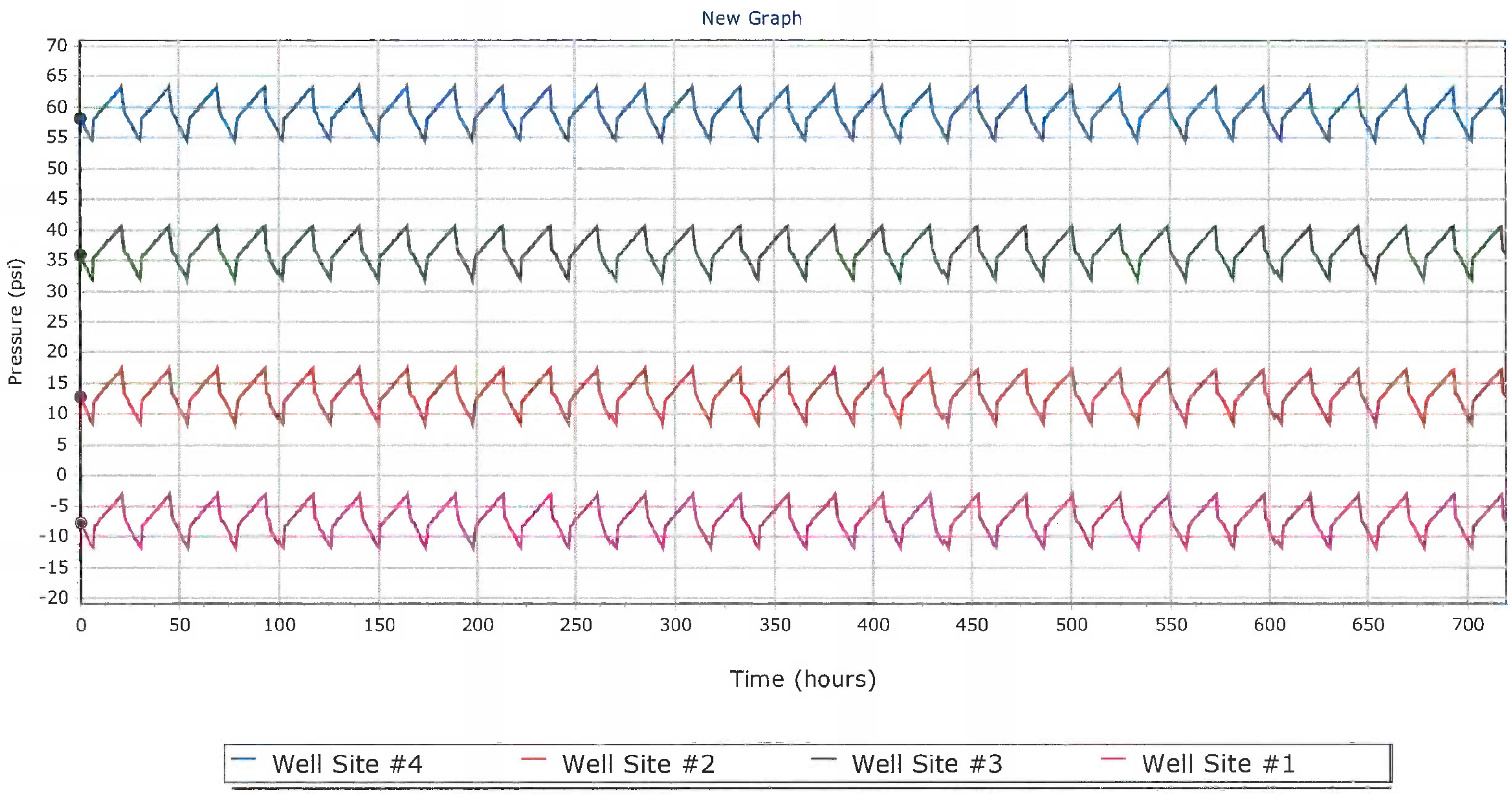
Tank Level

Graphs

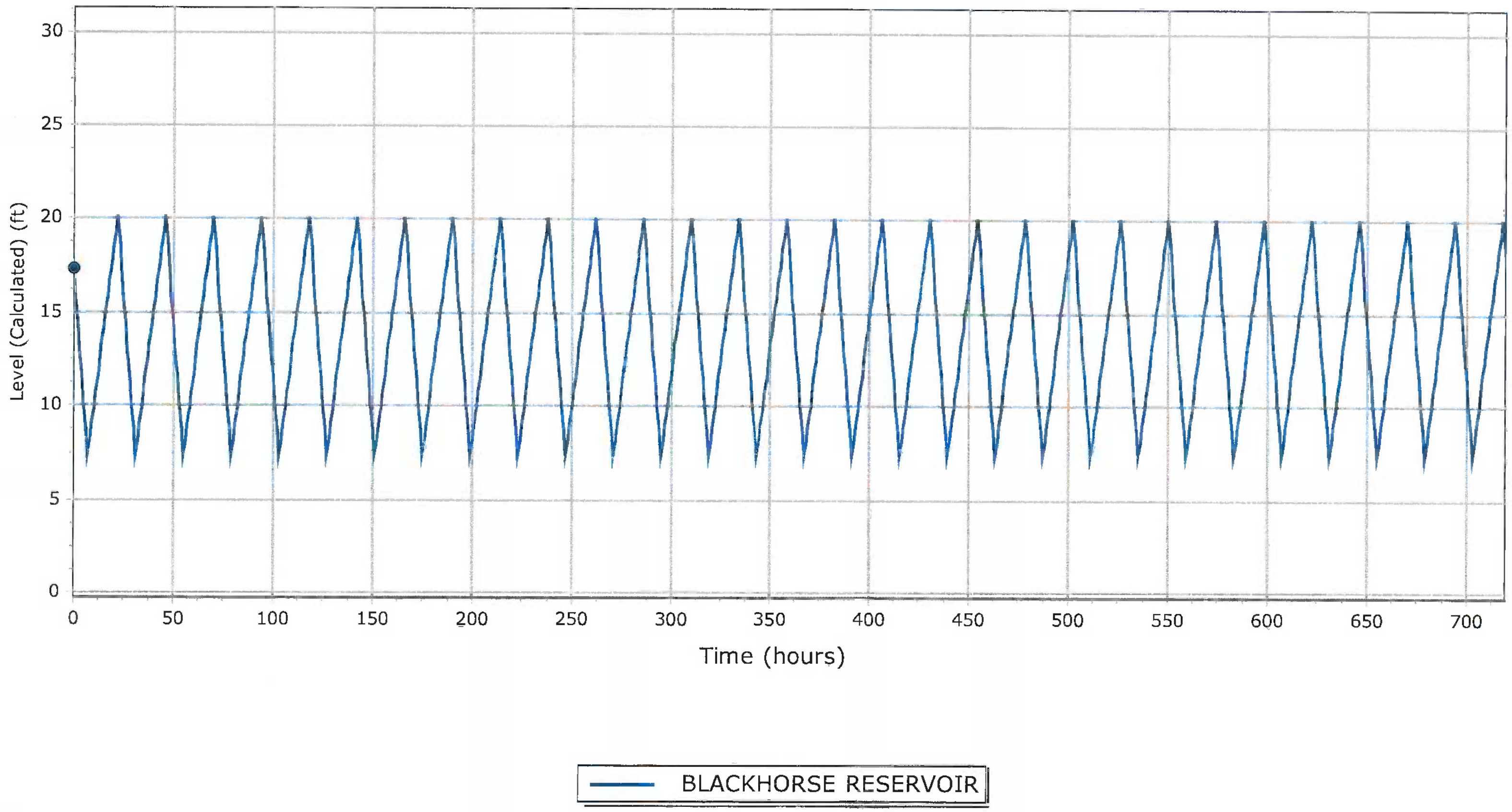
M1W AWPF Expansion

1668001.61
Conveyance and Reservoir
Operations Evaluation TM
Attachment F
4/2/2018

Wellhead Pressure
Scenario 1 - Summer Demands



Tank Level
Scenario 1 - Summer Demands



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M1W AWPF Expansion

Conveyance and Reservoir Operations Evaluation TM

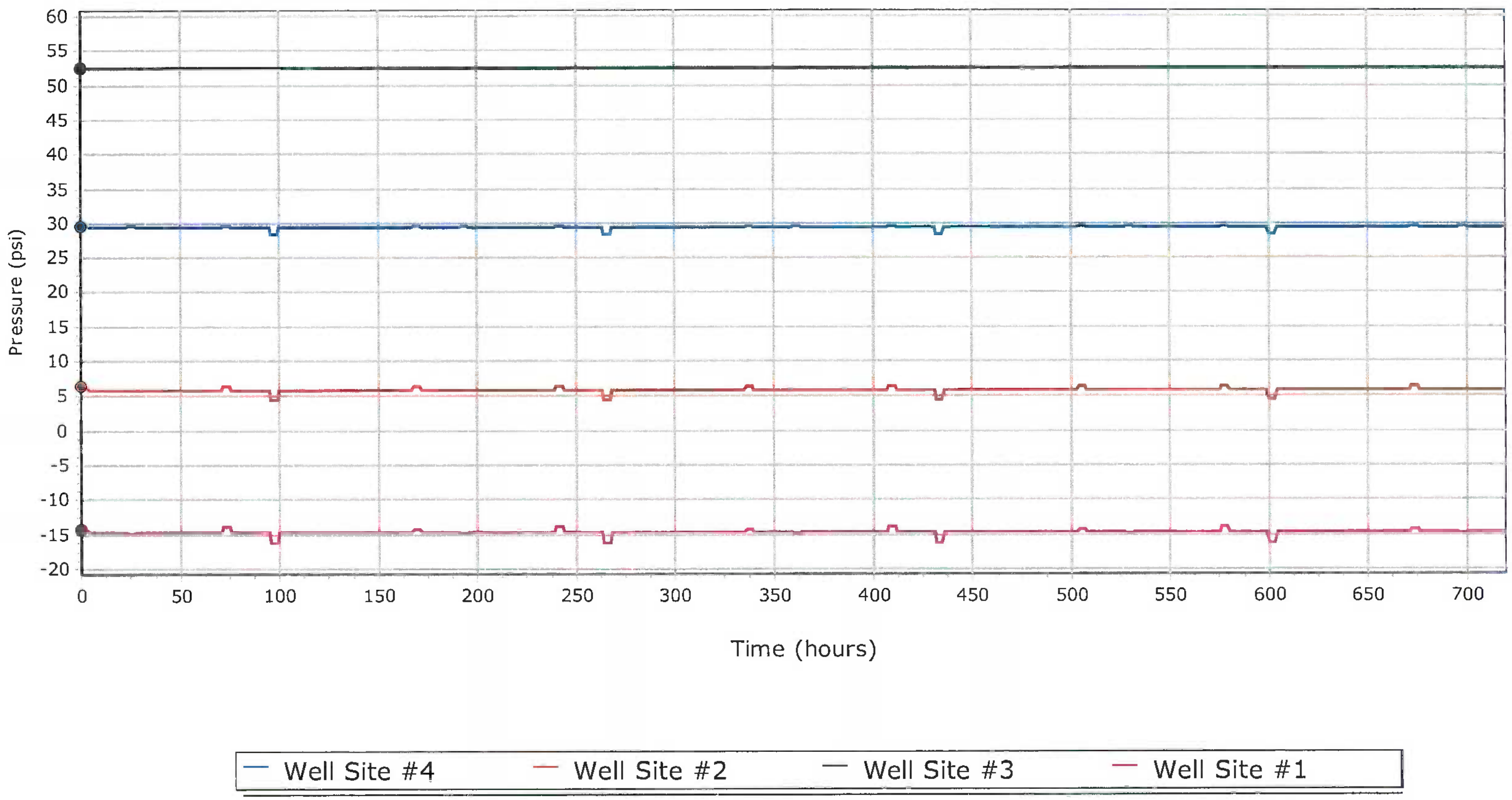
Scenario 1 - Winter

ATTACHMENT G

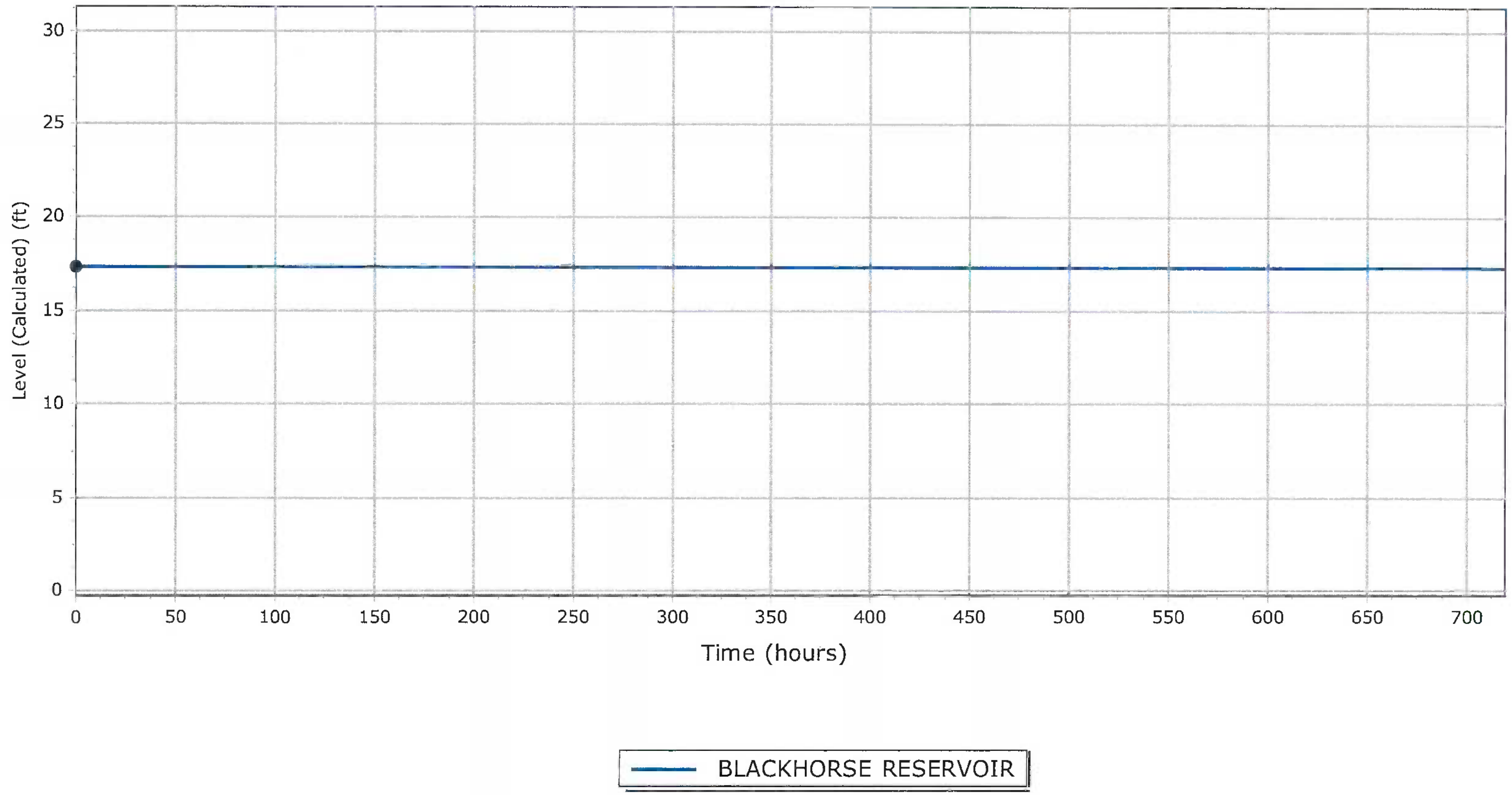
Well Head Pressure
and
Tank Level
Graphs

1668001.61
Conveyance and Reservoir
Operations Evaluation TM
Attachment G
4/2/2018

Wellhead Pressure
Scenario 1 - Winter Demands



Tank Level
Scenario 1 - Winter Demands



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M1W AWPF Expansion

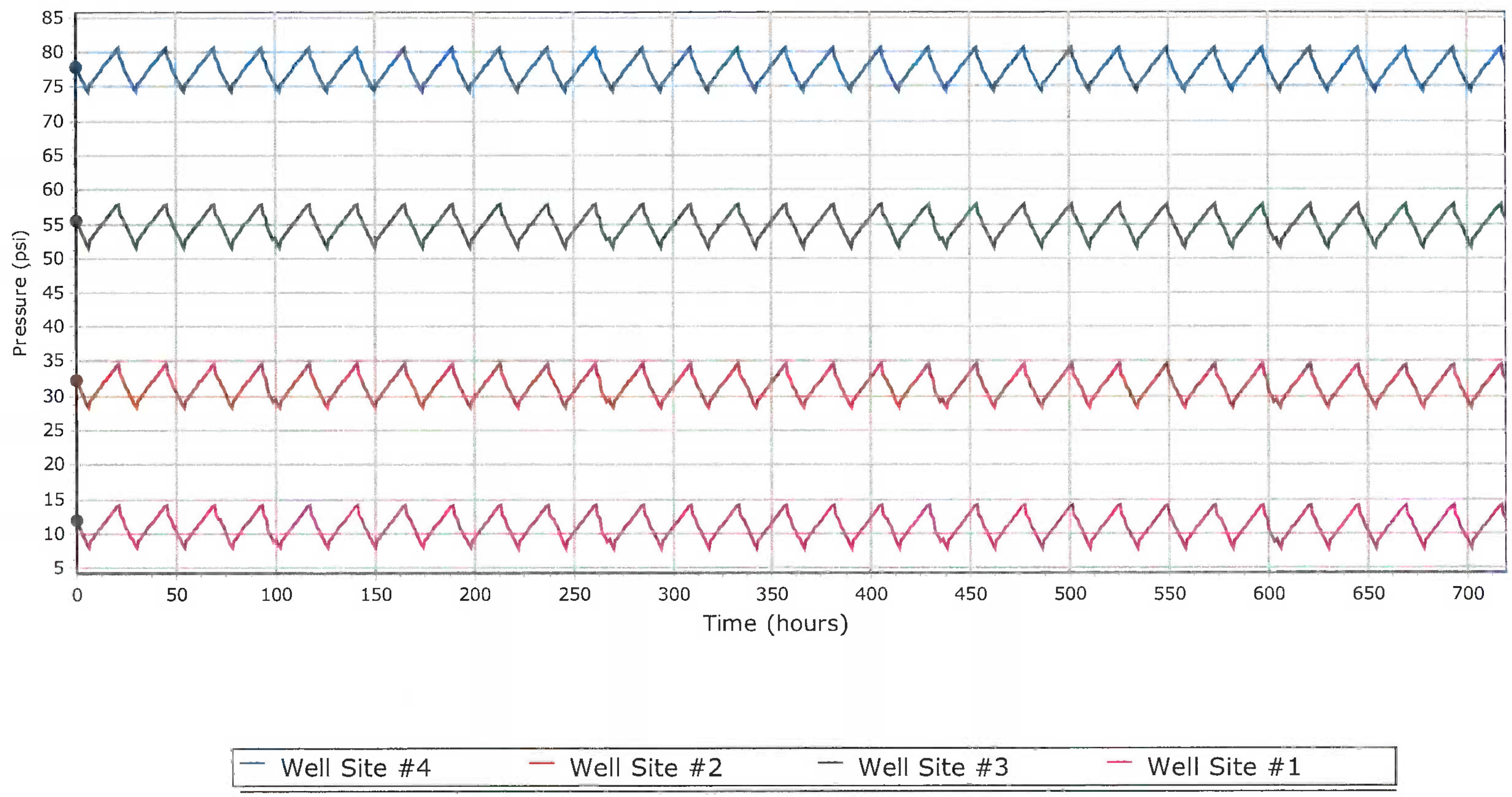
Conveyance and Reservoir Operations Evaluation TM

Scenario 2 - Summer

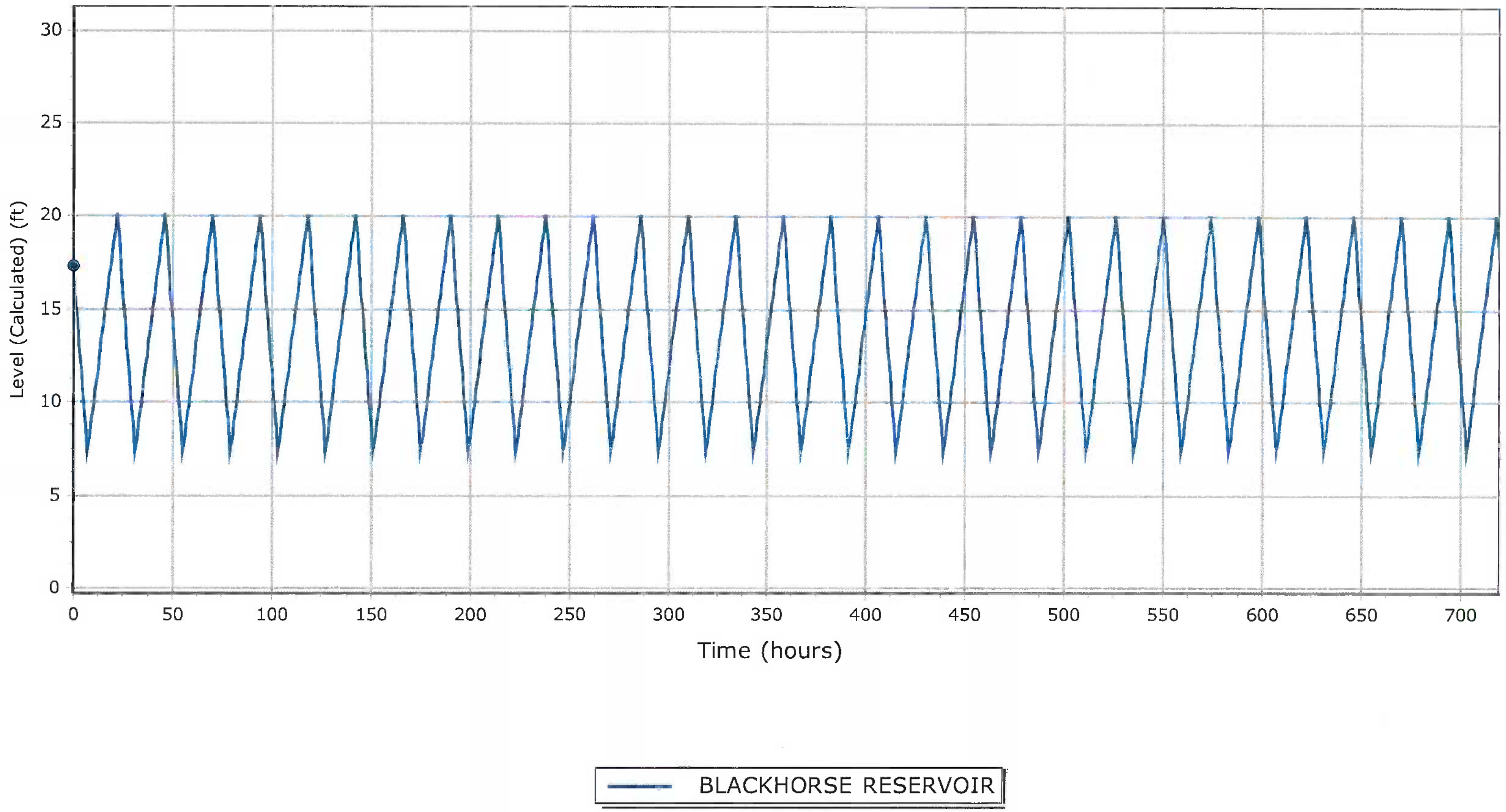
ATTACHMENT H

Well Head Pressure
and
Tank Level
Graphs

Wellhead Pressure
Scenario 2 - Summer Demands



Tank Level
Scenario 2 - Summer Demands



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M1W AWPF Expansion

Conveyance and Reservoir Operations Evaluation TM

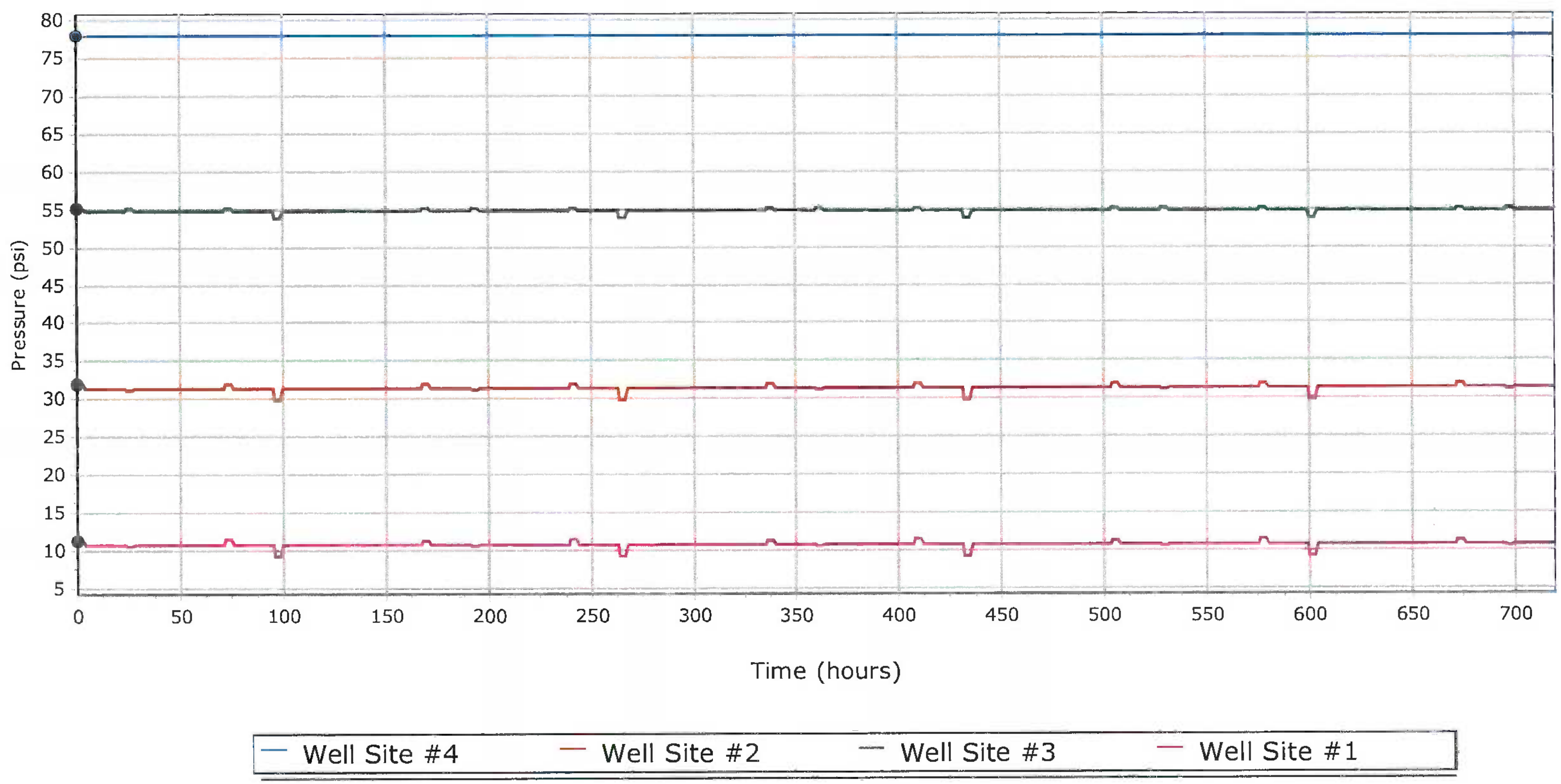
Scenario 2 - Winter

ATTACHMENT I

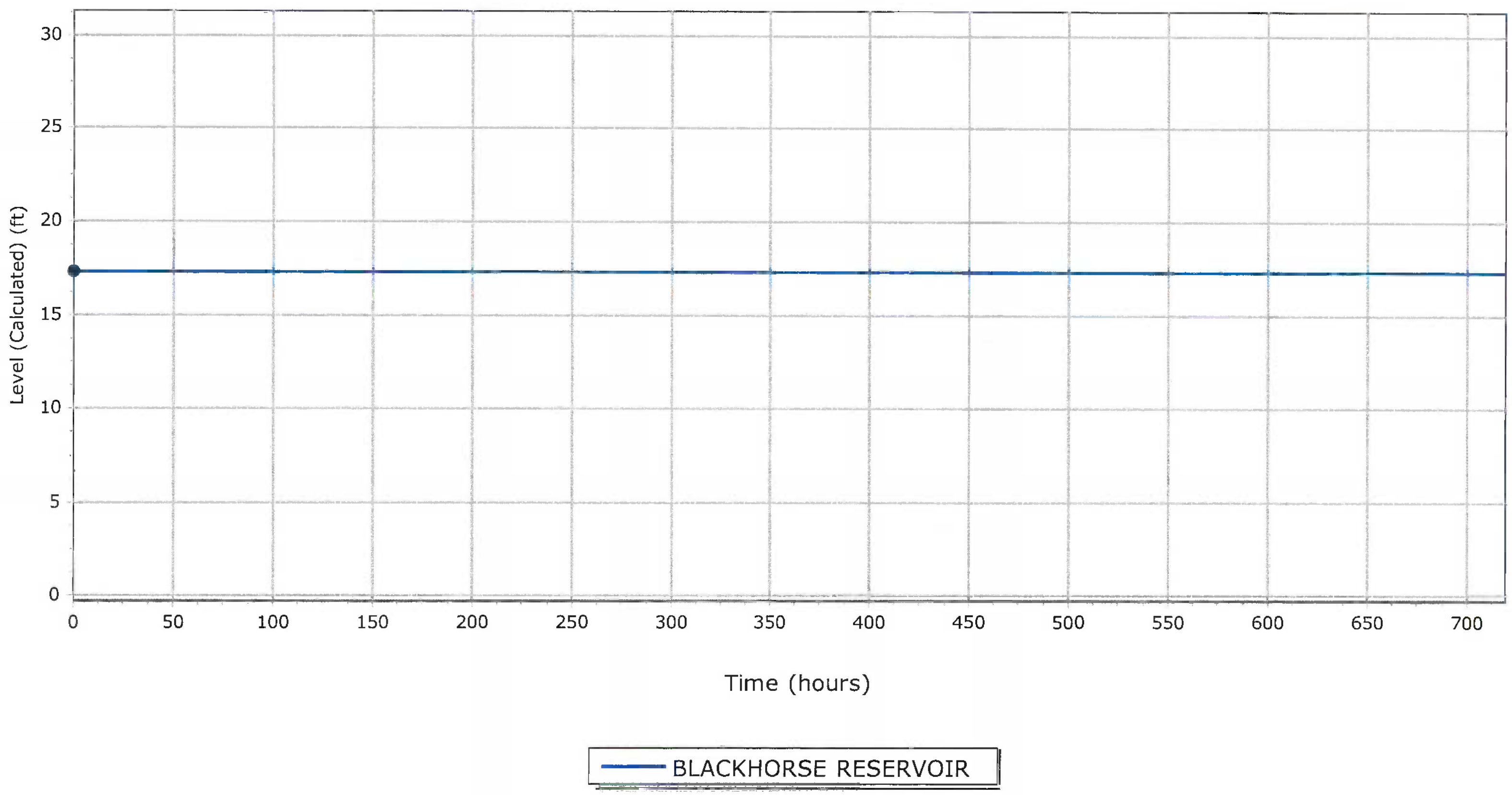
Well Head Pressure
and
Tank Level
Graphs

M1W AWPF Expansion
1668001.61
Conveyance and Reservoir
Operations Evaluation TM
Attachment I
4/2/2018

Wellhead Pressure
Scenario 2 - Winter Demands



Tank Level
Scenario 2 - Winter Demands



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M1W AWPF Expansion

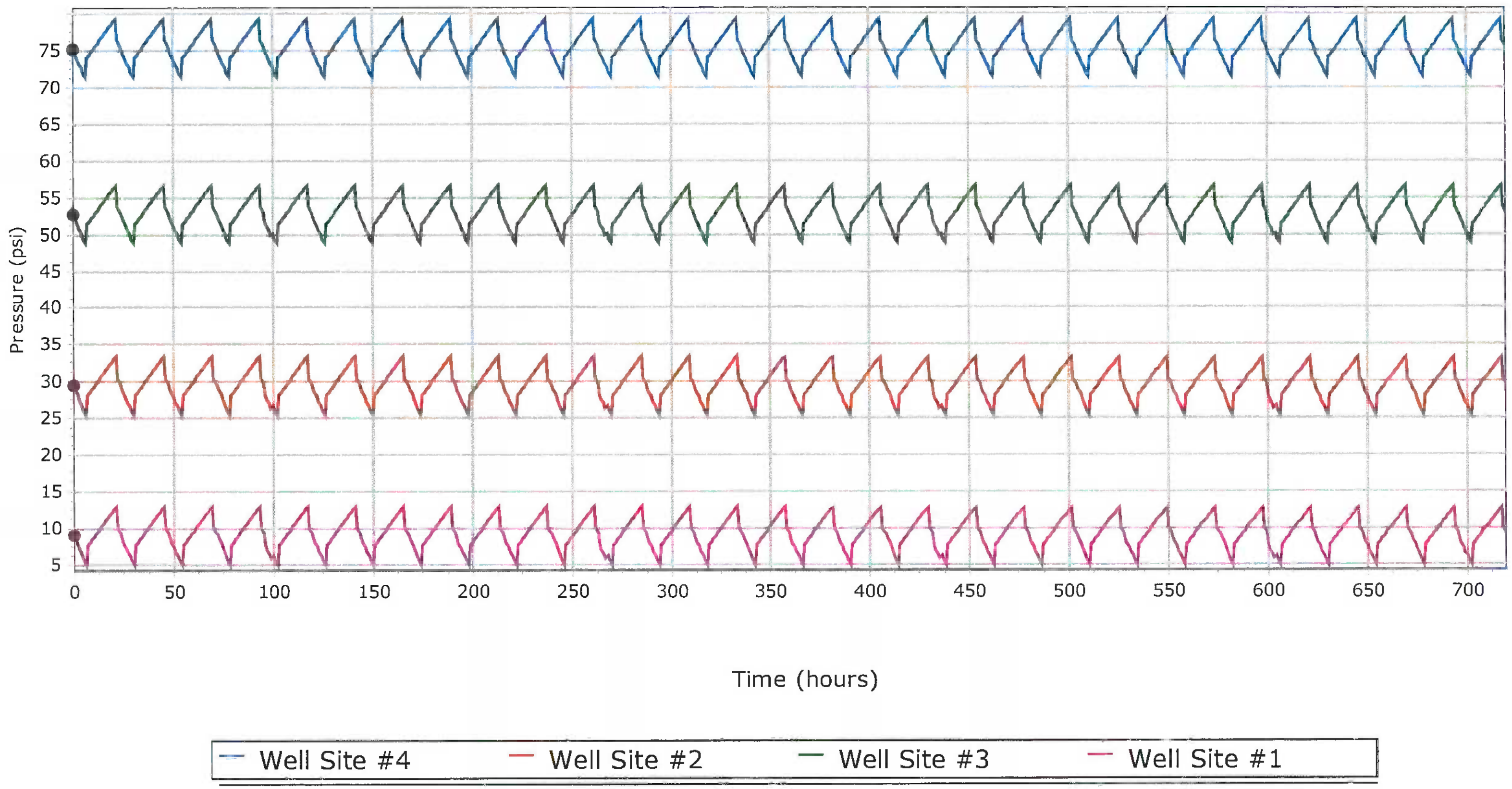
Conveyance and Reservoir Operations Evaluation TM

Scenario 3 - Summer

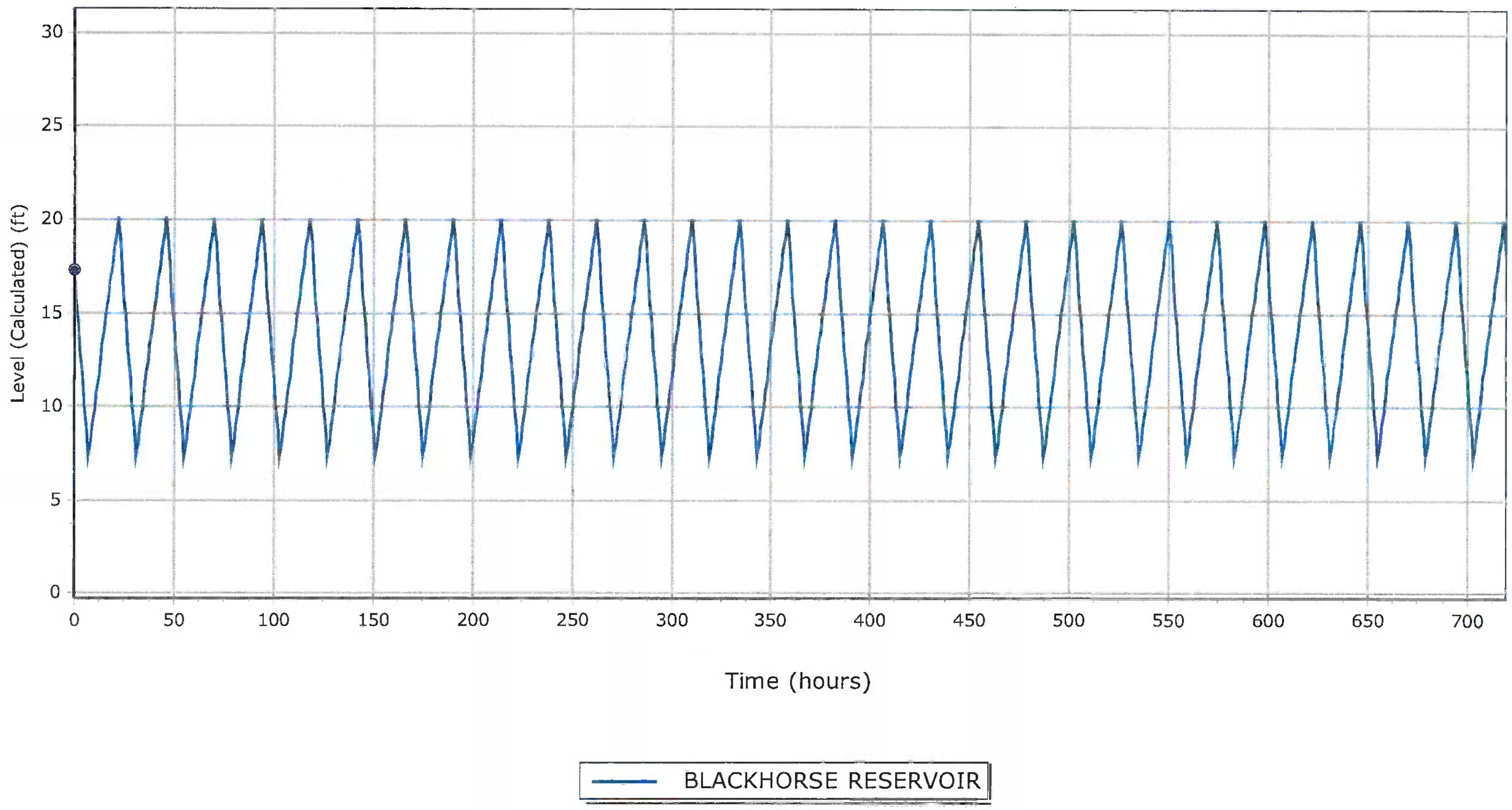
ATTACHMENT J

Well Head Pressure
and
Tank Level
Graphs

Wellhead Pressure
Scenario 3 - Summer Demands



Tank Level
Scenario 3 - Summer Demands



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M1W AWPF Expansion

Conveyance and Reservoir Operations Evaluation TM

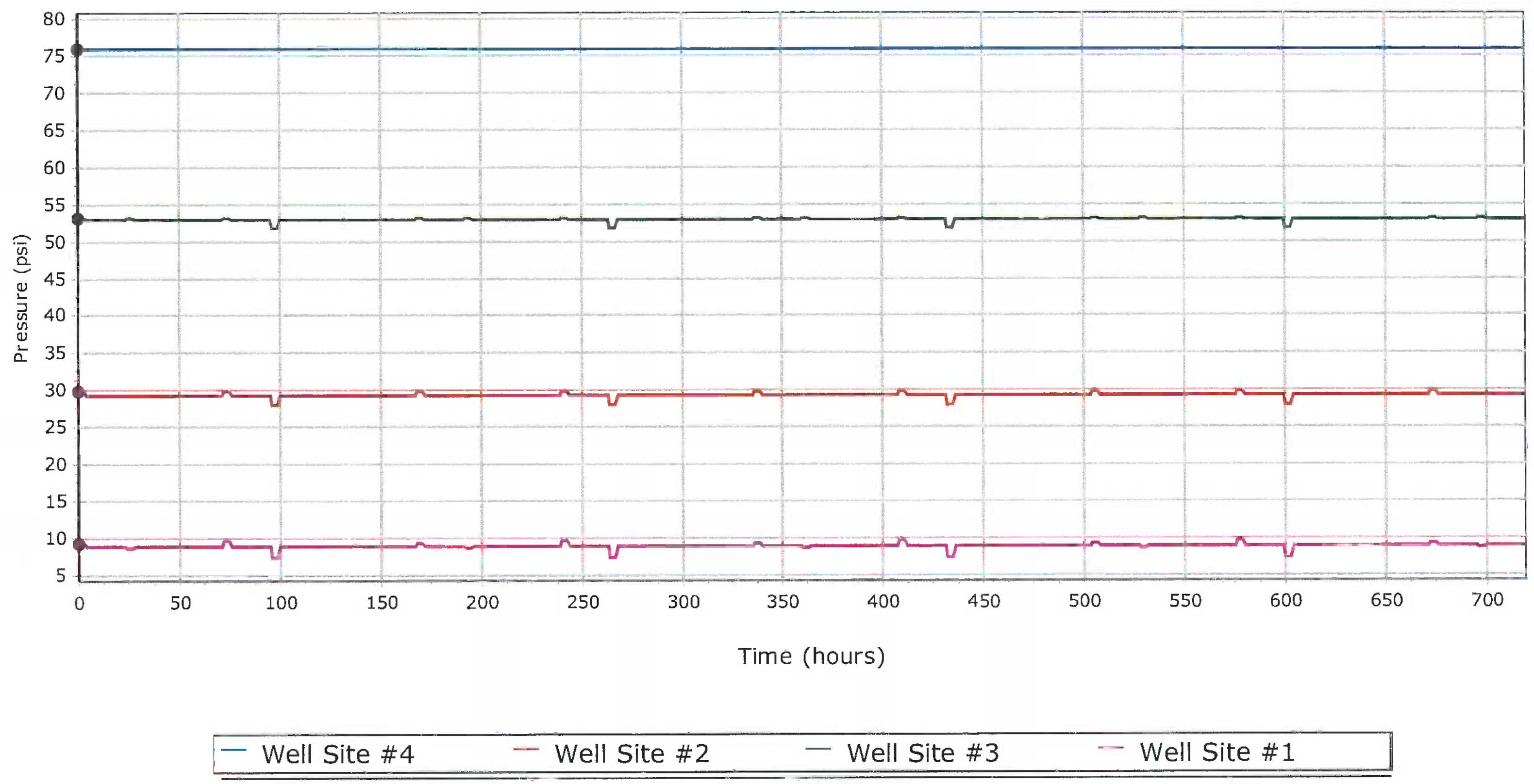
Scenario 3 - Winter

ATTACHMENT K

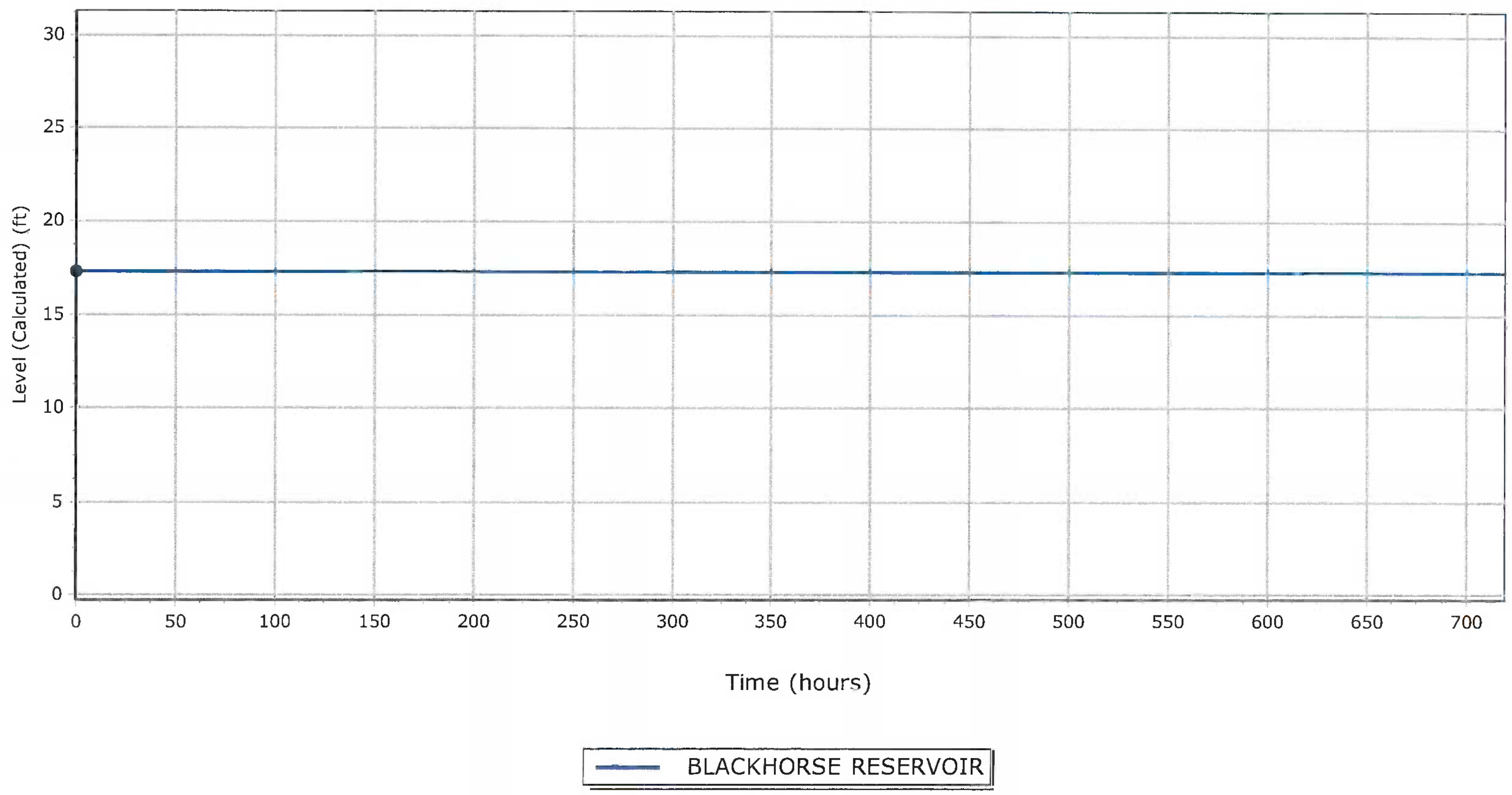
Well Head Pressure
and
Tank Level
Graphs

M1W AWPF Expansion
1668001.61
Conveyance and Reservoir
Operations Evaluation TM
Attachment K
4/2/2018

Wellhead Pressure
Scenario 3 - Winter Demands



Tank Level
Scenario 3 - Winter Demands



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Appendix C

Cost Estimate Tables

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OPINION OF PROBABLE CONSTRUCTION COST - SUMMARY

KENNEDY/JENKS CONSULTANTS

Client: Monterey One Water Agency
Project: PWM System Expansion Study - AWPF & Pump Station - Fast Track Expansion to 7 MGD

Prepared By: JLH
Date Prepared: 3-Apr-18
K/J Proj. No.: 1668001*61
Current at ENR
Escalated to ENR

Estimate Type: Conceptual — Construction
Preliminary (w/o plans) — Change Order
Design Development @ 30% X

SUMMARY BY AREA

AREA	ITEM DESCRIPTION		MATERIALS	INSTALLATION		ELECTRICAL & I/C	TOTAL
1	GENERAL SITEWORK AND YARD PIPING	None Existing is Sufficient					
1	MCCs, ELECTRICAL SWITCHGEAR & TRANSFORMERS to PG&E	None Existing is Sufficient					
2	SOURCE WATER PUMP STATION	Add pump and VFD	58,750	11,740		31,000	101,490
3	OZONE AREA INCLUDING LOX & SWITCHGEAR CANOPY		811,700	237,242		285,055	1,333,997
4	MF/RO & UV AREAS	Additional UV unit an	1,576,000	490,150		1,151,321	3,217,471
5	STABILIZATION & CHEMICAL FEED	None Existing is Sufficient					-
6	POST TREATMENT	None Existing is Sufficient					-
7	PRODUCT WATER PUMP STATION & MCC Building	Add pump and VFD	86,850	14,380		43,000	144,230
8	WASTE EQUALIZATION PUMP STATION	Add pump and VFD	38,680	11,773		33,000	83,453
9	PIPELINE TO PRODUCT WATER CONVEYANCE	None Existing is Sufficient					0
10	MEDIUM VOLTAGE POWER SUPPLY FROM MRWMD TO THE AWPF	None Existing is Sufficient					0
	Subtotals		**2,571,980**	**765,285**	**0**	**1,543,376**	**4,880,640**
	Adjustment on Labor from Recent Bid Environment	25%		191,321		0	191,321
	Division 1 Costs @	10%	257,198	76,529	0	154,338	488,064
	Subtotals		2,829,178	1,033,135	0	1,697,713	5,560,026
	Taxes - Materials @	8.63%	244,017				244,017
	Subtotals		3,073,194	1,033,135	0	1,697,713	5,804,042
	Bonds & Insurance @	2.25%	69,147	23,246	0	38,199	130,591
	Subtotals		3,142,341	1,056,381	0	1,735,912	5,934,633
	Contractor MU for Prepurchase @	12%			0		0
	Subtotals		3,142,341	1,056,381	0	1,735,912	5,934,633
	Contractor OH&P @	15%	471,351	158,457		260,387	890,195
	Subtotals		3,613,692	1,214,838	0	1,996,298	6,824,828
	Estimate Contingency @	17.5%	632,396	212,597		349,352	1,194,345
	Subtotal						8,019,173
	Total Opinion of Probable Construction Cost						**8,019,000**

	Estimate Accuracy	
+20%	Total Est.	-15%
$9,620,000	**$8,019,000**	**$6,820,000**

OPINION OF PROBABLE CONSTRUCTION COST — **KENNEDY/JENKS CONSULTANTS**

Client: Monterey One Water Agency
Project: PWM System Expansion Study - Groundwater Recharge Facilities - Expansion to 7 MGD
Location: Monterey , CA
Type: Conceptual

Prepared By: JLH
Date Prepared: 30-Mar-18
K/J Proj. No.: 1668001*06

SUMMARY BY DIVISION

	ITEM DESCRIPTION			MATERIAL	INSTALL	EQUIPMENT	SUBS	TOTAL
1	**SWPP**						8,000	8,000
2	**Traffic Controls**		Not required					
3	**Well Drilling & Testing**		2 additional DIWs, 3 additonal montitoring Well clusters (one at each DIW and one offsite between well field and extraction)				3,078,263	3,078,263
4	**Sitework (Pipelines, Driveway)**		Extend Piping to Well Site 1 and Well Site 4	234,511	175,446	3,580	10,000	423,537
5	**Well Site 1 - Equiping 1 DIW, Monitoring Well Cluster**			488,723	88,681	9,974	28,500	615,878
6	**Well Site 4 - Equiping 1 DIW, Monitoring Well Cluster**			488,723	88,681	9,974	28,500	615,878
7	**Percolation Basin & Electrical Building**		Existing is sufficient for 7 MGD					
8	**Electrical & I&C for 2 DIW (2 Sites)**			788,194	187,656		165,143	1,140,994
8	**Disinfection Residual Monitoring Station**			25,000	50,000		25,000	100,000
	Subtotal			**2,025,152**	**590,465**	**23,528**	**3,343,406**	**5,959,023**
	Taxes On Materials @	8.75%		**177,201**				**177,201**
	Local Labor Provisions	15%			**88,570**			**88,570**
	Market Conditions Adjustment	10%			**59,046**			**59,046**
	Subtotal Direct Cost			**2,202,352**	**738,081**	**23,528**	**3,343,406**	**6,283,839**
	Site Overhead/ General Conditions	15%						**942,576**
	Design/Estimating Contingency @	15%						**942,576**
	Subtotals							**8,168,991**
	Bonds & Insurance	2.5%						**204,225**
	Contractors OH&P @	15%						**1,225,349**
	Subtotals							**9,598,565**
	Estimated Bid Price							**9,598,565**
	Total Estimate							**9,600,000**

Estimate Accuracy

Estimated Range of Probable Cost		
+20%	Total Est.	-15%
$11,520,000	**$9,600,000**	**$8,160,000**

Appendix D

Energy and Chemical Use Tables

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AWPF and Poduct Water Pump Station
Estimated Energy Use at 7 mgd Production
and 90% Uptime

Column	A	B	P	K		T		G	
				Maximum	Maximum	Adjustment Factor	Adjusted	MDG = 7.0	
MCC	Area (Equipment)	Comment	Service Rating	HP	KW(KVA)	VFD or Infrequent Operation	KW	Adj. KWH/ yr	Adj. KWH/AF
Influent Pumping				200	216	4.20	182	1,431,532	183
1	Influent Pump 1		Continuous	40	43	1.00	43	340,841	43
1	Influent Pump 2	0	Continuous	40	43	1.00	43	340,841	43
1	Influent Pump 3	3 pumps at 100% for 5 mgd	Continuous	40	43	1.00	43	340,841	43
1	Influent Pump 4	Pump at 100% for 6.5 mgd and 7 mgd	Continuous	40	43	1.00	43	340,841	43
1	Influent Pump 5	standby for 6.5/7 mgd	Continuous	40	43	0.20	9	68,168	9
Ozone				303	300	12.80	721	5,683,861	725
2	Ozone Injection Pump 1	Fixed speed pumps	Continuous	40	43	1.00	43	340,841	43
2	Ozone Injection Pump 2	2 pumps for 4 mgd	Continuous	40	43	1.00	43	340,841	43
2	Ozone Injection Pump 3	3 pumps for 5 mgd	Continuous	40	43	1.00	43	340,841	43
2	Ozone Injection Pump 4	4 pumps for 6.5 mgd & 7 mgd	Continuous	40	43	1.00	43	340,841	43
2	Ozone Injection Pump 5	5 pumps for 7 mgd	Continuous	40	43	1.00	43	340,841	43
2	Ozone Injection Pump 6	standby	Non-Continuous	40	43	0.00	0	0	0
2	Nitrogen Boost Duplex Air Compressor	periodic 10%	Non-Continuous	3.0	4	0.10	0	3,146	0
2	Ozone Water Recirculation Pump 1	0	Continuous	15.0	17	1.00	17	137,647	18
2	Ozone Water Recirculation Pump 2	2 pumps for 7 mgd	Continuous	15.0	17	1.00	17	137,647	18
2	Ozone Water Recirculation Pump 3	standby	Non-Continuous	15.0	17	0.00	0	0	
2	Ozone Generator 1	Operation for 7 mgd at 75%	Continuous	0	280	0.75	210	1,655,640	211
2	Ozone Generator 2	Operation for 7 mgd at 75%	Continuous	0	280	0.75	210	1,655,640	211
2	Ozone Destruct Unit 1 (includes Blower)	4 for 7 mgd at 80% power	Continuous	0	10	0.80	8	63,072	8
2	Ozone Destruct Unit 2 (includes Blower)	4 for 7 mgd at 80% power	Continuous	0	10	0.80	8	63,072	8
2	Ozone Destruct Unit 3 (includes Blower)	4 for 7 mgd at 80% power	Continuous	0	10	0.80	8	63,072	8
2	Ozone Destruct Unit 4 (includes Blower)	4 for 7 mgd at 80% power	Continuous	0	10	0.80	8	63,072	8
2	Ozone Destruct Unit 5 (includes Blower)	standby	non-Continuous	0	10	0.00	0	0	0
4	Open Loop Cooling Water Pump 1	100%	Continuous	15.0	17	1.00	17	137,647	18
4	Open Loop Cooling Water Pump 2	standby	Continuous	15.0	17	1.00	17	137,647	18
MF and Waste Eq Pump Station				802	1,025	8.45	464	3,658,648	467
2	MF Feed Pumps 1	3 pumps at ~100% for 7 mgd	Continuous	100	103	1.00	103	812,775	104
2	MF Feed Pumps 2	4 pumps at ~100% for 7 mgd	Continuous	100	103	1.00	103	812,775	104
2	MF Feed Pumps 3	5 pumps at ~100% for 7 mgd	Continuous	100	103	1.00	103	812,775	104
2	MF Feed Pumps 4	standby	Continuous	100	103	0.00	0	0	0
2	Backwash/Strainer CP	both strainers on line -	Continuous		30	0.25	8	59,130	8
					0	0.25	0	0	0
					0	0.25	0	0	0
					0	0.00	0	0	0
3	MF Autostrainer 1	Strainer online, but motor runs periodically 25%	Continuous	0.5	1	0.25	0	1,803	0
					0	0.25	0	0	0
3	MF Backwash Supply Pump 1	runs 50% of time due to higher flows	Continuous	100	103	0.50	52	406,387	52
3	MF CIP Pump 1	only during CIP (Clean In Place) 5%	Continuous	25	28	0.05	1	11,143	1
3	MF Air Compressor 1	periodic 40%	Continuous	15.0	17	0.40	7	55,059	7
3	MF Air Scour Blower 1	runs 40% of time due to higher flows	Continuous	40	43	0.40	17	136,336	17
3	MF Acid Tank Immersion Heater 1	only during CIP 5%	Continuous	0	75	0.05	4	29,565	4
					0	0.25	0	0	0
4	MF Backwash Supply Pump 2	standby	Continuous	100	103	0.00	0	0	0
4	MF Acid CIP Tank Mixer	only for CIP 5%	Continuous	0.75	1	0.05	0	524	0
4	MF CIP Pump 2	standby	Non-Continuous	25	28	0.00	0	0	0
4	MF Air Compressor 2	standby	Non-Continuous	15.0	17	0.00	0	0	0
4	MF Air Scour Blower 2	runs 40% of time due to higher flows	Continuous	40.0	43	0.40	17	136,336	17
4	MF Caustic CIP Tank mixer	only for CIP 5%	Continuous	0.75	1	0.05	0	524	0
4	MF Caustic Tank Immersion Heater	only for CIP 5%	Continuous	0	75	0.05	4	29,565	4
5	Waste EQ Pump 1	1 pump at 100% for 7 mgd;	Continuous	20	22	1.00	22	176,975	23
5	Waste EQ Pump 2	2 pump at 100% for 7 mgd;	Continuous	20	22	1.00	22	176,975	23
5	Waste EQ Pump 3	standby	Non-Continuous	20	22	0.00	0	0	0
RO				1,595	1,927	8.30	1,440	11,356,790	1,449
3	RO Transfer Pump 1	0	Continuous	50	54	0.90	49	383,446	49
4	RO Transfer Pump 2	3 pumps at 80% for 4 mgd	Continuous	50	54	0.90	49	383,446	49
3	RO Transfer Pump 3	3 pumps at 100% for 5 mgd	Continuous	50	54	0.90	49	383,446	49
4	RO Transfer Pump 4	4 pumps at 100% for 6.5 mgd	Continuous	50	54	0.90	49	383,446	49
3	RO Transfer Pump 5	5 pumps at 90% for 7 mgd	Continuous	50	54	0.90	49	383,446	49
3	RO Feed Pump 1	Running at 7 mgd and 85% max feed pressure	Continuous	350	344	0.85	293	2,306,576	294
4	RO Feed Pump 2	Running at 7 mgd and 85% max feed pressure	Continuous	350	344	0.85	293	2,306,576	294
3	RO Feed Pump 3	Running at 7 mgd and 85% max feed pressure	Continuous	250	344	0.85	293	2,306,576	294
4	RO Feed Pump 4	Running at 7 mgd and 85% max feed pressure	Continuous	250	344	0.85	293	2,306,576	294
3	RO Permeate Transfer Pump 1	only for 10%	Continuous	7.5	9	0.10	1	7,210	1
4	RO CIP Pump	for CIP 10%	Continuous	100	103	0.10	10	81,277	10
4	RO Flush Pump	for CIP 10%	Continuous	30	33	0.10	3	26,219	3
4	RO Permeate Transfer Pump 2	standby	Non-Continuous	7.5	9	0.00	0	0	0
4	RO CIP Immersion Tank Heater 2	for CIP 10%	Continuous	0	125	0.10	13	98,550	13
								0	
UV				0	280	6.00	240	1,892,160	241
3	UV Power Supply- Unit 1	Runs for 5-mgd at 75% Power	Continuous		40	1.00	40	315,360	40
3	UV Power Supply- Unit 2	Runs for 5-mgd at 75% Power	Continuous		40	1.00	40	315,360	40
3	UV Power Supply- Unit 3	Runs for 5-mgd at 75% Power	Continuous		40	1.00	40	315,360	40
3	UV Power Supply- Unit 4	Runs for 5-mgd at 75% Power	Continuous		40	1.00	40	315,360	40
3	UV Power Supply- Unit 5	Runs for 6.5 mgd at 75% power	Continuous		40	1.00	40	315,360	40
3	UV Power Supply- Unit 6	Runs for 6.5 mgd at 75% power	Continuous		40	1.00	40	315,360	40
3	UV Power Supply- Unit 7	standby, assumes 6 units run for 7 mgd at 100% power	Non-Continuous		40	0.00	0	0	0
Post Treatment/Chemicals				46	55	4.25	37	292,337	37
5					0	0.25	0	0	0
5	Decarbonator Blower 1	running for all flows	Continuous	15	17	1.00	17	137,647	18
5	Decarbonator Blower 2	standby	Non-Continuous	15	17	0.00	0	0	0
5	Lime Mixer 1	0	Continuous	3.0	4	1.00	4	31,462	4
5	Lime Mixer 2	0	Continuous	3.0	4	1.00	4	31,462	4
5	Calcium Hydroxide Mixer	0	Continuous	10.0	12	1.00	12	91,765	12
Product Water Pumping				800	798	4.08	814	6,418,298	819
6	Product Water Pump 1		Continuous	200	200	1.02	204	1,604,575	205
6	Product Water Pump 2		Continuous	200	200	1.02	204	1,604,575	205
6	Product Water Pump 3		Continuous	200	200	1.02	204	1,604,575	205
6	Product Water Pump 4	4 pumps at 102% for 7mgd	Continuous	200	200	1.02	204	1,604,575	205
6	Product Water Pump 5	standby	Non-Continuous	200	200	0.00	0	0	0
6	Misc Valves and AC Control Panel		Continuous		10	0.25	3	19,710	3
BLDG Loads and Misc				0	50	2.00	50	394,200	50
5					0	1.00	0	0	0
5	Building Loads	0	Continuous	0	50	1.00	50	394,200	50
3	DP-460B		Continuous		65	1.00	65	512,460	65
							0	0	0
Transformer Losses				0	150	0.30	8	9,034	1
1	Transformer	Loss of 5%	Continuous	0	15	0.05	1	6,570	1
2	Transformer	Loss of 5%	Continuous	0	45	0.05	2	493	0
3	Transformer	Loss of 5%	Continuous	0	15	0.05	1	329	0
4				0	0	0.05	0	0	0
5	DP-481 + Transformer	Loss of 5%	Continuous	0	45	0.05	2	986	0
6	Transformer	Loss of 5%	Continuous	0	30	0.05	2	657	0
			TOTAL	**3,746**	**4,801**	**50.38**	**3,956**	**31,136,860**	**3,972**

Estimated cost per acre-foot of AWPF chemicals:

Chemical	7 MGD Avg Annual Usage (dry pounds)	7 MGD Cost per dry pound (est.)	7 MGD Annual cost (est.)
Sodium Hypochlorite (as Cl_2)	525,046	$0.81	$422,932
Liquid Oxygen (LOX)	4,262,247	$0.06	$250,141
Sodium Bisulfite	207,628	$0.68	$141,657
Sodium Hydroxide	108,426	$0.48	$52,147
Sulfuric Acid	4,085,546	$0.16	$640,738
Threshold inhibitor	65,877	$1.22	$80,586
Hydrogen Peroxide	62,254	$0.09	$5,678
Ammonium Sulfate (as N)	33,350	$0.29	$9,553
Slurry of Hydrated Lime (as $Ca(OH)_2$)	800,409	$0.31	$251,057
Tri-Sodium Phosphate	9,355	$2.48	$23,243
Sodium Dodecyl Benzene Sulfonate	9,355	$12.88	$120,467
Ferric Chloride	35,574	$0.39	$13,853
		Total annual cost	$2,012,052
		Production (AFY)	6,550
		Chem cost ($/AF)	$307

Injection Well Backwash Energy Calculations

Background:

- 4 Deep Injection Wells
- Each well backwashes 4 hours, one time per week
- Ground surface and water levels vary significant over the site
- 500 HP Motors
- Estimate wells will require between 400 and 500 HP for backwashing, variable

<u>400 HP Calculations</u>

400 HP,298 KW @ 90% efficiency translates to 331 KW input

4 wells X 4 hours/week X 331 KW X 52 weeks X 0.9 up time factor = 248,274 KWH/YR

<u>500 HP Calculations</u>

500 HP, 373 KW @ 90% efficiency translates to 414 KW input

4 wells X 4 hours/week X 373 KW X 52 weeks X 0.9 up time factor = 310,302 KWH/YR

<u>Assuming average well uses 450 HP. Total energy use estimate is:</u>

(248,274 KWH/YR + 310,302 KWH/YR) / 2 = 280,000 KWH/YR

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Attachment B

Summary Memorandum - M1W, Salinas Industrial Wastewater Treatment Facility Percolation and Water Reuse, March 19, 2018.

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SUMMARY:
Salinas Industrial Wastewater Treatment Facility Percolation and Water Reuse

Prepared by: Mike McCullough, Alison Imamura, Rachel Gaudoin
Version date: March 19, 2018

Monterey One Water
Providing Cooperative Water Solutions

Introduction

This fact sheet provides information about wastewater percolation from the Salinas Industrial Wastewater Treatment Facility (SIWTF), including information about net water flows into and out of the facility. Water quality and constituent loading analyses are not presented herein, but can be provided for interested stakeholders. Assumptions about future conditions based on planned and proposed projects are also presented for context.

The SIWTF is located 3 miles southwest of the City of Salinas and adjacent to the Salinas River. A schematic of the facility is provided in Figure 1.

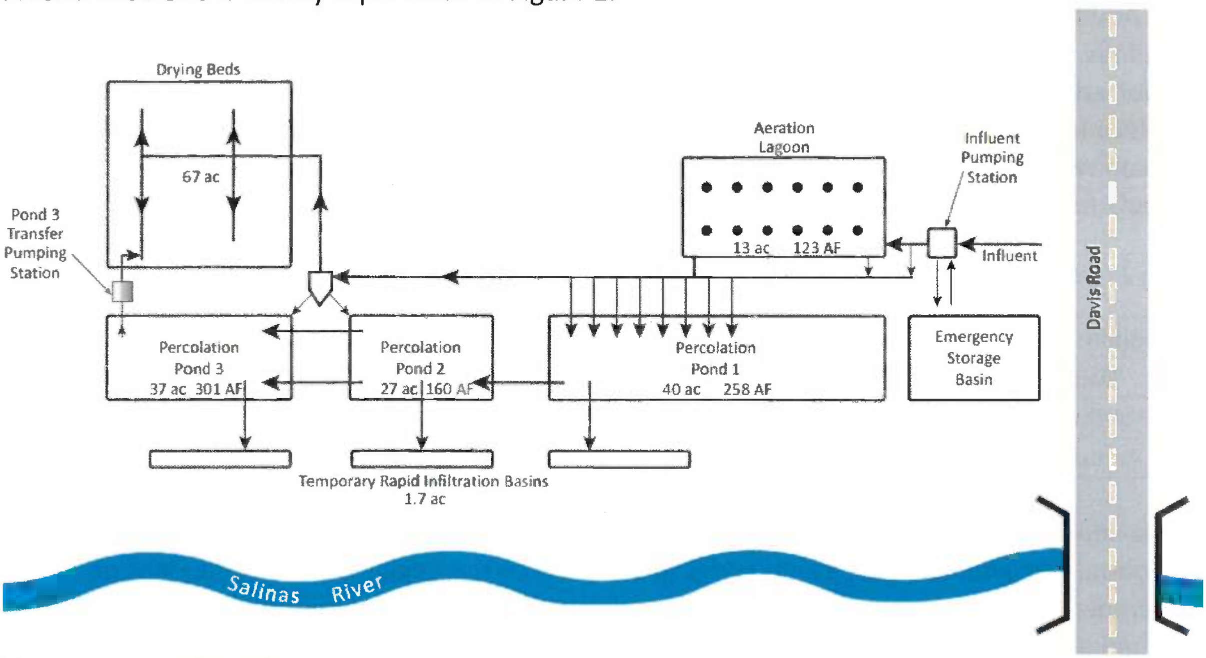

Figure 1. SIWTF Schematic

Percolation Studies

In 2015, the Monterey Peninsula Water Management District (MPWMD) conducted a water percolation field study of the SIWTF. Table 1 presents the results of that report, assuming water covers the bottom of all three ponds (MPWMD Technical Memorandum, 2015).

Table 1. Daily, Monthly, and Annual Pond Percolation (MPWMD, 2015)

*Daily Percolation	4.7 acre-feet (AF)[1]
Monthly Percolation	142 AF
Annual Percolation	**1,705 AF**

*Daily percolation by pond: Pond 1 – 2.1 AF; Pond 2 – 1.1 AF; Pond 3 – 1.5 AF

In 2014 and 2015, Gus Yates, Senior Hydrologist, Todd Groundwater, analyzed the proportional amounts of percolated wastewater contributing to flows in the Salinas River versus to deep recharge of the Salinas Valley Groundwater Basin. This analysis identified that water percolated from the ponds would either take a short path to the Salinas River or a longer route to the 180-Foot Aquifer. Based on evaluations of the subsurface soil profiles and well and river data, Todd Groundwater concluded that an annual average of 80% of percolation at the SIWTF contributes to flows in the Salinas River and 20% to recharging the groundwater basin, namely, the 180-Foot Aquifer by flowing north easterly direction toward the large groundwater depression east of Salinas. The lack of substantial amounts of deep percolation to water supply aquifers is supported by the proximity of the facility to the river and the presence of the Salinas Valley Aquitard (a shallow fine-grained layer that is viewed as an extensive, continuous, impermeable clay cap restricts direct downward recharge in the northern Salinas Valley from near Highway 1 to south/east of Salinas). Table 2 presents the results of the Todd Groundwater Analysis.

Table 2. Distribution of Percolated Water to River and Groundwater

To Salinas River		**To 180-Foot Aquifer**	
Daily Percolation	3.7 AF	Daily Percolation	0.9 AF
Monthly Percolation	114 AF	Monthly Percolation	28 AF
Annual Percolation	1,364 AF	**Annual Percolation**	**341 AF**

These analyses were used in support of a SWRCB Wastewater Change Petition WW0089. The City obtained rights to divert all industrial wastewater to the Regional Treatment Plant on November 30, 2015. In its approval, "the State Water Board has determined that the petition for change of place of use and purpose of use will not cause injury to any other lawful uses of water."

Historic Operations

Historically, the SIWTF was used to treat and dispose of all agricultural wash water (i.e., SIWTF inflow occurred year round, peaking in the summer). After aeration treatment, water was directed into the ponds, typically first to Pond 1, where it either percolated into the ground (80%) or evaporated into the air (20%). The ponds were filled sequentially – when Pond 1 was full, the water would move into Pond 2. When Pond 2 was full, the water would move into

[1] One acre-foot equals about 326,000 gallons, or enough water to cover an acre of land, about the size of a football field, one foot deep. An average California household uses between one-half and one acre-foot of water per year for indoor and outdoor use.

Pond 3 (see Figure 2, below). In the years prior to 2014, drying beds north of Pond 3 and rapid infiltration beds (along the Salinas River) were also being used to dispose the full amount of the influent wastewater so as to avoid going below the minimum allowable freeboard. This was likely due to fine sediments covering the pond bottoms and higher than average inflows and, potentially, high groundwater levels in the local vicinity. It was also the City's motivation for receiving approval for sending the industrial wastewater to the Regional Treatment Plant.

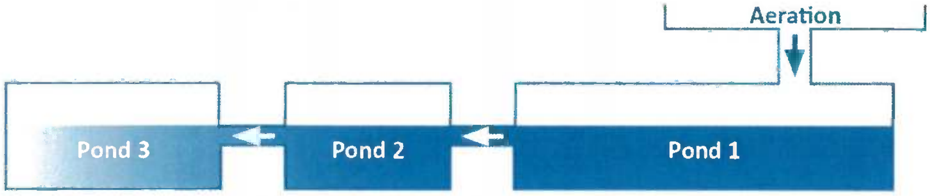

Figure 2. Historic Operational Scheme at SIWTF

Since 2014, the ponds have operated in a much different manner than described above. The primary differences include:

- **Water is no longer diverted to the ponds year round.** Under agreements between M1W and the City of Salinas, a shunt was installed near the Salinas Pump Station to direct industrial wastewater to the M1W Regional Treatment Plant at certain times of the year. This diversion supplements recycled water available for growers in the Castroville Seawater Intrusion Project (CSIP) system during the peak growing season. The additional water available to be recycled is estimated to have reduced groundwater pumping in the pressure, 180- and 400-foot aquifers of the Salinas Valley by several thousand acre-feet. These diversions also have the potential to further reduce groundwater pumping into the future, if regional partners can reach agreements on equitable and optimal costs and use. Recently, enabled by the lack of pond water, the City scarified (ripped) the pond bottoms. This maintenance work, coupled with warmer climates and reduced flow to the SIWTF, has resulted in one or two ponds being dry year round. This diversion of wastewater to the Regional Treatment Plant for recycling will continue in the future seasonally, in particular, if drought conditions persist in the region.
- **New facility efficiencies have been implemented.** In addition to the shunt, the City of Salinas has performed valve improvements. Valves located between each pond now control flow, allowing facility operators the flexibility of moving water from pond to pond or restricting flow between ponds. This creates greater operational and maintenance efficiencies. For example, the city staff operators have sent all wastewater to Pond 1 since Nov. 17, 2017 and will continue this until further notice.

Due to these new factors, it is expected that all the ponds will not be filled to capacity in the foreseeable future. When storm water is allowed to be processed in the pond system, which is currently being pursued through a State Water Resources Control Board Proposition 1 Grant and Regional Water Quality Control Board permitting process, additional water will be sent to the ponds during wet weather. In addition, greater storage and recovery of water from Pond 3 will be enabled and the operational methods may change again upon operation of the Pure

Water Monterey Project to optimize the use of the ponds for seasonal storage and recycled water yield.

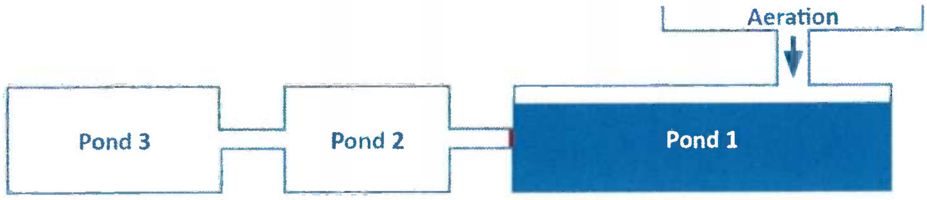

Figure 3. Recent Operational Scheme at SIWTF

Current Percolation Rates: Nov 2017 – February 2018

During the winter months, flows from the industrial wastewater dischargers and demand for recycled water within the CSIP system reduce due to reduced crop productivity. Table 3, below shows the estimated percolation to the groundwater basin from Pond 1, the only pond currently containing water. The data assumes:

1) All inflow to Pond 1 (daily percolation 2 AF)
2) 80% of percolation at the SIWTF goes to the Salinas River and 20% to recharging the 180-Foot Aquifer.

These wintertime inflows to the SIWTF will continue into the future, including with implementation of the Pure Water Monterey project and complimentary Salinas Storm Water Project, because the amount of municipal inflows to the Regional Treatment Plant without the industrial wastewater are adequate to supply all recycled water demands.

Table 3. Recent Wintertime Percolation to Continue into the Future

	Inflow to Pond 1	Percolation	To Salinas River	To 180-Foot Aquifer
Nov 2017	221 AF	62 AF	50 AF	12 AF
Dec 2017	163 AF	64 AF	51 AF	13 AF
Jan 2018	183 AF	64 AF	51 AF	13 AF
Feb 2018	148 AF	58 AF	46 AF	12 AF
TOTAL	**715 AF**	**248 AF**	**571 AF**	**50 AF**

Although percolation is not directly related to pond height, some additional percolation (i.e., through the sides of the pond is enabled as water levels rise). Pond 1 could still rise approximately 4.8 feet higher over the next few months if inflow exceeds percolation and evaporation. Volume flowrates of wastewater tend increase in late March and into April as agricultural processing increases. If no flows are diverted to the Regional Treatment Plant in 2018, it is anticipated that Pond 1 and Pond 2 could be near capacity by early fall, and the capacity in Pond 3 and/or the drying beds will be needed to accommodate winter flows of industrial wastewater during the 2018-2019 wet season.

In addition, with the implementation of the Salinas Storm Water Projects (funded by a Proposition 1 Grant from the SWRCB), all three ponds would be expected to be filled by the end of March every year (i.e., with both industrial wastewater and storm water) and would continue to percolate including up to approximately 1,000 AF annually to the river and 300 AF annually to the groundwater basin.

Pond Lining Costs

As part of conceptual investigation of feasibility of expanding recycled water projects (CSIP/SVRP and Pure Water Monterey) by Monterey One Water, MPWMD, and MCWRA, in March 2018, Monterey One Water received a preliminary analysis of pond lining options, including a 10% conceptual design cost estimate (prepared by Geo-Logic Associates), to determine the costs and benefits of lining the ponds to meet increased recycling demands during the peak irrigation season. Table 4, below shows preliminary costs estimates for lining Pond 3, for each of three potential lining methods.

Table 4. Conceptual Alternative Costs for Lining Pond 3 (*)

Pond 3	**Liner Alternative**				
		Range of Bentonite			
	HDPE Liner	3% Bentonite		6% Bentonite	
Mob & Demob	$ 300,000	$ 300,000		$ 300,000	
Construction Costs	$ 4,425,571	$ 4,673,124		$ 5,424,489	
Ancillary Facilities	$ 476,800	$ 476,800		$ 476,800	
Contractor OH - included above	$ -	$ -		$ -	
Construction Costs	**$ 5,202,371**	**$ 5,449,924**		**$ 6,201,289**	
Contingency @ 20%	$ 1,040,474	$ 1,089,985		$ 1,240,258	
Including Contingency	**$ 6,242,845**	**$ 6,539,909**		**$ 7,441,547**	
Owners Costs:					
Admin & PM @ 2%	$ 124,857	$ 130,798		$ 148,831	
Engineering @ 6%	$ 374,571	$ 392,395		$ 446,493	
ESCD & CM @ 5%	$ 312,142	$ 326,995		$ 372,077	
TOTAL =	**$ 7,054,415**	**$ 7,390,097**	**to**	**$ 8,408,948**	
		4.8%	to	19%	more for bentonite

Notes:
1 - If the bentonite functions properly. Site soils must be sampled and tested to verify viability.
2 - These cost estimates assume the perimeter berms are stable and no retrofitting required by DSOD.

Summary:
Liner vs. bentonite are similar costs within this study's Level of Accuracy.

* Class 4 cost estimate for conceptual projects (accuracy is -30% to + 50%) based on criteria from Association for the Advancement of Cost Engineering International.

Status and Potential Schedule for Lining Pond 3

Currently, neither Monterey One Water nor their partners (MPWMD, MCWRA, or City of Salinas) are actively pursuing a pond lining project; however, lining of one or more ponds would have substantive benefits for the Salinas Valley Groundwater Basin due to the availability of approximately an additional 500 to 700 acre-feet for recycling in the months of April through approximately July for each lined pond (for example, reducing the need for well use to irrigate crops or for additional recycled water demands). The pollutant load from the SIWTF to the Salinas River, a Clean Water Act 303(d)-listed water body, would also be reduced assisting the City with compliance.

If M1W, its recycled water customer(s), and the City choose to pursue a pond lining project, the planning, environmental review, engineering design, permitting, and would take approximately 10 – 12 months and bidding, construction, and testing would require one additional year.

Summary Schedule for Pond Lining (earliest possible)	2018									2019											
	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Soft cost funding (fastest possible estimated)																					
Planning/Environmental																					
Engineering Design and Permitting																					
Bidding																					
Construction																					

Attachment C

Preliminary Conceptual Design for Potable Water Extraction Wells for the Pure Water Monterey Expansion Project

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Monterey One Water
Providing Cooperative Water Solutions

Monterey Peninsula Water Management District

DRAFT TECHNICAL MEMORANDUM

To: Bob Holden, PE, Principal Engineer
Paul Sciuto, General Manager
Dave Stoldt, General Manager

From: Jonathan Lear, Senior Hydrogeologist (MPWMD)
Maureen Hamilton, Associate Water Resources Engineer (MPWMD)
Alison Imamura, Associate Engineer (Monterey One Water)
Edwin Lin (Todd Groundwater)

Date: May 7, 2018

Subject: Preliminary Conceptual Design for Potable Water Extraction Wells for the Pure Water Monterey Expansion Project

This Technical Memorandum presents information on the assumptions and methodology for selection of conceptual site plan and locations, and design parameters used to develop conceptual costs estimates, and to scope the environmental review, permitting, and design process for potential expansion of the Pure Water Monterey (PWM) Project (PWM Expansion). The well location factors, well site constraints and opportunities, and extraction modeling assumptions were provided by Jonathon Lear, Senior Hydrogeologist at MPWMD; well design parameters were provided by Ed Lin, Todd Groundwater; and cost estimates (transmitted separately), were developed by MPWMD staff and consultants.

Selection Factors for New Extraction Well Locations

From the drilling of the Aquifer Storage and Recovery (ASR) wells #3 and #4 at the Seaside Middle School and exploratory borings at Fitch Park site, it is understood that the Santa Margarita Sandstone is dipping at 4 degrees moving north from ASR 4 to the Fitch Park Test Well. It is also understood that the Santa Margarita Sandstone is not tilting to the east from the recent wells drilled for PWM at the first injection site (PWM Well Site 2). Wells screened in this portion of the Santa Margarita have proven to be large capacity wells and the siting of 4 wells between the ASR sites would provide the additional production capacity required to support PWM Expansion.

Specific Well Siting Specifications:

- *Extraction Well 1:* This well is sited on Monterey Peninsula Unified School District (MPUSD) property at the north-west corner of the Seaside Middle School Property (See Attachment 1 for a location map). Based on the lithologic and geophysical logs at ASR 4, it is expected that the top of the Santa Margarita Aquifer occurs at approximately 750 feet below ground surface (feet BGS) with a vertical thickness of approximately 260 feet (i.e., extend to 910 feet BGS). The static water level (SWL) is estimated at 350 feet BGS, thus providing approximately 400 feet of available drawdown. Based on the high specific capacities of nearby production wells screened in the Santa Margarita Aquifer, this location should yield a high-capacity well. MPWMD and CalAm already have easements for the ASR facilities and monitoring wells located on the east side of the parcel, which can help expedite the acquisition of additional easements needed.

Proposed Well Design for EW 1

	Length (feet)	Wall Thickness (inches)	Material
2-inch sounding tube	750	3/8	Carbon Steel
18-inch blank	750	3/8	Carbon or Stainless
16-inch screen	260	3/8	Stainless
14-inch blank	20	5/16	Carbon or Stainless

- *Extraction Well 2:* This well is sited on the north corner of the Seaside Middle School parcel (See Attachment 1 for a location map). It is anticipated that the top of the Santa Margarita Aquifer occurs at approximately 800 feet BGS and is approximately 240 feet thick (i.e., extends to a 1,040 feet BGS). The SWL is approximately 400 feet BGS, thus providing approximately 400 feet of available drawdown. Based on the high specific capacities of nearby wells producing from the Santa Margarita Aquifer, this location should yield a high-capacity well. MPWMD and CalAm already have easements for the ASR facilities and monitoring wells located on the south-east portion of the parcel.

Proposed Well Design for EW 2

	Length (feet)	Wall Thickness (inches)	Material
2-inch sounding tube	800	3/8	Carbon Steel
18-inch blank	800	3/8	Carbon or Stainless
16-inch screen	240	3/8	Stainless
14-inch blank	20	5/16	Carbon or Stainless

- *Extraction Well 3 at the ASR 6 site:* This portion of the MPWSP is proposed by CalAm as an ASR well site in the application for the Monterey Peninsula Water Supply Project (MPWSP); however, under a PWM Expansion project, the need for a well at this site is exclusively for extraction (no injection is proposed). CalAm will construct these facilities which can be operated exclusively as recovery wells to support the PWM Expansion until water suitable for injection is developed. If CalAm is not able to construct these facilities for legal reasons, one well could be constructed at this location to the specifications proposed for the Fitch Park ASR Project provided another environmental review document provides CEQA compliance for such a well. One extraction well (that can be converted to an ASR well in the future with no changes to the below-ground infrastructure) with associated appurtenances, electrical works, General Jim Moore Boulevard (GJM) pipeline tie-ins, access road, and other site works including grading and fencing. For the PWM Expansion Project, the extracted water is proposed to be chlorinated on site, then conveyed using a 30-inch diameter pipeline within the General Jim Moore Boulevard right of way to potable distribution system pipeline near the ASR 1 and 2 site (Santa Margarita site) for distribution to customers.

Proposed Well Design for EW 3

	Length (feet)	Wall Thickness (inches)	Material
2-inch sounding tube	600	3/8	Carbon Steel
18-inch blank	600	3/8	Carbon or Stainless
16-inch screen	220	3/8	Stainless
14-inch blank	20	5/16	Carbon or Stainless

- *Alternative Extraction Well Site:* Another well site considered as an alternative to one of the above-described sites would be located at the reservoir owned by the City of Seaside. There is an existing onsite well (screened in the Paso Robles Aquifer) that feeds the reservoir. This alternative well location would include construction and operation of a new well at the south-east corner of the parcel that is screened in the Santa Margarita Aquifer. At this site, it is estimated that the top of the Santa Margarita Aquifer occurs at approximately 600 feet BGS and is approximately 220 feet thick (i.e., extends to a depth of 820 feet BGS). The SWL is approximately 400 feet BGS, thus providing approximately 200 feet of available drawdown. Based on the specific capacities of nearby wells producing from the Santa Margarita Aquifer, this location should yield a high-capacity well. *Although this site is not assumed to be included in the conceptual planning for a PWM Expansion Project, it could be considered in the environmental review document as an alternative site location for an extraction well.*

Preliminary Extraction Well Design Assumptions

For all proposed extraction wells, the following basis of design was applied to each of the selected sites (*Source: MPWMD and Todd Groundwater).*

- *Perforated Interval:* The Santa Margarita Sandstone Aquifer is ubiquitous in this area of the Seaside Groundwater Basin and had been found to be on the order of 200 to 250 feet thick. The extraction wells should be designed with wire wrap well screens across the entire thickness of the formation. The wells should be designed to contain a 20-foot cellar (or sump) at the base of the screened interval extending down into the Monterey Formation.

- *Screen Open Area:* Well screen and gravel pack should be designed to minimize entrance velocity at the well screens. A continuous-slot wire wrap well screen (as opposed to a louvered screen) provides significantly more open area and connectivity to the Santa Margarita Sandstone.

- *Casing Diameter:* To achieve the required extraction pumping rate of 1,750 gallons per minute (GPM), a blank casing diameter of 18 inches is recommended. This diameter will allow the pump bowl assemblage to be set as low as necessary to achieve the design well capacity.

- *Borehole Diameter:* For the purposes of well construction, a minimum 4-inch think annular thickness is required to run a tremie pipe for proper installation of gravel pack and cement seal materials. Accordingly, a minimum 26-inch diameter borehole is required to construct the extraction wells.

- *Gravel Pack/Seal Depths:* The wells should be designed with an annular cement seal extending from the top of the annular gravel pack to the ground surface. A temporary tremie pipe can be used for gravel pack and seal installation; a permanent gravel tube will not be necessary. A highly-spherical, silica-based gravel pack should be selected to minimize settlement of gravel during installation. The gravel pack should extend 20 feet above the top of the well screen to account for potential settlement.

- *Casing Material Evaluation:* Water quality data suggests that native water in the Santa Margarita Sandstone is of a magnesium-chloride-sulfate character and has trace levels of hydrogen sulfide gas. The Langelier Index suggests the water is mildly corrosive. Due to the high surface areas of wire wrap screen sections, stainless steel is the only practical material to ensure long-term integrity. Alternatives for blank screen materials include various levels of carbon and stainless steel. Because multiple sources and qualities of water are proposed for injection, storage, and recovery from this area of the Seaside Groundwater Basin, stainless steel may be the best option to avoid corrosion.

- *Well Design:* The wells should be designed with a telescoping screen design, whereby the 18-inch casing transitions to a 16-inch screen. The transition involves the use of a figure-K packer to ensure a sand-tight seal between the casing and screen. A telescope-design provides the advantage of ensuring a minimum 5-inch thick gravel pack (based on a 26-inch diameter borehole) to ensure proper formation stability opposite the screen. Each well would have the capacity to pump 1,750 gallons per minute.

Baseline Hydrogeologic Assumptions for Groundwater Modeling

The following are the assumptions and methods used for analyzing the need for and future use of the new extraction wells. Namely, this section describes the infrastructure and water rights constraints in the existing system/legal framework that led to the proposal for new extraction wells.

Carmel River Production

CalAm has three water rights to pump water from the Carmel Valley Alluvial Aquifer (CVAA):

- *Water Rights related to San Clemente and Los Padres Dams (3,376 AFY).* SWRBO 98-02 limits production from the upper valley (above the narrows) to when the Carmel River is not in the Low-Flow regime (more than 5 days of below 20 cubic feet per second (cfs) flow at Don Juan Bridge). In testimony to the California Public Utilities Commission in 2013, Richard Svindland, California American Water Company, indicated that once the CDO is lifted, CalAm intends to pump the majority of this water right in the winter and reduce the summer diversions to 1 MGD that would serve as maintenance flows through the Begonia Iron Removal Plant. To achieve this goal, CalAm proposed to extract 470 AF per month January through June and 92 AF per month July through December.
- *Table 13 Carmel River Rights:* CalAm has the right to divert water and serve it to customers that reside in the Carmel River Watershed and the City limits of Carmel when the instream flow requirements are met. Flows must be in excess of a daily average of 120 cfs at the Highway 1 stream gage from December 1 through April 15 or in excess of 80 cfs from April 16 through May 31 to meet instream flow requirements. Average demand for customers eligible to receive Table 13 water is 4.3 AF per day.
- *20808 Carmel River Water Rights:* ASR water rights 20808 A and C are held jointly by CalAm and MPWMD and allow them to divert water from the CVAA and inject into the Seaside Groundwater Basin. Diversions are subject to the same instream flow requirements as the Table 13 water right. Maximum daily diversion is 29 AF.

Seaside Groundwater Basin Production

CalAm has rights to pump 1,474 AF per year through the Seaside Adjudication Decision (2008) but must pay back historical over-pumpage once a water supply is established. CalAm has reached an agreement to pay back the Seaside Basin through a 25-year in-lieu recharge program. CalAm will leave 700 AF of its allotment in the Basin once a water supply project is established. Although not required, the analysis for this technical memorandum assumes that CalAm would recover the 774 AF at a constant rate of 61 AF per month over the water year.

To establish the assumptions for the groundwater modeling for the PWM Expansion, MPWMD staff, established a spreadsheet model to emulate the ASR operations, water supplies and groundwater extractions consistent with CalAm-proposed water demands distributed by Ian Crooks of CalAm. The model showed how each of the sources is assumed to be used in the future by CalAm. For the PWM Expansion, the PWM product water previously injected into the Seaside Groundwater Basin (base project amount plus expansion) would be used first, while banking Carmel River ASR as a drought reserve to the extent that those flows are available. This is consistent with the need to fund the PWM Project through sale of water to CalAm annually. To model the operation of the CalAm system to meet future demand scenarios, an operational model was created with a hierarchical order of use of each source to meet demand. The order assumed for this model is Carmel River, Table 13 Water Rights, Seaside Basin Native Groundwater, Sand City Desal, PWM Recovery, and Carmel River ASR Recovery.

Operational Rules for Groundwater Modeling

The following operational rules and assumptions were used to perform the supply-demand analysis for PWM Expansion (Note: a screen-shot of the water supply / demand model for the PWM Expansion is provided in Attachment 2a and for a long term, cumulative scenario with maximum future water demands is provided in Attachment 2b):

1. ASR wells must rest for two months following injection to allow for reduction of disinfection byproduct concentrations and are not available as sources to the system during that time.
2. Chlorination facilities would be provided at the new Extraction Well 3 at the ASR-6 well site (Fitch Park).
3. A new 30-inch potable water pipeline (as described and evaluated in the Monterey Peninsula Water Supply Project) will be installed in General Jim Moore Boulevard between the proposed new Extraction Well 3 at the ASR-6 well site (Fitch Park) and the Santa Margarita (ASR-1/ASR-2) Site where are located; thus, enabling recovery and delivery of water from a new extraction well at that site and from two new extraction well sites at Seaside Middle School.
4. All water produced at the Santa Margarita and the Seaside Middle School ASR sites and at the new extraction well sites at Seaside Middle School (EW-3 and EW-4) can be treated (chlorinated) at Santa Margarita prior to entering the Distribution System.
5. The existing Seaside Well Field will be connected to the Monterey Pipeline Transmission Main which will allow for water produced from that well field to reach demand outside of the system bulkhead at the Naval Postgraduate School. The required pipeline connections will be constructed independently of the PWM Expansion and may be considered as a cumulative project in any environmental review of the PWM Expansion project.
6. Only one well per ASR couplet can be used as a source to the system due to the proximity of the wells to one another.
7. Two additional extraction only wells will be drilled to address the lost production capacity when ASR wells are resting and for redundancy.
8. An extraction well at the Fitch Park ASR site facilities will be constructed (although it may be constructed as a ASR injection/extraction well, the PWM Expansion Project would only include operating it for extraction).
9. CalAm will be able to bank Carmel River ASR water for drought reserve once the CDO has been lifted (i.e., water injected can be used in future years)
10. CalAm will begin payback to the Seaside Basin once the PWM Expansion Project is operational, unless supplies are less than demands.

Magnitude of sources to meet demand assumed in the water supply and demand analysis are:

1. Carmel River 3,376 AFY
2. Seaside Native Water (without payback 700 AFY) 774 AFY
3. Sand City Desalination 150 AFY
4. PWM with Expansion 5,570 AFY
   includes PWM approved project yield of 3,500 AFY and an PWM Expansion Project of 2,250 AFY
5. Carmel River ASR diversion rate 29.0 acre-feet per day[1]
6. Table 13 water rights 4.3 acre-feet per day[2]

The supply demand analysis also use the following assumptions. Streamflow from water years 1987 to 2015 at the Highway 1 gage on the Carmel River were used for the analysis. The record of daily average flows was analyzed to determine if diversion of Carmel River ASR would have been permitted. If flows were sufficient to allow diversion, 29 acre-feet and 4.3 acre-feet were accounted as diverted for 20808 and Table 13 water rights respectively. The daily values were compiled into monthly totals to match the timestep of the groundwater model. Monthly demand was estimated by the percent use by month multiplied by the annual system demand. For each monthly time step, ASR diversions were assigned as injected, Table 13 diversions were assigned to meet demands within the Carmel River Watershed, Carmel River pumping was assigned to meet system demand, Sand City Desal Production was assigned to meet system demand, Seaside Native groundwater pumping was assigned to meet system demand, PWM recovery was assigned to meet demand, and finally ASR recovery was assigned to meet system demand. If PWM and/or ASR was not required to meet system demand, the remainder was banked in the Seaside Groundwater Basin. If demand is greater than all the sources and there is not a bank of water stored, the analysis identified the volume as a supply shortage.

The analysis for required Seaside Groundwater Basin extraction identified that two new extraction wells would be necessary to recover water from PWM Expansion. An additional extraction well at the ASR 5 or 6 site would be needed for redundancy during some of the spring and summer months, specifically, when Carmel River flows were high enough to enable ASR injections late into the spring. CalAm requested this analysis also be performed with the firm capacity of the existing Seaside well field by removing Paralta Well (Paralta), the largest well, from the field. When Paralta is removed, 3 additional wells are required. MPWMD did not remove use of the Paralta Well from the groundwater model assumptions, but to use the firm capacity analysis to realize that three (3) additional wells are required for PWM expansion when completing the analysis using firm capacity (i.e., two in service and one for standby/backup). CalAm also expressed a desire to site another redundant extraction well. Therefore, this memo presents two sites for extraction wells, one alternative site, and an additional site at the planned ASR-6 well site at the Fitch Park used for extraction as the three required wells. One additional

[1] Annual yield from Carmel River ASR diversions will vary by hydrology/precipitation from year to year from a low of zero to a high of 1,900 AFY (the maximum allowed by the water right permits).
[2] Annual yield from Table 13 water rights will vary by hydrology/precipitation from year to year from a low of zero to a high of the maximum allowed by the water right permit).

ASR well would be built at ASR-5 in the future (i.e., currently assumed to be a cumulative project component). Although not part of the PWM Expansion, the extraction wells proposed to be located at ASR-5 and ASR-6 would potentially be used for ASR operations, if and when water rights are acquired for additional Carmel River ASR injections or for the MPWSP desalination project injection when a future it is constructed.

Additional Future ASR Facilities (Cumulative Projects)

CalAm facilities, namely ASR facilities, proposed by CalAm in their Monterey Peninsula Water Supply Project (MPWSP) at the Fitch Park site would be constructed in the future pursuant to the description and analysis in the MPWSP EIR/EIS (as a component of the MPWSP), or separately implemented in a future phase of the MPWMD/CalAm ASR program.

The required facilities for the construction and operation of a Fitch Park ASR well site include the following (these facilities would be for a potential future, cumulative project that would include full use of the Fitch Park ASR wells as Aquifer Storage and Recovery Wells, not for PMW Expansion):

- One extraction well would become an ASR well and an additional ASR would be built by CalAm. As discussed previously, the Extraction Well #3 described above would be built to function as an ASR well but would not be used for injection until a future project, such as the MPWSP Desalination Project or if a future expansion of ASR is pursued. The new well at ASR-5 would be built with all associated appurtenances, electrical works, General Jim Moore Boulevard (GJM) pipeline tie-ins (if needed), access road, and other site works including grading and fencing. For the PWM Expansion Project, the extracted water is proposed to be conveyed to the ASR 1 and 2 sites (Santa Margarita site) for chlorination.
- Chemical facilities are required to disinfect production water from this new well. For the site layout assumptions, space will be made available for future chlorination facilities at the site in the event that on-site chlorination is needed for future projects.
- The MPWSP's "Transmission Pipeline," including construction of a 4,800 linear feet of 36-inch Ductile Iron Pipe (DIP) and appurtenances, between Fitch Park site and the existing 30" transmission header near the southwest corner of the Santa Margarita site. The Transmission Pipeline will convey disinfected production water from the new Fitch Park well to the existing 30" transmission pipe located near the southeast corner of the Santa Margarita site. The line size is 36" for consistency with the future MPWSP project. This assumes chlorination would be provided at the Fitch Park Site.
- Backflush Pipeline construction, 3,700 linear feet of 16-inch HDPE pipe and appurtenances, between Fitch Park site and the Backflush Pipeline current termination in GJM near the Seaside Middle School site ASR 3 and ASR 4 wells. The Backflush Pipeline conveys pump-to-waste water from blow-off and backflushing operations to the backflush basin at the Santa Margarita site. A backflush basin is not allowed at the Fitch Park site due to space constraint.
- Recirculation Pipeline construction, 3,700 linear feet of 30-inch DIP and appurtenances, between Fitch Park site and the Recirculation Pipeline current termination in GJM near the

Seaside Middle School site ASR 3 and ASR 4 wells. The Recirculation Pipeline serves two purposes:
  - Allows for water circulation during periods when water is not being injected, recovered, or conveyed.
  - Conveys undisinfected production water from the Seaside Middle School, where chemicals have been prohibited in the past, to the Santa Margarita site where the water will be disinfected for transmission and distribution.

Alternative or Cumulative Extraction Wells

The required facilities for a potential new well as an alternative to one of the three Extraction Wells described above or to provide additional extraction capabilities for cumulative project at the Bayonet and Black Horse Reservoir are as follows (an Alternative Extraction Well Site):

- One new production well with associated appurtenances, electrical works, GJM pipeline tie-ins, access road, and site other works including grading and fencing. Alternatively, this well may be constructed as an ASR well for non-PWM water if future potential water rights are identified.
- Chemical facilities including storage, housing, and injection works. Chemical facilities are required to disinfect production water from the new well.
- In a cumulative condition with use of this alternative well site, construction of 2,400 linear feet of 30-inch DIP and appurtenances between the Pipeline in General Jim Moore and the new wells. This pipe will convey disinfected extracted groundwater from this new well to the Transmission Pipeline (described above). Thirty-inch pipe size is required to convey disinfected water from this wells and the new production wells at Seaside Middle School site in the event Santa Margarita site disinfection is not available.
- In a cumulative condition with use of this alternative well site, construction of 2,400 linear feet of 24-inch DIP and appurtenances between the Recirculation Pipeline (described above) and the new wells. This pipe will convey undisinfected extracted groundwater from the new well to the Santa Margarita site in the event chemical disinfection is unavailable at this site. This pipe may also convey undisinfected water from the new production wells at Seaside Middle School site in the event disinfection at this site is preferable.
- Construction of 1000 linear feet of 16-inch HDPE pipe and appurtenances between the new well and the Backflush Pipeline to convey blow-off water to the Santa Margarita backflush basin. If the existing reservoir can be used to contain blow-off water, only 200 linear feet of 16-inch HDPE pipe would need to be installed.

If chemical facilities are not allowed at the Bayonet and Black Horse Reservoir, the following new facilities would be required for the Santa Margarita site:

- Land to construct additional chemical facilities at ASR 1/2.
- Chemical facilities including storage, housing, and injection works. Chemical facilities are required to disinfect production water from the new well. Associated facilities include

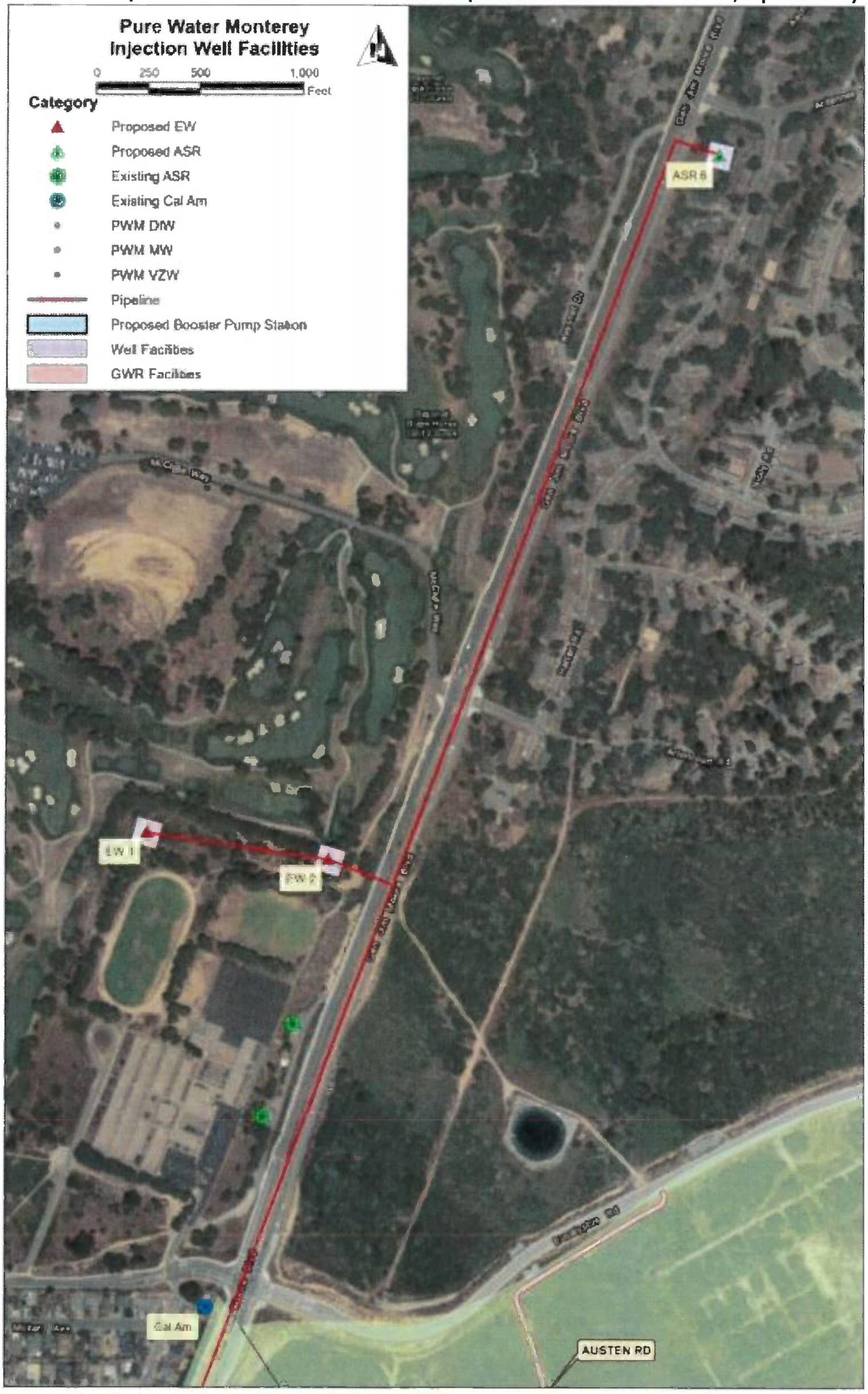
appurtenances, electrical works, GJM pipeline tie-ins, access road, and site other works including grading and fencing.

- In a cumulative condition with use of this alternative well site, construction of 900 linear feet of 30-inch DIP and appurtenances between the Transmission Pipeline (described above) the disinfection facility. This pipe will convey disinfected production water from this new disinfection facility to the Transmission Pipeline.
- Construction of 900 linear feet of 30-inch DIP and appurtenances between the Recirculation Pipeline the new disinfection facility. This pipe will convey undisinfected water from the production wells to the new chemical facility for disinfection.

Other Cumulative CalAm System Facilities

In addition, two other cumulative CalAm Distribution Facilities would be needed for the CalAm System to meet other regional demands or optimize the distribution system (i.e., not needed for PWM Expansion), if the MPWSP desalination project is not built, namely, the Carmel Valley Pump Station and satellite interconnections, as described and evaluated in the MPWSP EIR.

Attachment 1. Proposed Extraction Wells Location (source: Schaaf &Wheeler, April 2018)



Attachment 2a. Excerpt of Water Supply and Demand Analysis for Preliminary Design and Groundwater Modeling (proposed project) (Source: Jonathon Lear, MPWMD, April 2018)

Row	Month (F)	2007 to 2017 percent (G)	H	Annual Demand (I)	Sand City (J)	PWM Annual (K)	PWM Baseline (L)	Seaside Native (M)	Carmel River (N)	ASR Baseline (O)
3	1	0.079	begin	10400	150	6732	0	747	3376	1200
4	2	0.068	end	10400		All Values in Acre Feet				
5	3	0.083		0.0						
6	4	0.082								
7	5	0.090								
8	6	0.089								
9	7	0.095								
10	8	0.095								
11	9	0.087								
12	10	0.091								
13	11	0.075								
14	12	0.067								

Carmel Valley Pumping — Other Sources (Firm Capacity) — Seaside Supply Capacity — Injection and Storage — In addition to ASR 5 or 6

Row	D	Model Stress Period	Year/Month	CR ASR	Table 13 D	CV Pumping for Customer Service	Total CV Pumping	CV Supply Sufficient	Sand City Desal	System Demand	Seaside Pumping	CalAm wellfield W/O ASR Capacity	ASR 1 to 4 Recovery Capacity	ASR 5 and 6 Recovery Capacity	Total Seaside Capacity	Seaside Well Capacity Sufficient	Shortage of Seaside Capacity (GPM)	ASR1 and 2 Injection	ASR 3 and 4 Injection	PWM Injection	PWM In Storage	ASR in Storage	Seaside Pumping	Native Groundwater	PWM Recovery	ASR Recovery	Supply Shortage	Extra Wells @ 1750 GPM
20	11	Nov-20	2020_11	0	0	92	92	Yes	12	778	673	358	464	232	1055	Yes	None	0	0	563.0	331	416	673	61	331	281	0	0
21	12	Dec-20	2020_12	58	6.5	470	534.5	Yes	12	702	213	358	0	0	358	Yes	None	29	29	592.4	563	193	213	61	152	0	0	0
22	1	Jan-21	2021_1	899	100.75	470	1469.75	Yes	12	819	236	358	0	0	358	Yes	None	449.5	449.5	576.4	1004	1092	236	61	175	0	0	0
23	2	Feb-21	2021_2	580	65	470	1115	Yes	12	702	155	358	0	0	358	Yes	None	290	290	525.4	1405	1672	155	61	93	0	0	0
24	3	Mar-21	2021_3	899	100.75	470	1469.75	Yes	12	863	280	358	0	0	358	Yes	None	449.5	449.5	572.0	1837	2571	280	61	219	0	0	0
25	4	Apr-21	2021_4	870	97.5	470	1437.5	Yes	12	852	273	358	0	0	358	Yes	None	435	435	524.0	2190	3441	273	61	211	0	0	0
26	5	May-21	2021_5	638	71.5	470	1179.5	Yes	12	933	380	358	0	0	358	No	162	319	319	511.4	2503	4079	380	61	318	0	0	0.092789637
27	6	Jun-21	2021_6	0	0	92	92	Yes	12	923	819	358	0	232	591	No	1728	0	0	491.0	2636	4079	819	61	757	0	0	0.987366524
28	7	Jul-21	2021_7	0	0	92	92	Yes	12	983	879	358	0	232	591	No	2183	0	0	508.4	2430	4079	879	61	818	0	0	1.247312189
29	8	Aug-21	2021_8	0	0	92	92	Yes	12	986	882	358	464	232	1054	Yes	None	0	0	467.0	2121	4079	882	61	821	0	0	0
30	9	Sep-21	2021_9	0	0	92	92	Yes	12	907	803	358	464	232	1054	Yes	None	0	0	287.6	1767	4079	803	61	742	0	0	0
31	10	Oct-21	2021_10	0	0	92	92	Yes	12	950	845	358	464	232	1054	Yes	None	0	0	331.4	1313	4079	845	61	784	0	0	0
32	11	Nov-21	2021_11	0	0	92	92	Yes	12	778	673	358	464	232	1054	Yes	None	0	0	563.0	861	4079	673	61	612	0	0	0
33	12	Dec-21	2021_12	0	0	470	470	Yes	12	702	220	358	464	232	1054	Yes	None	0	0	592.4	811	4079	220	61	158	0	0	0
34	1	Jan-22	2022_1	522	58.5	470	1050.5	Yes	12	819	278	358	0	0	358	Yes	None	261	261	576.4	1246	4601	278	61	217	0	0	0
35	2	Feb-22	2022_2	812	91	470	1373	Yes	12	702	129	358	0	0	358	Yes	None	406	406	525.4	1605	5413	129	61	67	0	0	0
36	3	Mar-22	2022_3	899	100.75	470	1469.75	Yes	12	863	280	358	0	0	358	Yes	None	449.5	449.5	572.0	2063	6312	280	61	219	0	0	0
37	4	Apr-22	2022_4	464	52	470	986	Yes	12	852	318	358	0	0	358	Yes	None	232	232	524.0	2416	6776	318	61	257	0	0	0
38	5	May-22	2022_5	87	9.75	470	566.75	Yes	12	933	441	358	0	0	358	No	630	43.5	43.5	511.4	2683	6863	441	61	380	0	0	0.359784875
39	6	Jun-22	2022_6	0	0	92	92	Yes	12	923	819	358	0	232	591	No	1728	0	0	491.0	2815	6863	819	61	757	0	0	0.987366524
40	7	Jul-22	2022_7	0	0	92	92	Yes	12	983	879	358	0	232	591	No	2183	0	0	508.4	2548	6863	879	61	818	0	0	1.247312189
41	8	Aug-22	2022_8	0	0	92	92	Yes	12	986	882	358	464	232	1054	Yes	None	0	0	467.0	2239	6863	882	61	821	0	0	0
42	9	Sep-22	2022_9	0	0	92	92	Yes	12	907	803	358	464	232	1054	Yes	None	0	0	287.6	1885	6863	803	61	742	0	0	0
43	10	Oct-22	2022_10	0	0	92	92	Yes	12	950	845	358	464	232	1054	Yes	None	0	0	331.4	1431	6863	845	61	784	0	0	0
44	11	Nov-22	2022_11	0	0	92	92	Yes	12	778	673	358	464	232	1054	Yes	None	0	0	563.0	979	6863	673	61	612	0	0	0
45	12	Dec-22	2022_12	754	84.5	470	1308.5	Yes	12	702	135	358	0	0	358	Yes	None	377	377	592.4	930	7617	135	61	74	0	0	0
46	1	Jan-23	2023_1	899	100.75	470	1469.75	Yes	12	819	236	358	0	0	358	Yes	None	449.5	449.5	576.4	1449	8516	236	61	175	0	0	0
47	2	Feb-23	2023_2	725	81.25	470	1276.25	Yes	12	702	139	358	0	0	358	Yes	None	362.5	362.5	525.4	1850	9241	139	61	77	0	0	0
48	3	Mar-23	2023_3	0	0	470	470	Yes	12	863	381	358	0	232	591	Yes	None	0	0	572.0	2298	9241	381	61	320	0	0	0
49	4	Apr-23	2023_4	0	0	470	470	Yes	12	852	370	358	0	232	591	Yes	None	0	0	524.0	2551	9241	370	61	309	0	0	0
50	5	May-23	2023_5	0	0	470	470	Yes	12	933	451	358	464	232	1054	Yes	None	0	0	511.4	2766	9241	451	61	390	0	0	0
51	6	Jun-23	2023_6	0	0	92	92	Yes	12	923	819	358	464	232	1054	Yes	None	0	0	491.0	2888	9241	819	61	757	0	0	0
52	7	Jul-23	2023_7	0	0	92	92	Yes	12	983	879	358	464	232	1054	Yes	None	0	0	508.4	2621	9241	879	61	818	0	0	0
53	8	Aug-23	2023_8	0	0	92	92	Yes	12	986	882	358	464	232	1054	Yes	None	0	0	467.0	2312	9241	882	61	821	0	0	0
54	9	Sep-23	2023_9	0	0	92	92	Yes	12	907	803	358	464	232	1054	Yes	None	0	0	287.6	1958	9241	803	61	742	0	0	0
55	10	Oct-23	2023_10	0	0	92	92	Yes	12	950	845	358	464	232	1054	Yes	None	0	0	331.4	1504	9241	845	61	784	0	0	0
56	11	Nov-23	2023_11	87	9.75	92	188.75	Yes	12	778	664	358	0	0	358	No	2312	43.5	43.5	563.0	1052	9328	664	61	602	0	0	1.320959291
57	12	Dec-23	2023_12	174	19.5	470	663.5	Yes	12	702	200	358	0	0	358	Yes	None	87	87	592.4	1013	9502	200	61	139	0	0	0
58	1	Jan-24	2024_1	870	97.5	470	1437.5	Yes	12	819	239	358	0	0	358	Yes	None	435	435	576.4	1466	10372	239	61	178	0	0	0
59	2	Feb-24	2024_2	841	94.25	470	1405.25	Yes	12	702	126	358	0	0	358	Yes	None	420.5	420.5	525.4	1665	11213	126	61	64	0	0	0
60	3	Mar-24	2024_3	899	100.75	470	1469.75	Yes	12	863	280	358	0	0	358	Yes	None	449.5	449.5	572.0	2326	12112	280	61	219	0	0	0

Attachment 2b. Excerpt of Water Supply and Demand Analysis for Preliminary Design and Groundwater Modeling (cumulative) (Source: Jonathon Lear, MPWMD, April 2018)

2007 to 2017 percent		Annual Demand	Sand City	PWM Annual	PWM Baseline	Seaside Native	Carmel River	ASR Baseline
0.079	begin	10400	150	6752	0	747	3376	1200
0.068	end	14400	cumulative		All Values in Acre Feet			
0.083		1.0						
0.082								
0.090		Maximum Extra Wells 1,750 gpm wells required =				3		
0.089		CUMULATIVE DEMAND						
0.095								
0.095								
0.087								
0.091								
0.075								
0.067								

Carmel Valley Pumping — Other Sources — Firm Capacity — Seaside Supply Capacity — Injection and Storage — In addition to ASR 5 or

	Model Stress Period	CR ASR I	Table 13 Di	CV Pumping for Customer Service	Total CV Pumpin	CV Supply Sufficien	Sand City De	System Dema	Seaside Pumpin	CalAm wellfield W/O ASR Capacity	ASR 1 to 4 Recovery Capacit	ASR 5 and 6 Recovery Capacit	Total Seaside Capacity	Seaside Well Capacity Sufficie	Shortage of Seaside Capacity (GPM)	ASR1 and 2 Injection	ASR 3 and 4 Injection	PWM Injection	PWM In Storage	ASR in Storage	Seaside Pumping	Native Groundwater	PWM Recovery	ASR Recovery	Supply Shortage	Extra Wells @ 1750 GPM
		Paste from Pivot Table																								
10	Oct-20	0	0	92	92	Yes	12	950	845	358	464	232	1055	Yes	None	0	0	331.4	0	1200	845	61	0	784	0	0
11	Nov-20	0	0	92	92	Yes	12	779	674	358	464	232	1055	Yes	None	0	0	563.0	331	416	674	61	331	282	0	0
12	Dec-20	58	6.5	470	534.5	Yes	12	704	215	358	0	0	358	Yes	None	29	29	592.4	563	193	215	61	154	0	0	0
1	Jan-21	899	100.75	470	1469.75	Yes	12	822	239	358	0	0	358	Yes	None	449.5	449.5	576.4	1002	1092	239	61	178	0	0	0
2	Feb-21	580	65	470	1115	Yes	12	706	159	358	0	0	358	Yes	None	290	290	525.4	1401	1672	159	61	97	0	0	0
3	Mar-21	899	100.75	470	1469.75	Yes	12	868	285	358	0	0	358	Yes	None	449.5	449.5	572.0	1829	2571	285	61	224	0	0	0
4	Apr-21	870	97.5	470	1437.5	Yes	12	858	278	358	0	0	358	Yes	None	435	435	524.0	2177	3441	278	61	217	0	0	0
5	May-21	638	71.5	470	1175.5	Yes	12	940	386	358	0	0	358	No	213	319	319	511.4	2484	4079	386	61	325	0	0	0.121780697
6	Jun-21	0	0	92	92	Yes	12	931	827	358	0	232	591	No	1786	0	0	491.0	2670	4079	827	61	765	0	0	1.020499164
7	Jul-21	0	0	92	92	Yes	12	992	888	358	0	232	591	No	2248	0	0	508.4	2356	4079	888	61	826	0	0	1.28458641
8	Aug-21	0	0	92	92	Yes	12	996	892	358	464	232	1054	Yes	None	0	0	467.0	2078	4079	892	61	830	0	0	0
9	Sep-21	0	0	92	92	Yes	12	918	813	358	464	232	1054	Yes	None	0	0	287.6	1715	4079	813	61	752	0	0	0
10	Oct-21	0	0	92	92	Yes	12	961	857	358	464	232	1054	Yes	None	0	0	331.4	1251	4079	857	61	795	0	0	0
11	Nov-21	0	0	92	92	Yes	12	790	686	358	464	232	1054	Yes	None	0	0	563.0	787	4079	686	61	625	0	0	0
12	Dec-21	0	0	470	470	Yes	12	715	233	358	464	232	1054	Yes	None	0	0	592.4	725	4079	233	61	172	0	0	0
1	Jan-22	522	58.5	470	1050.5	Yes	12	834	293	358	0	0	358	Yes	None	261	261	576.4	1146	4601	293	61	231	0	0	0
2	Feb-22	812	91	470	1373	Yes	12	717	144	358	0	0	358	Yes	None	406	406	525.4	1491	5413	144	61	83	0	0	0
3	Mar-22	899	100.75	470	1469.75	Yes	12	880	297	358	0	0	358	Yes	None	449.5	449.5	572.0	1934	6312	297	61	235	0	0	0
4	Apr-22	464	52	470	586	Yes	12	870	335	358	0	0	358	Yes	None	232	232	524.0	2270	6776	335	61	274	0	0	0
5	May-22	87	9.75	470	566.75	Yes	12	952	460	358	0	0	358	No	767	43.5	43.5	511.4	2521	6863	460	61	398	0	0	0.438474895
6	Jun-22	0	0	92	92	Yes	12	942	838	358	0	232	591	No	1873	0	0	491.0	2634	6863	838	61	777	0	0	1.070198124
7	Jul-22	0	0	92	92	Yes	12	1003	899	358	0	232	591	No	2335	0	0	508.4	2348	6863	899	61	838	0	0	1.33428537
8	Aug-22	0	0	92	92	Yes	12	1007	903	358	464	232	1054	Yes	None	0	0	467.0	2019	6863	903	61	842	0	0	0
9	Sep-22	0	0	92	92	Yes	12	929	825	358	464	232	1054	Yes	None	0	0	287.6	1644	6863	825	61	764	0	0	0
10	Oct-22	0	0	92	92	Yes	12	973	868	358	464	232	1054	Yes	None	0	0	331.4	1168	6863	868	61	807	0	0	0
11	Nov-22	0	0	92	92	Yes	12	802	697	358	464	232	1054	Yes	None	0	0	563.0	693	6863	697	61	636	0	0	0
12	Dec-22	754	84.5	470	1308.5	Yes	12	727	160	358	0	0	358	Yes	None	377	377	592.4	620	7617	160	61	99	0	0	0
1	Jan-23	899	100.75	470	1469.75	Yes	12	845	262	358	0	0	358	Yes	None	449.5	449.5	576.4	1113	8516	262	61	201	0	0	0
2	Feb-23	725	81.25	470	1276.25	Yes	12	729	165	358	0	0	358	Yes	None	362.5	362.5	525.4	1489	9241	165	61	104	0	0	0
3	Mar-23	0	0	470	470	Yes	12	891	409	358	0	232	591	Yes	None	0	0	572.0	1911	9241	409	61	347	0	0	0
4	Apr-23	0	0	470	470	Yes	12	881	399	358	0	232	591	Yes	None	0	0	524.0	2135	9241	399	61	338	0	0	0
5	May-23	0	0	470	470	Yes	12	963	481	358	464	232	1054	Yes	None	0	0	511.4	2322	9241	481	61	419	0	0	0

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Attachment D

Preliminary Draft Technical Memorandum - Trussell Tech Draft Preliminary Synopsis of Ocean Plan Compliance Assessment, February 2018.

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DRAFT PRELIMINARY SYNOPSIS OF OCEAN PLAN COMPLIANCE ASSESSMENT

6.5 MGD Capacity Advanced Water Purification Facility

Draft Date: February 22, 2018

Author: Brie Webber, P.E.
Mitchell Mysliwiec, Ph.D. (Larry Walker Associates)

Reviewer: Elaine Howe, P.E.
John Kenny, P.E.

Subject: Draft preliminary synopsis of Ocean Plan compliance assessment

The following communication provides a synopsis of the Ocean Plan compliance assessment results for Monterey One Water (M1W) and the Monterey Peninsula Water Management District's proposed Groundwater Recharge (GWR) Project. This compliance assessment considered an expanded Advanced Water Purification Facility (AWPF) with a production capacity of 6.5 mgd. The main conclusions from this work are described below, as well as assumptions that were made specific to this compliance assessment. The modeling approach follows what was described in the 2017 assessment *Ocean Plan Compliance Assessment for the Pure Water Monterey Groundwater Replenishment Project* prepared by Trussell Technologies. The ocean dilution modeling was executed by Mitchell Mysliwiec of Larry Walker Associates. This brief document includes only the preliminary conclusions and specific assumptions required to convey the necessary information for M1W's California Public Utilities Commission hearing on February 27, 2018. For more information and specific details on the modeling approach and assumptions, please refer to the 2017 report.

Preliminary Conclusions:

- When considering the GWR Project and the reverse osmosis (RO) concentration from the AWPF – called the GWR Concentrate flow – all constituents are ≤ 80% of the Ocean Plan objective, with ammonia being the constituent estimated to come closest to exceeding the objective (at 80% of the limit – see **Table 1**)
- The combination of the Monterey Peninsula Water Supply Project (MPWSP) and the GWR Project – called the Variant Project – also shows all constituents compliant with the Ocean Plan when the mitigation option of angling the discharge ports to 60° is implemented. All constituents are ≤ 91%

of the Ocean Plan objective, with ammonia being the constituent estimated to come closest to exceeding the objective (at 91% of the limit – see **Table 2).** The Variant Project would be out of compliance for multiple constituents if the ports are not modified.

- With the increase in GWR Concentrate flow from 1.17 mgd to 1.52 mgd due to the expansion of the GWR Project product water from 5 to 6.5 mgd, the amount of estimated ocean dilution (D_m value) decreased by 9% - 1%, with the larger decrease observed at zero to low secondary effluent flows.
- **Figure 1, Figure 2,** and **Figure 3** show a comparison between the amount of ocean dilution required to be compliant with the Ocean Plan (curves) and the amount of ocean dilution estimated to occur via modeling (purple and black points). Each figure shows a different operating condition of the GWR Project or Desal Plant along with the full range of Monterey One Water's (M1W's) Regional Treatment Plant (RTP) flows to be discharged through the existing outfall that may occur during normal plant operation.
- The Variant Project analysis includes flow scenarios with GWR Concentrate, brine from the desalination facility – called Desal Brine – and secondary effluent flow. However, there would be times in the operation of these facilities where the desalination facility is offline. These instances are represented in **Figure 1**, with the dilution achieved being equal to the modeled dilution with angled ports (black diamonds in **Figure 1**). As shown in the figure, although the estimated ocean dilution with angled ports (black diamonds) is less than the amount estimated with the existing port configuration (purple points), the dilution achieved is still higher than the amount required for compliance.

Assumptions:

- The constituents estimated to come closest to exceeding the Ocean Plan objectives in the modeled scenarios are shown in **Table 1** and **Table 2**. All of the remaining Ocean Plan objectives assessed in this analysis are either estimated to be well within compliance, or a compliance determination cannot be made due to insufficient analytical sensitivity (*i.e.*, the constituent was not detected above the method reporting limit (MRL) in any of the source waters, but the MRL is not sensitive enough to demonstrate compliance with the Ocean Plan objective).
- Four scenarios for M1W's RTP source water flow blends were considered (see **Table 3**). All the different flow scenarios were considered in developing the assumed worst-case concentrations for the Ocean Plan constituents in the secondary effluent.
- The highest observed concentrations from all data sources for each source water were assumed in the analysis (see **Table 4**). The exceptions to this statement are copper and ammonia.
  - The median copper concentration was used to estimate the water quality impact of the additional source waters because the maximum values detected appear to be outliers.

    - The ammonia concentration in the RTP secondary effluent used for this analysis was determined by calculating a 6-month running median from all grab samples collected between January 2000 – January 2018. The highest 6-month median value was used in the compliance analysis (see **Figure 4**).
- The maximum GWR Concentrate flow of 1.52 mgd was considered for all compliance scenarios with the AWPF online. Similarly, the maximum Desal Brine flow of 8.99 mgd was assumed, which is the typical maximum brine discharge expected from the desalination facility. Ocean Plan compliance was assessed at various secondary effluent flows to cover the range of potential total discharge flow rates between 0 and 29.6 mgd. (see **Table 5**).
- The discharge ports along M1W's existing ocean outfall were assumed to remain oriented horizontally for the GWR Project compliance assessment but were assumed to be at an angle of 60° for the Variant Project assessment (see **Table 5**).

Table 1 - Analysis Results – Estimated concentrations at the edge of the ZID for Ocean Plan constituents of interest for the Pure Water Monterey GWR Project (Concentration in top half; percent of COP limit in bottom half)

Constituent	Units	G1	G2	G3	G4	G5	G6	G7	G8	G9	G10	G11	G12	G13
Cyanide	ug/L	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.5	0.5	0.5	0.5
Ammonia (as N) - 6-mo median	ug/L	481	430	412	342	302	296	292	283	283	288	297	301	309
Acrylonitrile	ug/L	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Bis(2-ethyl-hexyl)phthalate	ug/L	0.9	0.8	0.7	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.6
Chlordane	ug/L	1.4E-05	1.2E-05	1.2E-05	9.7E-06	8.6E-06	8.4E-06	8.3E-06	8.0E-06	8.0E-06	8.2E-06	8.4E-06	8.5E-06	8.8E-06
PCBs	ug/L	7.6E-06	6.8E-06	6.5E-06	5.4E-06	4.8E-06	4.7E-06	4.6E-06	4.5E-06	4.5E-06	4.6E-06	4.7E-06	4.8E-06	4.9E-06
TCDD Equivalents	ug/L	1.5E-09	1.4E-09	1.3E-09	1.1E-09	9.6E-10	9.5E-10	9.3E-10	9.0E-10	9.0E-10	9.2E-10	9.5E-10	9.6E-10	9.9E-10
Toxaphene	ug/L	8.0E-05	7.1E-05	6.8E-05	5.7E-05	5.0E-05	4.9E-05	4.8E-05	4.7E-05	4.7E-05	4.8E-05	4.9E-05	5.0E-05	5.1E-05
Cyanide	--	8%	7%	7%	6%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Ammonia (as N) - 6-mo median	--	80%	72%	69%	57%	50%	49%	49%	47%	47%	48%	49%	50%	52%
Acrylonitrile	--	29%	26%	24%	20%	18%	18%	17%	17%	17%	17%	18%	18%	18%
Bis(2-ethyl-hexyl)phthalate	--	25%	22%	21%	18%	16%	15%	15%	15%	15%	15%	15%	16%	16%
Chlordane	--	59%	53%	51%	42%	37%	37%	36%	35%	35%	35%	37%	37%	38%
PCBs	--	40%	36%	34%	28%	25%	25%	24%	24%	24%	24%	25%	25%	26%
TCDD Equivalents	--	39%	35%	34%	28%	25%	24%	24%	23%	23%	24%	24%	25%	25%
Toxaphene	--	38%	34%	32%	27%	24%	23%	23%	22%	22%	23%	23%	24%	24%

Table 2 - Analysis Results – Estimated concentrations at the edge of the ZID for Ocean Plan constituents of interest for the MPWSP Variant (Concentration in top half in ug/L; percent of COP limit in bottom half)

Constituent	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	V12	V13	V14	V15	V16	V17	V18	V19	V20	V21	V22	V23	V23	V24
Cyanide	0.2	0.4	0.3	0.3	0.6	0.6	0.5	0.5	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.4	0.3	0.3	0.6	0.6	0.6	0.5	0.5	0.5	0.4
Ammonia (as N) - 6-mo median	3	119	131	113	235	239	231	206	199	200	225	548	517	501	432	393	231	234	467	463	453	353	306	270	258
Acrylonitrile	--	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.03	0.03	0.03	0.03	0.02	0.01	0.01	0.03	0.03	0.03	0.02	0.02	0.02	0.02
Bis(2-ethyl-hexyl)phthalate	0.0	0.2	0.2	0.2	0.4	0.4	0.4	0.4	0.4	0.4	0.4	1.0	0.9	0.9	0.8	0.7	0.4	0.4	0.9	0.8	0.8	0.6	0.6	0.5	0.5
Chlordane	3E-7	4E-6	4E-6	3E-6	7E-6	7E-6	7E-6	6E-6	6E-6	6E-6	6E-6	2E-5	1E-5	1E-5	1E-5	1E-5	7E-6	7E-6	1E-5	1E-5	1E-5	1E-5	9E-6	8E-6	7E-6
PCBs	3E-6	3E-6	3E-6	2E-6	5E-6	5E-6	4E-6	4E-6	4E-6	4E-6	4E-6	1E-5	1E-5	1E-5	8E-6	7E-6	4E-6	4E-6	8E-6	8E-6	8E-6	6E-6	5E-6	5E-6	4E-6
TCDD Equivalents	--	4E-10	4E-10	4E-10	7E-10	8E-10	7E-10	7E-10	6E-10	6E-10	7E-10	2E-9	2E-9	2E-9	1E-9	1E-9	7E-10	7E-10	1E-9	1E-9	1E-9	1E-9	1E-9	9E-10	8E-10
Toxaphene	8E-7	2E-5	2E-5	2E-5	4E-5	4E-5	4E-5	3E-5	3E-5	3E-5	4E-5	9E-5	9E-5	8E-5	7E-5	7E-5	4E-5	4E-5	8E-5	8E-5	7E-5	6E-5	5E-5	4E-5	4E-5
Cyanide	18%	35%	33%	27%	56%	56%	54%	47%	45%	44%	49%	47%	47%	47%	45%	43%	29%	31%	62%	63%	63%	52%	48%	46%	45%
Ammonia (as N) - 6-mo median	1%	20%	22%	19%	39%	40%	39%	34%	33%	33%	37%	91%	86%	84%	72%	65%	38%	39%	78%	77%	75%	59%	51%	45%	43%
Acrylonitrile	--	7%	8%	7%	14%	14%	14%	12%	12%	12%	13%	32%	31%	30%	26%	23%	14%	14%	28%	27%	27%	21%	18%	16%	15%
Bis(2-ethyl-hexyl)phthalate	1%	6%	7%	6%	12%	13%	12%	11%	10%	10%	12%	29%	27%	26%	23%	21%	12%	12%	24%	24%	24%	18%	16%	14%	13%
Chlordane	1%	15%	16%	14%	29%	30%	29%	26%	25%	25%	28%	68%	64%	62%	54%	49%	29%	29%	58%	57%	56%	44%	38%	33%	32%
PCBs	15%	18%	16%	12%	25%	25%	23%	20%	19%	19%	20%	55%	52%	50%	42%	38%	22%	22%	44%	43%	42%	33%	28%	24%	23%
TCDD Equivalents	--	10%	11%	9%	19%	19%	19%	17%	16%	16%	18%	45%	42%	41%	35%	32%	19%	19%	38%	38%	37%	29%	25%	22%	21%
Toxaphene	0%	9%	10%	9%	19%	19%	18%	16%	16%	16%	18%	43%	41%	40%	34%	31%	18%	18%	37%	36%	36%	28%	24%	21%	20%

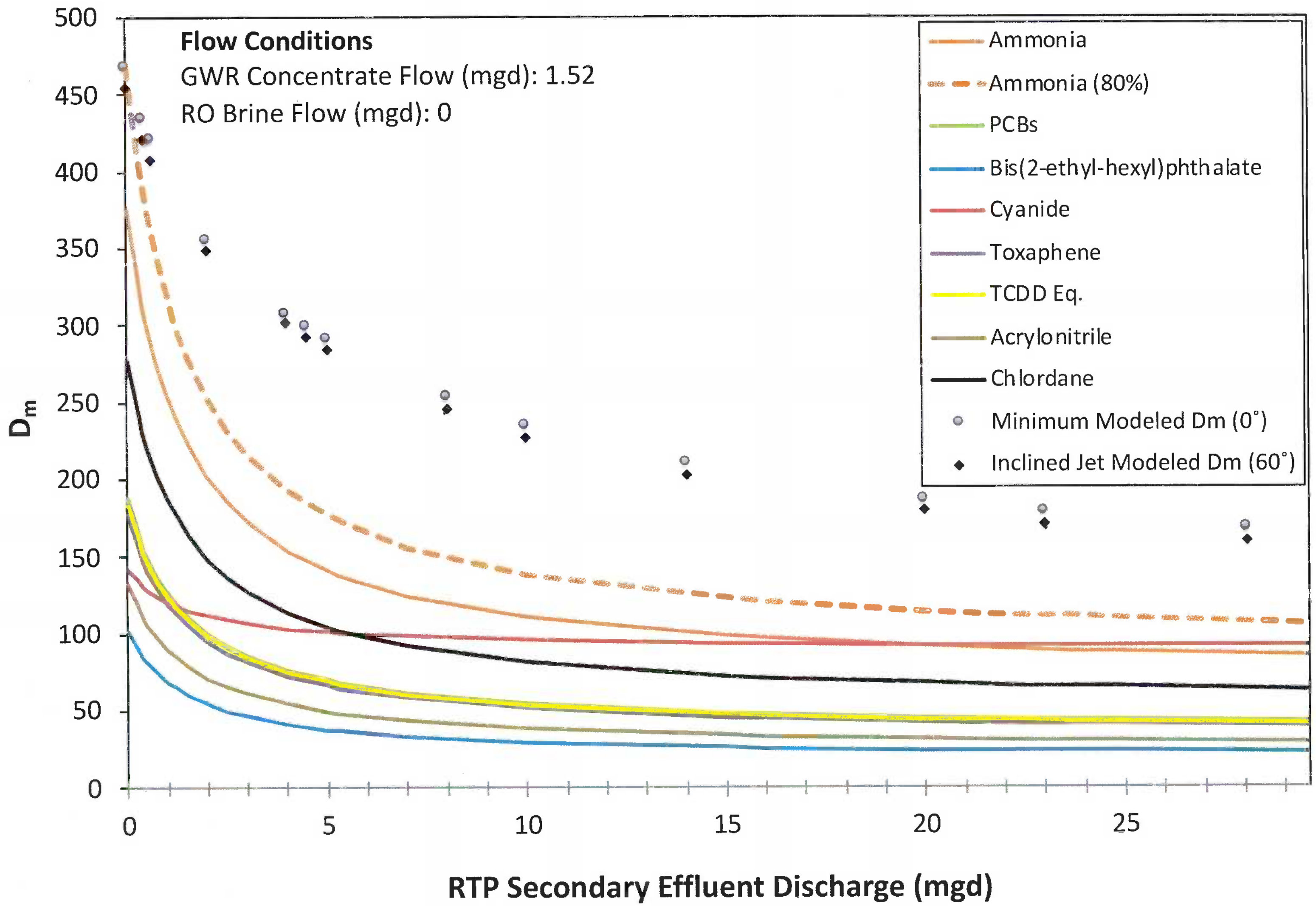

Figure 1 - Minimum dilution curves and modeled D_m values for the GWR Project

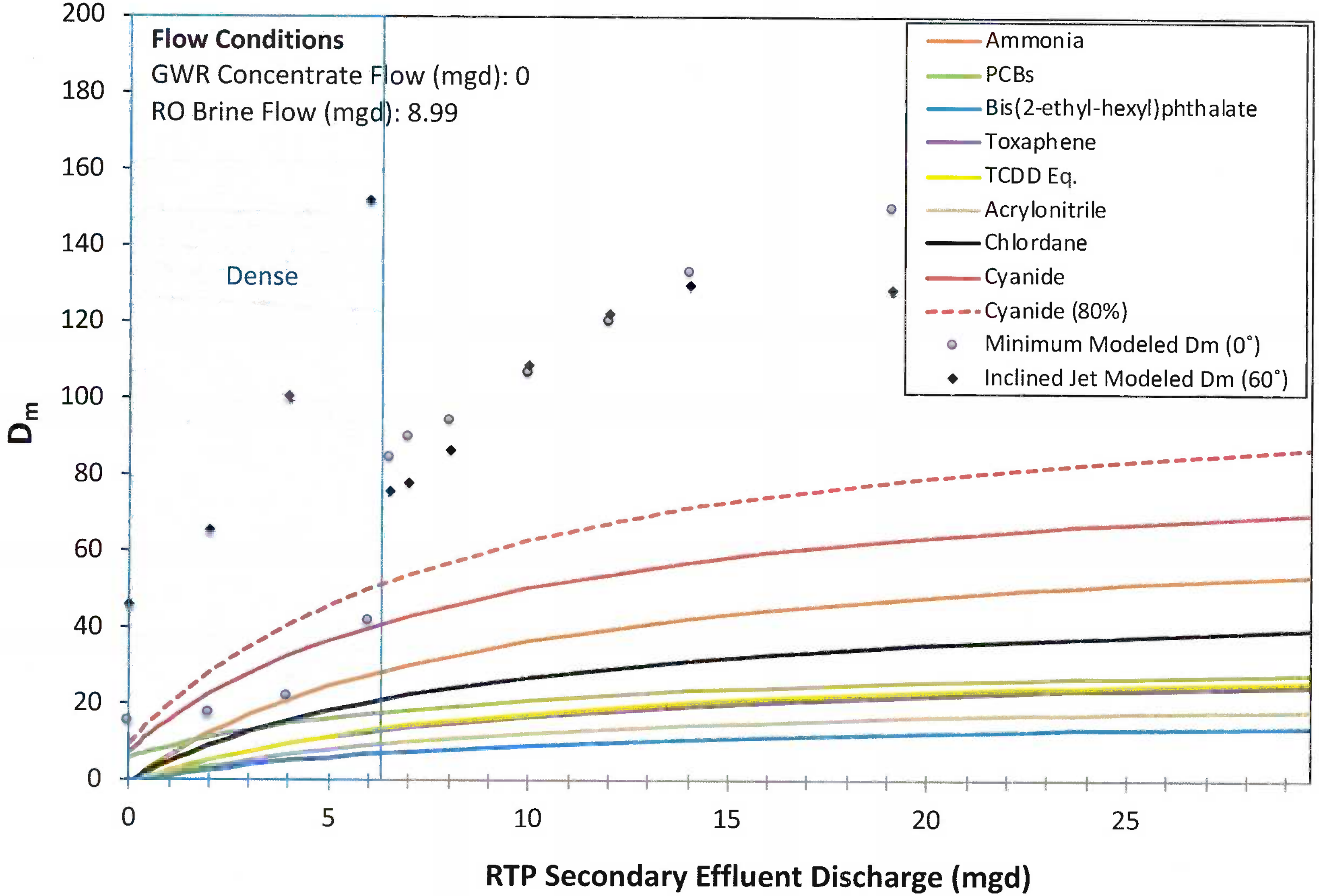

Figure 2 - Minimum dilution curves and modeled D_m Values for the Variant Project with GWR offline

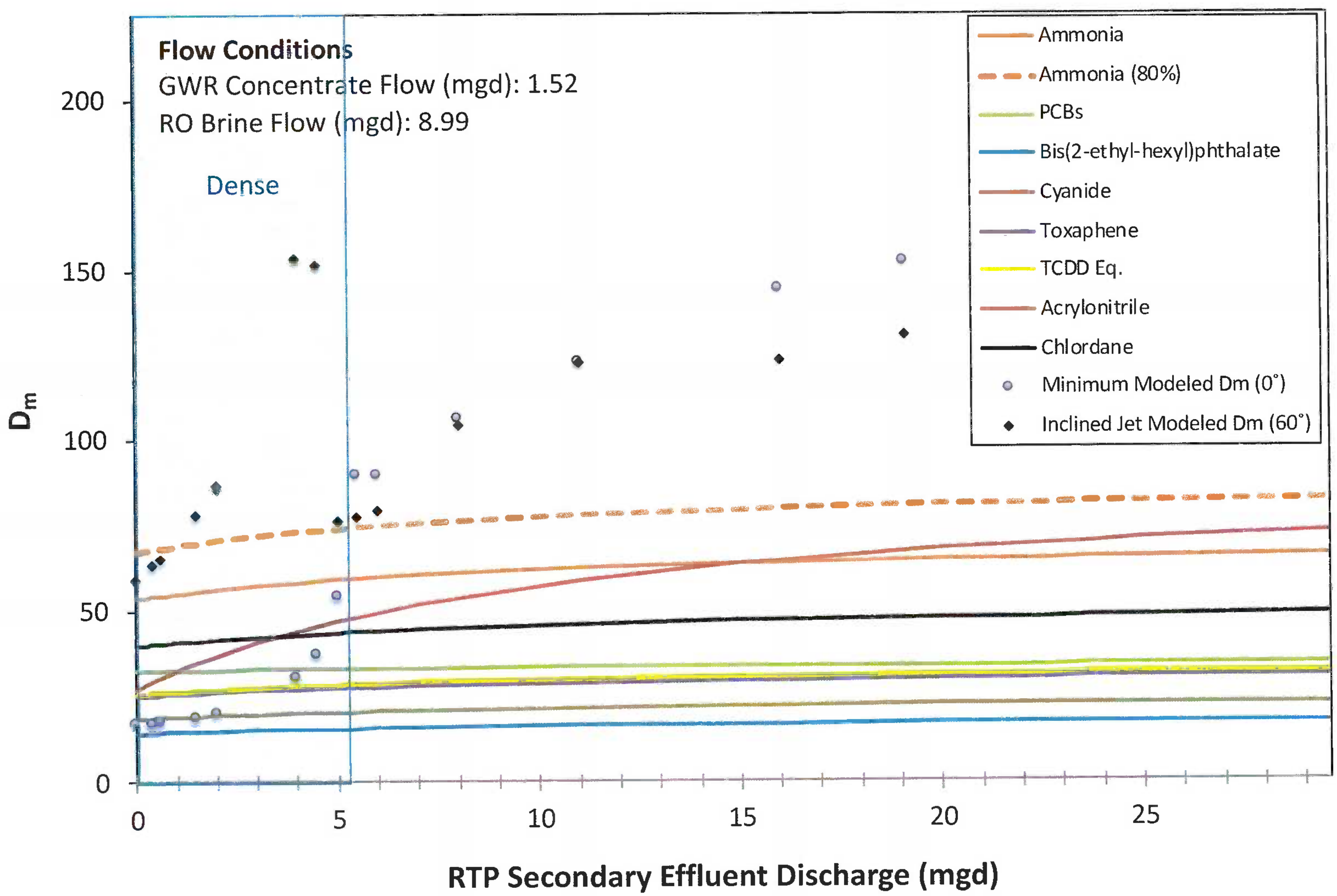

Figure 3 - Minimum dilution curves and modeled D_m Values for the Variant Project

Table 3 - RTP source water flow blends by scenario and month (flows in ac-ft per month) – Projected 2018*

	Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Normal/Wet - Building Reserve	Municipal WW	1,442	1,370	1,521	1,482	1,470	1,481	1,538	1,522	1,493	1,489	1,408	1,456	17,672
	Ag Wash	0	18	35	387	427	426	405	409	283	295	0	0	2,685
	Blanco Drain	0	0	0	252	225	274	277	244	184	0	0	0	1,456
	El Estero	0	0	0	0	0	0	0	0	0	0	0	0	0
	Tembladero Slough	0	0	0	0	0	0	0	0	0	0	0	0	0
	Rec Ditch	0	0	0	106	79	99	113	109	72	0	0	0	578
Normal/Wet - Full Reserve	Municipal WW	1,442	1,370	1,521	1,482	1,470	1,481	1,538	1,522	1,493	1,489	1,408	1,456	17,672
	Ag Wash	0	1	69	387	427	426	405	399	283	254	0	0	2,651
	Blanco Drain	0	0	0	252	225	274	277	244	184	0	0	0	1,456
	El Estero	0	0	0	0	0	0	0	0	0	0	0	0	0
	Tembladero Slough	0	0	0	0	0	0	0	0	0	0	0	0	0
	Rec Ditch	0	0	0	106	79	99	113	109	72	0	0	0	578
Drought	Municipal WW	1,258	1,108	1,263	1,381	1,449	1,450	1,498	1,407	1,425	1,469	1,318	1,343	16,369
	Ag Wash	0	221	230	393	416	422	430	438	317	229	0	0	3,096
	Blanco Drain	0	0	246	133	102	155	154	121	65	45	133	0	1,154
	El Estero	0	0	0	0	0	0	0	0	0	0	0	0	0
	Tembladero Slough	0	0	0	0	0	0	0	0	0	0	0	0	0
	Rec Ditch	0	0	70	106	79	99	113	109	72	65	89	0	802
Scenario B4	Municipal WW	1,442	1,370	1,521	1,482	1,470	1,481	1,538	1,522	1,493	1,489	1,408	1,456	17,672
	Ag Wash	0	0	0	567	580	565	405	309	283	193	0	0	2,902
	Blanco Drain	0	0	0	252	225	274	277	244	184	168	0	0	1,624
	El Estero	0	0	0	0	0	0	0	0	0	0	0	0	0
	Tembladero Slough	0	0	0	0	0	0	0	0	0	0	0	0	0
	Rec Ditch	0	0	0	106	79	99	113	109	72	65	0	0	643

*Normal/Wet-Building Reserve, Normal/Wet-Full Reserve, Drought scenarios from Andy Sterbenz's file CSIP-GWR-6.5mgd-01FEB18-Revised emailed 02/01/18. Scenario B4 from Bob Holden's file 6.5 expansion source water distribution emailed 1/17/18

Table 4 - Water quality assumptions for all source waters

Constituent	Units	RTP Effluent (no GWR)	Hauled Waste (no GWR)	RTP Effluent (with GWR)	Hauled Waste (with GWR)	GWR RO Brine	Assumed Desal Conc	COP Defined Ocean Background	Ocean Plan Objective
Objectives for protection of marine aquatic life									
Arsenic	ug/L	45	45	45	45	12	17.2	3	8
Cadmium	ug/L	1	1.0	1.2	1.2	6.5	5.0	0.0	1.0
Chromium (Hexavalent)	ug/L	2	130	2.6	130	14	0.034	0	2
Copper	ug/L	11	39	11.1	39	58	0.5	2	3
Lead	ug/L	0.11	0.76	2.47	2.47	13.0	0.5	0.0	2.0
Mercury	ug/L	0.019	0.044	0.089	0.089	0.510	0.414	0.0005	0.04
Nickel	ug/L	5.2	5.2	12.5	12.5	66	11.0	0	5
Selenium	ug/L	4	75	6.5	75	34	8.40	0	15
Silver	ug/L	0.14	0.14	0.72	0.72	3.81	0.50	0.16	1
Zinc	ug/L	20	170	58.8	170.0	310	9.5	8	20
Cyanide (ALL data)	ug/L	81	81	90.1	90.1	143	8.6	0	1
Cyanide	ug/L	7.2	46	7.2	46	38	8.6	0	1
Total Chlorine Residual	ug/L	--	--	--	--	--	--	0	2
Ammonia (as N) - 6-mo median	ug/L	42,900	42,900	42,900	42,900	225,789	143.1	0	600
Ammonia (as N) - Daily Max	ug/L	49,000	49,000	49,000	49,000	257,895	143.1	0	2,400
Acute Toxicity	TUa	2.3	2.3	2.3	2.3	0.77	--	0	0.3
Chronic Toxicity	TUc	40	80	40	40	100	--	0	1
Phenolic Compounds (non-chlorinated)	ug/L	69	69	69	69	363	86.2	0	30
Chlorinated Phenolics	ug/L	20	20	20	20	20	34.5	0	1
Endosulfan	ug/L	0.015	0.015	0.048	0.048	0.25	3.4E-06	0	0.01
Endrin	ug/L	0.000112	0.000112	0.000112	0.000112	0.00059	1.6E-06	0	0.002
HCH (Hexachlorocyclohexane)	ug/L	0.036	0.036	0.061	0.061	0.320	0.000043	0	0.004
Radioactivity (Gross Beta)	pci/L	32	307	32	307	34.8	5.2	0	0
Radioactivity (Gross Alpha)	pci/L	18	457	18	457	14.4	22.4	0	0
Objectives for protection of human health - non-carcinogens									
Acrolein	ug/L	5	5	8.8	8.8	46	3.4	0	220
Antimony	ug/L	0.65	0.65	0.79	0.79	4.1	0.21	0	1200
Bis (2-chloroethoxy) methane	ug/L	0.5	0.5	4.2	4.2	1	16.7	0	4
Bis (2-chloroisopropyl) ether	ug/L	0.5	0.5	4.2	4.2	1	16.7	0	1200
Chlorobenzene	ug/L	0.5	0.5	0.5	0.5	0.5	0.9	0	570
Chromium (III)	ug/L	3.6	87	7.1	87	37	17	0	190000
Di-n-butyl phthalate	ug/L	5	5	7	7	1	16.7	0	3500
Dichlorobenzenes	ug/L	1.6	1.6	1.6	1.6	8.4	0.9	0	5100
Diethyl phthalate	ug/L	5	5	5	5	1	0.9	0	33000
Dimethyl phthalate	ug/L	2	2	2	2	0.5	0.9	0	820000

Constituent	Units	RTP Effluent (no GWR)	Hauled Waste (no GWR)	RTP Effluent (with GWR)	Hauled Waste (with GWR)	GWR RO Brine	Assumed Desal Conc	COP Defined Ocean Background	Ocean Plan Objective
4,6-dinitro-2-methylphenol	ug/L	0.5	0.5	19.7	19.7	5	84.5	0	220
2,4-Dinitrophenol	ug/L	0.5	0.5	9.6	9.6	5	86.2	0	4
Ethylbenzene	ug/L	0.5	0.5	0.5	0.5	0.5	0.9	0	4100
Fluoranthene	ug/L	0.00684	0.00684	0.0068	0.0068	0.0360	0.2	0	15
Hexachlorocyclopentadiene	ug/L	0.5	0.5	0.5	0.5	0.05	0.09	0	58
Nitrobenzene	ug/L	0.5	0.5	2.2	2.2	1	41.4	0	5
Thallium	ug/L	0.5	0.5	0.69	0.69	3.7	0.1	0	2
Toluene	ug/L	0.47	0.47	0.48	0.48	2.5	0.9	0	85000
Tributyltin	ug/L	0.05	0.05	0.05	0.05	0.02	0.08	0	0.0014
1,1,1-Trichloroethane	ug/L	0.5	0.5	0.5	0.5	0.5	0.9	0	540000
Objectives for protection of human health - carcinogens									
Acrylonitrile	ug/L	2	2	2.5	2.5	13	0.0	0	0.1
Aldrin	ug/L	0.005	0.005	0.007	0.007	0.01	6.66E-05	0	0.000022
Benzene	ug/L	0.5	0.5	0.5	0.5	0.5	0.9	0	6
Benzidine	ug/L	0.5	0.5	19.7	19.7	0.05	86.2	0	0.000069
Beryllium	ug/L	0.5	0.0052	0.69	0.0052	0.5	0.0	0	0.033
Bis(2-chloroethyl)ether	ug/L	0.5	0.5	4.2	4.2	1	41.4	0	0.045
Bis(2-ethyl-hexyl)phthalate	ug/L	78	78	78	78	411	1.0	0	4
Carbon tetrachloride	ug/L	0.5	0.5	0.5	0.5	2.66	0.9	0	0.9
Chlordane	ug/L	0.00122	0.00122	0.00122	0.00122	0.0064	1.45E-05	0	0.00002
Chlorodibromomethane	ug/L	0.5	0.5	2.4	2.4	13	0.9	0	9
Chloroform	ug/L	2	2	38	38	201	0.9	0	130
DDT	ug/L	0.0010	0.0010	0.0010	0.0010	0.0003	1.72E-06	0	0.00017
1,4-Dichlorobenzene	ug/L	1.6	1.6	1.6	1.6	8.4	0.9	0	18
3,3-Dichlorobenzidine	ug/L	0.03	0.03	19.40	19.40	2	86.2	0	0.0081
1,2-Dichloroethane	ug/L	0.5	0.5	0.5	0.5	0.5	0.9	0	28
1,1-Dichloroethylene	ug/L	0.5	0.5	0.5	0.5	0.5	0.9	0	1
Dichlorobromomethane	ug/L	0.5	0.5	2.6	2.6	14	0.9	0	6
Dichloromethane (methylenechloride)	ug/L	0.88	0.88	0.88	0.88	4.6	0.9	0	450
1,3-dichloropropene	ug/L	0.5	0.5	0.57	0.57	3.0	0.9	0	8.9
Dieldrin	ug/L	0.0007	0.0007	0.0015	0.0015	0.0001	4.66E-05	0	0.00004
2,4-Dinitrotoluene	ug/L	2	2	2	2	0.1	0.2	0	2.6
1,2-Diphenylhydrazine (azobenzene)	ug/L	0.5	0.5	4.2	4.2	1	16.7	0	0.16
Halomethanes	ug/L	0.54	0.73	1.4	1.4	7.4	0.9	0	130
Heptachlor	ug/L	0.01	0.01	0.01	0.01	0.01	6.9E-07	0	0.00005
Heptachlor Epoxide	ug/L	0.000088	0.000088	0.000088	0.000088	0.000463	1.6E-06	0	0.000020
Hexachlorobenzene	ug/L	0.000078	0.000078	0.000078	0.000078	0.000411	6.5E-05	0	0.000210
Hexachlorobutadiene	ug/L	0.000009	0.000009	0.000009	0.000009	0.000047	3.45E-07	0	14

Constituent	Units	RTP Effluent (no GWR)	Hauled Waste (no GWR)	RTP Effluent (with GWR)	Hauled Waste (with GWR)	GWR RO Brine	Assumed Desal Conc	COP Defined Ocean Background	Ocean Plan Objective
Hexachloroethane	ug/L	0.5	0.5	2.2	2.2	0.5	16.7	0	2.5
Isophorone	ug/L	0.5	0.5	0.5	0.5	0.5	0.9	0	730
N-Nitrosodimethylamine	ug/L	0.017	0.017	0.095	0.095	0.150	0.003	0	7.3
N-Nitrosodi-N-Propylamine	ug/L	0.076	0.076	0.076	0.076	0.019	0.003	0	0.38
N-Nitrosodiphenylamine	ug/L	0.5	0.5	2.2	2.2	1	16.7	0	2.5
PAHs	ug/L	0.04	0.05	0.04	0.05	0.22	0.00217	0	0.009
PCBs	ug/L	0.00068	0.00068	0.00068	0.00068	0.00357	0.00013	0	0.00002
TCDD Equivalents	ug/L	1.37E-07	1.37E-07	1.37E-07	1.37E-07	7.21E-07	0.0E+00	0	3.90E-09
1,1,2,2-Tetrachloroethane	ug/L	0.5	0.5	0.5	0.5	0.5	0.9	0	2.3
Tetrachloroethylene	ug/L	0.5	0.5	0.5	0.5	0.5	0.9	0	2
Toxaphene	ug/L	0.0071	0.0071	0.0071	0.0071	0.0373	3.97E-05	0	2.10E-04
Trichloroethylene	ug/L	0.5	0.5	0.5	0.5	0.5	0.9	0	27
1,1,2-Trichloroethane	ug/L	0.5	0.5	0.5	0.5	0.5	0.9	0	9.4
2,4,6-Trichlorophenol	ug/L	0.5	0.5	2.2	2.2	1	16.7	0	0.29
Vinyl chloride	ug/L	0.19	0.19	0.23	0.23	1.22	0.5	0	36

NOTES:

Black Shading	= Constituent was never detected in source water. Value represents the maximum flow-weighted average method reporting limit based on the blend of source waters
Orange Shading	= Special case assumptions: Acrylonitrile, beryllium and TCDD equivalents represent a special case; they were detected in some source waters, but were also not detected above the MRL in others, and the MRL values are above the Ocean Plan objectives. For these constituents, a value of 0 was assumed when it was not detected in a source water and the MRL was above the Ocean Plan objective. This assumption was made to show there is potential for the constituent to exceed the Ocean Plan objective in some flow scenarios, but there is not enough information to provide a complete compliance determination at this time.

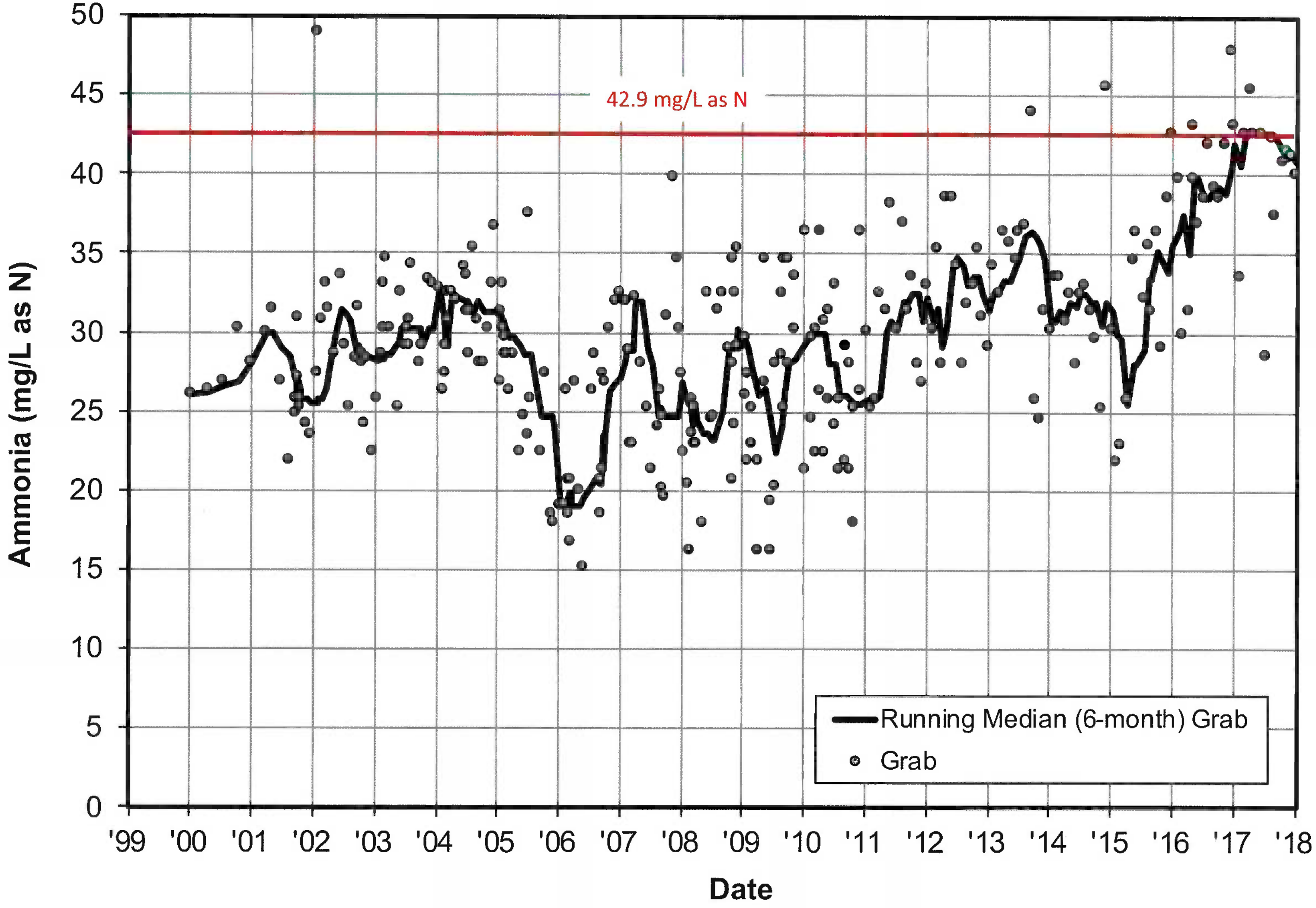

Figure 4 - RTP secondary effluent ammonia concentration trend

Table 5 - Discharge scenarios for the GWR Project and Variant Project

No.	Discharge Flow (mgd) RTP Secondary Effluent	Hauled Brine	GWR Brine	Desal Brine	D_m Used in Analysis	Model D_m Results – Horizontal Ports (0°) U *	D *	O *	Model D_m Results – Angled Ports (60°) U *	D *	O *
Pure Water Monterey GWR Project - 6.5 mgd AWPF											
G1	0.0	0	1.52	0	468.3	469.1	864.8	468.3	455.2	829.6	501.7
G2	0.4	0	1.52	0	435.0	435.0	767.5	455.8	421.7	737.1	474.1
G3	0.6	0	1.52	0	420.9	420.9	730.7	445.5	407.8	701.8	460.4
G4	2.0	0	1.52	0	355.3	355.3	582.1	381.3	348.8	561.0	387.9
G5	4.0	0	1.52	0	307.9	307.9	507.1	329.7	302.2	498.8	344.2
G6	4.5	0	1.52	0	299.5	299.5	500.8	321.9	292.9	498.4	340.2
G7	5.0	0	1.52	0	291.5	291.5	498.3	315.5	284.0	502.7	335.5
G8	8.0	0	1.52	0	253.4	253.4	462.6	289.1	245.0	445.8	303.7
G9	10.0	0	1.52	0	235.6	235.6	428.6	274.9	227.1	412.6	284.4
G10	14.0	0	1.52	0	210.3	210.3	367.8	248.3	202.4	353.6	257.9
G11	20.0	0	1.52	0	187.0	187.0	311.6	222.5	179.4	291.9	237.9
G12	23.0	0	1.52	0	179.0	179.0	288.5	213.6	171.1	276.0	230.9
G13	28.08	0	1.52	0	168.0	168.0	262.8	202.4	160.0	246.2	216.7
MPWSP Variant - 6.4 mgd desalination facility and 6.5 mgd AWPF											
V1	0	0	0	8.99	46.3	15.4	15.4	15.4	46.3	46.3	46.3
V2	2	0	0	8.99	65.5	17.5	17.4	17.5	66.6	65.5	66.2
V3	4	0	0	8.99	100.4	22.8	22.0	22.5	106.2	100.4	104.2
V4	6	0	0	8.99	151.9	67.8	41.6	53.7	151.9	151.9	151.9
V5	6.5	0	0	8.99	76.0	109.9	84.4	90.1	78.2	150.6	76.0
V6	7	0	0	8.99	77.9	94.4	165.3	89.7	81.9	124.4	77.9
V7	8	0	0	8.99	86.7	94.4	168.3	94.6	92.4	137.9	86.7
V8	10	0	0	8.99	108.9	126.9	187.8	106.8	108.9	129.3	116.1
V9	12	0	0	8.99	122.3	137.5	164.4	120.3	122.3	146.8	127.7
V10	14	0	0	8.99	130.1	143.7	178.1	133.0	130.1	167.8	139.8
V11	19.09	0	0	8.99	128.9	153.4	202.8	149.9	141.7	188.5	128.9
V12	0	0	1.52	8.99	58.8	16.7	16.6	16.7	59.4	58.8	59.3
V13	0.4	0	1.52	8.99	63.1	17.2	17.1	17.2	64.0	63.1	63.7
V14	0.6	0	1.52	8.99	65.5	17.5	17.4	17.5	66.5	65.5	66.2
V15	1.5	0	1.52	8.99	77.8	19.2	18.9	19.1	80.2	77.8	79.4
V16	2	0	1.52	8.99	86.5	20.5	20.0	20.4	90.0	86.5	88.8
V17	4	0	1.52	8.99	153.1	34.7	30.0	32.7	153.1	153.1	153.1
V18	4.5	0	1.52	8.99	151.8	51.4	37.2	44.4	151.8	151.8	151.8
V19	5	0	1.52	8.99	76.2	127.4	54.3	91.6	78.2	97.1	76.2
V20	5.5	0	1.52	8.99	77.3	112.3	164.8	89.6	80.1	124.0	77.3
V21	6	0	1.52	8.99	79.5	112.1	162.6	89.5	85.6	126.7	79.5
V22	8	0	1.52	8.99	104.1	123.5	179.8	106.3	104.1	153.8	105.0
V23	11	0	1.52	8.99	122.9	137.4	165.2	122.7	122.9	148.5	128.6
V24	16	0	1.52	8.99	142.9	150.7	197.0	143.9	138.7	188.3	123.1
V25	19.09	0	1.52	8.99	151.2	153.6	204.1	152.2	141.1	188.7	130.8

NOTES:

UM3 Model Result	Cederwall Model Result	Abessi and Roberts Model Result

D_m used for the Ocean Plan compliance assessment is the minimum model result for **horizontal (0°)** discharge ports

D_m used for the Ocean Plan compliance assessment is the minimum model result for **angled (60°)** discharge ports

* : **U** = Upwelling Ocean Condition; **D** = Davidson Ocean Condition; **O** = Oceanic Ocean Condition

Attachment E

Technical Memorandum - Trussell Tech Pathogen Crediting Alternatives for Pure Water Monterey Advanced Water Purification Facility Expansion.

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TECHNICAL MEMORANDUM

Draft Date: April 6, 2018
Final Date:

Authors: Elaine Howe, P.E.
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Reviewers: Shane Trussell, Ph.D., P.E.

Subject: Pathogen Crediting Alternatives for Pure Water Monterey Advanced Water Purification Facility Expansion

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EXECUTIVE SUMMARY

The Monterey One Water (M1W) Pure Water Monterey (PWM) Advanced Water Purification Facility (AWPF) is currently designed to produce 5 million gallons per day (mgd) of purified recycle water, with peak injection well capabilities of 4 mgd. The California Public Utilities Commission (CPUC) has asked M1W to assess the feasibility of expanding the AWPF to provide additional purified water for injection to offset the Cease and Desist Order (CDO) requiring California American Water (CalAm) to stop using Carmel River water. M1W is considering two expansion scenarios for the AWPF: 6.5 mgd and 7.0 mgd.

Title 22 California Code of Regulations for indirect potable reuse through groundwater replenishment by subsurface application allow for virus reduction credit as a function of underground retention and method used to estimate the retention time. Shorter underground times are expected with the expansion; thus, additional virus removal/inactivation credit must be achieved through treatment: either at the Regional Treatment Plant (RTP), through the AWPF treatment train, and/or in the conveyance pipeline. It is estimated that an additional 1.7-log virus credit is needed to counteract the reduced underground travel time for the 7.0 mgd expansion.

The following treatment alternatives were considered to obtain the required additional credit:

- Chloramine disinfection credit in the conveyance pipeline
- Preozonation disinfection credit

- Wastewater treatment credit
- Enhanced reverse osmosis removal credit

These treatment alternatives do not require additional treatment; rather, the approach is to make use of existing facilities through further characterization of the existing treatment facilities and validation of these facilities as pathogen treatment barriers; thus, the alternatives can be implemented with minimal costs. A summary of the crediting options, expected credit, and implementation requirements is provided in Table 7-1.

All options have the potential to independently meet the target virus log removal requirements. Each option carries pros and cons, including more or less certainty related to DDW approval and more or less operational flexibility, as well as additional pathogen removal credits for *Giardia* cysts and *Cryptosporidium* oocysts.

The recommended approach is to pursue multiple crediting options. Multiple crediting options provides redundancy of treatment crediting, which enhances reliability of operation. Redundant credits allow for treatment failures to occur, or failure of treatment monitoring to occur, without impacting production.

In order to support further development of the crediting alternatives, the following next, initial steps are recommended:

- Conceptual design of chloramine disinfection crediting in conveyance pipeline
- Proof-of-concept bench-scale evaluation of ozone virus inactivation in the unfiltered secondary effluent, and/or select sampling of native phage removal through ozonation at the Demonstration Facility
- Proof-of-concept sampling of enteric virus in the influent and effluent of the Regional Treatment Plant
- Routine sampling of strontium removal through the Demonstration Facility RO membranes

These next steps will provide further information and certainty regarding cost effective pathogen crediting options for the expanded AWPF.

Table E-1. Summary of treatment alternatives considered for additional virus treatment credit

Treatment Alternative	Estimated Attainable Virus Credit		Precedence Set with DDW	Study Required	Feasibility Level Estimate of Cost ($/yr)
	Attainable Credit	Conditions			
Final Disinfection with Chloramines	1.9 to 3.8 logs, 15°C 3.9 to 4.0-logs, 25°C	6.5 mgd with chloramine residual of 2 to 4 mg/L	Yes, drinking water CT tables in Surface Water Treatment Rule Guidance Manual (USEPA, 1991)	No	$60k ($Cl_2$ monitors at Well Site #4) $10k/yr (Ops)
	1.8 to 3.6 logs, 15°C 3.6 to 4.0 logs, 25°C	7.0 mgd with chloramine residual of 2 to 4 mg/L			
Ozone Disinfection Based on O3:TOC Ratio	1.7-log to 6 logs	O3:TOC ratio 0.25 to 0.5	No. Wedeco has submitted validation report for O3:TOC ratio, but approach does not yet have approval	Yes. Pilot study required as well as a full-scale bioassay	$100k ($NO_2$ monitors) $10k/yr (Ops) $150-300k study $50k bioassay
Strontium Rejection through RO Membranes	Additional 1.5-log to 2.3-log over current RO credit (based on conductivity)	Old to new ESPA-2 membrane elements	Yes. Accepted by DDW for the City of San Diego Pure Water Project in Engineering Report	No. But monitoring at demo recommended	$64k/yr (lab costs)
Pathogen Removal Through RTP	0.7-log to 2.0-log	Range observed at other facilities	Yes. Accepted by DDW for the City of San Diego Pure Water Project in Engineering Report	Yes	$150-200k study

1 - INTRODUCTION

Monterey One Water's (M1W's) Pure Water Monterey (PWM) Advanced Water Purification Facility (AWPF) was designed to produce up to 4,300 acre-feet per year (AFY) of purified recycle water. 3,500 AFY will be injected into the Seaside Groundwater Basin, with an extra 200 AFY to be injected as drought reserve during wet and normal water years, and 600 AFY will be used by Marina Coast Water District (MCWD) for landscape irrigation. The AWPF has a design product water capacity of 5 million gallons per day (mgd) and a design build-out capacity of 6.5 mgd. The injection wells have a design capacity of 3.1 mgd.

The California Public Utilities Commission (CPUC) has asked M1W to assess the feasibility of providing California American Water (CalAm) with more than 3,500 AFY. Accordingly, M1W is evaluating the feasibility of producing up to 7 mgd of AWPF product water, with higher flowrates injected into the Seaside Basin. These higher flowrates result in reduced underground retention time.

A regulatory constraint of producing more AWPF water is the lower virus reduction credit that results from the reduced underground residence time in the aquifer. The Title 22 California Code of Regulations for indirect potable reuse through groundwater replenishment by subsurface application ("Groundwater Reuse Regulations") allow for virus reduction credit as a function of underground retention and method used to estimate the retention time. Because of the reduced travel time, additional virus removal/inactivation credit must be achieved through treatment.

The objective of this technical memorandum (TM) is to discuss the feasibility of implementing alternative pathogen reduction crediting options for the 6.5 and 7.0 mgd AWPF expansion scenarios. Treatment options considered are:

- Receive credit for the pathogen reduction achieved through the Regional Treatment Plant (RTP)
- Disinfection credit for ozonation, based on the applied ozone to total organic carbon (O3:TOC) ratio
- Enhanced pathogen removal credit through the reverse osmosis (RO), based on monitoring strontium rejection
- Product water disinfection with combined chlorine (i.e., chloramines) or free chlorine in the product water conveyance pipeline.

2 - REQUIRED PATHOGEN TREATMENT

The Groundwater Reuse Regulations require that recycled municipal wastewater used for groundwater replenishment achieve a minimum of 12-log virus reduction, 10-log *Giardia* cyst reduction, and 10-log *Cryptosporidium* oocyst reduction. Pathogen treatment credit is available for most advanced treatment processes along with reduction through primary and secondary treatment at the RTP and travel time through the aquifer. A schematic of the RTP and AWPF process trains is shown in Figure 2-1.

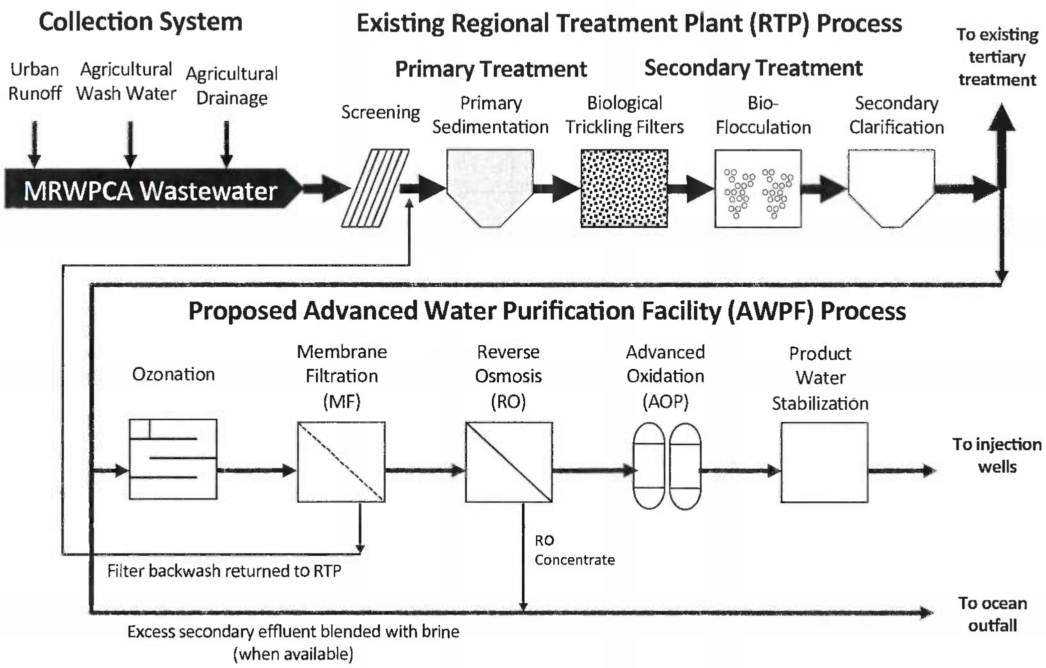

Figure 2-1 Process Train Schematic for RTP and AWPF

Pathogen treatment credit for the 5 mgd AWPF is summarized in Table 2-1 (Nellor 2017). Membrane filtration (MF), reverse osmosis (RO), ultraviolet light with hydrogen peroxide (UV/H_2O_2) advanced oxidation, and underground residence time in the aquifer were credited for pathogen removal. Treatment through the RTP, ozone, and final chlorine disinfection prior to injection were not credited. Per the Groundwater Reuse Regulations, each month the purified water is retained underground, as validated with an added tracer, will be credited with a 1-log virus reduction, up to a maximum of 6-log credit. If an intrinsic tracer is used in lieu of an added tracer, the virus credit is no more than 0.67-log per month underground. In project planning and design, groundwater models are used to estimate the underground retention time, and DDW grants no more than 0.50-log virus reduction per month underground when modeling is used to estimate time.

For the 7.0 mgd expansion, virus credit associated with the reduced underground residence time, based on modeling by Todd Groundwater, is estimated to drop from 5.4-log to 3.3-log, leaving a deficit of 1.7-log virus credit below the 12-log requirement.

There is no comparable deficit for *Giardia* cysts or *Cryptosporidium* oocysts since treatment credit through the AWPF remains unchanged and underground travel time is not credited with *Giardia* cyst or *Cryptosporidium* oocyst removal. Note that this log removal values are minimums and any credit beyond the minimum will enhance the reliability of the overall project.

Table 2-1 Pathogen Treatment Credit for the 5 MGD AWPF

Treatment Process	Log Reduction Credits		
	Virus	*Giardia*	*Crypto*
Required by Groundwater Reuse Regulations	12	10	10
5 mgd AWPF:			
RTP Primary and Secondary[1]	0	0	0
Ozone[1]	0	0	0
Membrane Filtration	0	4	4
Reverse Osmosis	1	1	1
UV/H_2O_2 Advanced Oxidation	6	6	6
Final Disinfection with Chlorine[1]	0	0	0
Underground Residence Time in Aquifer	5.4	0	0
Total Credit	12.4	11	11
Excess	0.4	1.0	1.0

[1] Credit not pursued in the 5-mgd AWPF Engineering Report

[2] Based on numerical modeling, the fastest underground travel time from injection to extraction is estimated to be 10.8 months. Based on Title 22 Regulations, virus credit for numerical modeling equals 0.5-log per month underground. Greater credit is expected to be achieved after an intrinsic tracer test.

3 - CHLORINE DISINFECTION IN COVEYANCE PIPELINE

3.1 Background

The 5-mgd AWPF design includes provisions for use of chloramines in the conveyance system to control biological growth at the wellhead. Sodium hypochlorite will be dosed into the secondary effluent, which is rich in ammonia, forming chloramines. Chloramines will be carried through the ozone, MF, RO, and UV/H_2O_2 process, with provisions for boosting both the chlorine residual and the ammonia concentration, as needed, prior to the product water pump station and conveyance pipeline. The target wellhead residual concentration is 2 to 4 mg/L as Cl_2, as shown in Table 3-1.

Table 3-1 Chlorine water quality goals and assumptions at the injection wellhead.

Parameter	Unit	Value
Temperature	°C	16-24
pH	pH units	7.5-8.5
Total Chlorine Residual	mg/L as Cl_2	2-4

3.2 Approach for Estimating Virus Credit

Bench-scale free chlorine and chloramine decay tests were conducted in the Trussell Technologies Pasadena lab, using RO permeate shipped from M1W's demonstration facility. Bench tests were conducted with and without a peroxide residual since peroxide exerts an additional chlorine demand through reaction with both free chlorine and chloramines. The results of the chloramine decay tests are shown in Figure 3-1. Doses for target residuals and times were estimated using a parallel first order decay model (Haas and Karra, 1984).

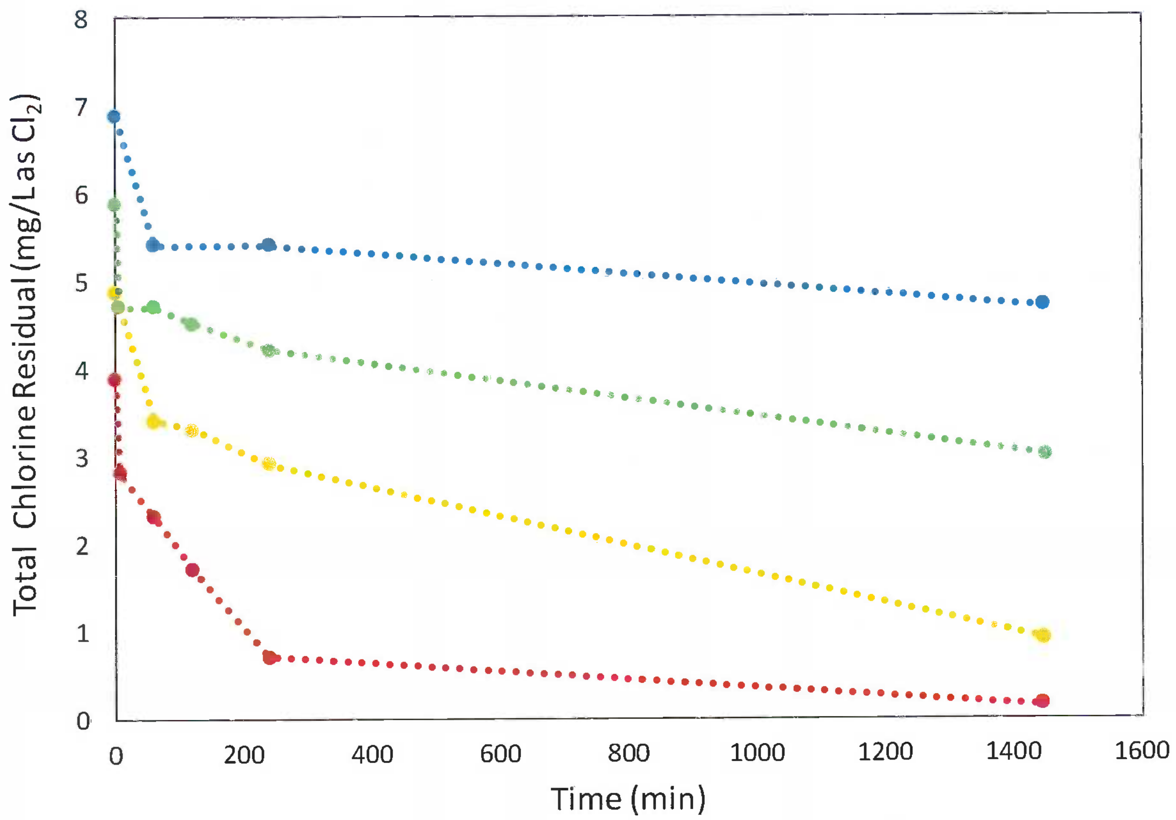

Figure 3-1 Chloramine decay in RO permeate buffered to pH 8 at temperature of 25°C

Disinfection credit was considered at two locations: (1) the tee on the conveyance pipeline where water is diverted to the Purified Water Reservoir (at the intersection of General Jim Moore Boulevard and Normandy Road), and (2) Well Site #4. Well Site #4 is the first well along the pipeline (i.e., shortest HRT); thus, it would be the compliance point for disinfection crediting at the well heads. The hydraulic residence time (HRT) through the product water conveyance pipeline was evaluated for four flows: 1.2 MGD (minimum flow for the AWPF), 4 MGD (nominal flow under the 5 mgd design), 6.5 MGD (expansion), and 7.0 MGD (peak AWPF production). The volume to the tee at which point some flow is diverted to the Purified Water Reservoir is 0.96 million gallons, and the volume to Well Site #4 is 1.06 million gallons.

Based on HRTs calculated from these pipe volumes, virus and *Giardia* cyst inactivation credit was calculated for chlorine residuals of 2 and 4 mg/L at the flowrates listed above. CT (chlorine residual times contact time) tables provided in the United States Environmental Protection Agency's (USEPA's) Surface Water Treatment Rules (SWTR) Guidance Manual (USEPA 1991) were used to calculate virus and *Giardia* cyst inactivation credit, at both the minimum and maximum water temperature.

3.3 Chloramine Disinfection Credit Options

CTs required for pathogen inactivation with free chlorine are much lower than with chloramines since free chlorine is a more effective disinfectant and reacts faster than chloramines; however, the HRT in the conveyance pipeline is long enough to achieve virus inactivation with chloramines. Disinfection with chloramines is the preferred option since a significantly lower chlorine dose is required. A higher dose is required for free chlorine because free chlorine reacts with ammonia (estimated to be 7 to 29 mg/L of free chlorine demand, based the range of expected ammonia and chloramine levels expected) and other constituents in the water (up to two times higher demand with free chlorine), as well as has a larger hydrogen peroxide demand (three times higher demand with free chlorine). Since time is available in the conveyance pipeline for chloramine disinfection, and chloramines require a significantly lower dose, the remaining discussion of CT credit is based on chloramines rather than free chlorine.

Several operating scenarios are summarized in Table 3-2, along with the HRT, chlorine and ammonia doses, and log removal value (LRV) attained at both the Purified Water Reservoir tee and Well Site #4. The first two scenarios assume a chloramine residual of 2 and 4 mg/L as Cl_2 at Well Site #4. The third and fourth scenarios assume 4-log virus inactivation at Well Site #4, at the minimum and maximum temperatures. The SWTR guidelines do not grant virus and *Giardia* cyst credit in excess of 4 and 3 logs of inactivation, respectively, without demonstration testing. In these cases, the attainable LRVs are listed as >4-log and >3-log, respectively. No credit for *Cryptosporidium* oocysts are granted with either free chlorine or chloramine, since *Cryptosporidium* oocysts are resistant to chlorine.

The chlorine doses account for an estimated 3.2 mg/L hydrogen peroxide residual in the ultraviolet light advanced oxidation process (UV/AOP) effluent (estimated effluent residual from average inlet residual of 3.5 mg/L), and conservatively assume no background chloramine residual. In determining the ammonia doses a UV/AOP effluent ammonia concentration of 1.5 mg/L as N was conservatively assumed (1.5 mg/L as N is the modeled permeate ammonia concentration with new RO membranes).

The following conclusions can be made about chloramine disinfection in the conveyance pipeline:

1. The chloramine disinfection approach can yield virus removals of up to 4 logs at 6.5 and 7.0 mgd (e.g., 4.1 mg/L residual at 7 mgd, minimum temperature), which is sufficient for the estimated required virus credit of 1.7-log
2. A chloramine residual of 2.0 mg/L at the injection well manifold is sufficient for the required 1.7 log removal (at 7 mgd or less, minimum temperature)
3. Lower flowrates result in more log removal credit for the same residual, due to longer contact times (e.g., maximum allowable log removal credit of 4 at minimum flows with a residual of 2.0 mg/L).
4. Temperature impacts log removal, with log removals at 15°C being lower than at 25 °C, for the same chloramine residuals and flowrates. Thus, winter operation, when temperatures are the lowest and flow rates are generally higher, governs disinfection crediting.
5. Additional Giardia credit can also be attained with the chloramine approach (1.3

logs or more).

One aspect of final chloramine disinfection that requires further exploration is diversion or failure response options if a chlorine dosing or monitoring failure were to occur. As there are no diversion points downstream of final chloramine disinfection, emphasis must be placed on failure prevention. In order to minimize monitoring failures, two analyzers are recommended. Likewise, it may be advantageous to operate two chemical dosing pumps at 50% each, to ensure a minimum level of chlorine dosing at all times.

Table 3-2 Summary of estimated doses and log removal values for various operating conditions; V = virus, G = giardia

Chloramine Residual (mg/L as Cl_2)		Flow Rate (MGD)	HRT (min)[a]		Dose at Product Water Pump Station		Log Inactivation at 15 °C				Log Inactivation at 25 °C			
Well Site #4 Manifold	Purified Water Reservoir Tee		Purified Water Reservoir Tee	Well Site #4	Chlorine[b] (mg/L as Cl_2)	Ammonia[c] (mg/L as N)	Purified Water Reservoir		Well Site #4 Manifold		Purified Water Reservoir		Well Site #4 Manifold	
							V	G	V	G	V	G	V	G
2.0	2.1	1.2	1282	1409	6.1	0.3	>4	>3	>4	>3	>4	>3	>4	>3
	2.1	4	385	423	6.2	0.3	3.2	1.6	3.4	1.7	>4	>3	>4	>3
	2.0	6.5	237	260	5.6	0.2	1.9	1.0	2.1	1.0	3.9	1.9	>4	2.1
	2.0	7	220	242	5.6	0.2	1.8	0.9	1.9	1.0	3.6	1.8	3.9	1.9
4.0	4.2	1.2	1282	1409	10.0	1.1	>4	>3	>4	>3	>4	>3	>4	>3
	4.0	4	385	423	7.9	0.7	>4	>3	>4	>3	>4	>3	>4	>3
	4.0	6.5	237	260	7.7	0.6	3.8	1.9	>4	2.1	>4	>3	>4	>3
	4.0	7	220	242	7.6	0.6	3.6	1.8	3.9	1.9	>4	>3	>4	>3

a. HRT calculations assume that the baffling efficiency is 90%

b. Chlorine dose assumes 2.2 mg/L as Cl_2 to react with 3.2 mg/L hydrogen peroxide. Chlorine dose does not assume a background chloramine concentration.

c. Ammonia dose assumes 0.9 mg/L as N in the RO permeate.

3.4 Estimated Cost for Implementation

To implement the chloramine approach, it would be necessary to purchase two online continuously monitoring chloramine analyzers (one duty and one standby) to measure the chloramine residual at the compliance point, which could be either the tee to the Purified Water Reservoir or Well Site #4. The Hach CL10 sc amperometric total chlorine analyzer, used elsewhere in the AWPF, could also be used for this application.

The estimated planning level cost to station the analyzers at the tee to the Purified Water Reservoir or Well Site 4 is $230,00 and $35,000, respectively. This estimate includes the cost of the analyzers, all-weather housing cabinets, power, SCADA connection, and security. The Purified Water Reservoir option is more expensive because the SCADA transmission line must be buried in the ground, and the distance from the tee to the Reservoir is nearly 4,000 ft. Furthermore, security is a larger concern at the tee to the Purified Water Reservoir, and it would be necessary to store the analyzers belowground in a buried pre-cast concrete vault.

The current AWPF design already includes chloramination of the UV/AOP effluent using 12.5% sodium hypochlorite to achieve a target residual of 2 to 4 mg/L at the wellhead. Since, 2 to 4 mg/L is sufficient for virus inactivation, there are no additional chemical costs.

The specified UV/AOP effluent sodium hypochlorite chemical pumps (ProMinent DulcoFlex DBF10) can supply a dose of 15 mg/L (maximum capacity of 31 gph), which is greater than the estimated maximum requirement of 10 mg/L.

4 - REGIONAL TREATMENT PLANT REMOVAL CREDIT

While pathogen densities in drinking water have been well characterized, there have not been strong drivers to investigate pathogens in wastewaters that precede potable reuse treatment. Accordingly, few studies have been conducted to date aimed at characterizing pathogens such as enteric virus, *Giardia* cysts, or *Cryptosporidium* oocysts through wastewater treatment facilities. The 2004 study conducted by Dr. Joan Rose and colleagues under a collaborative Water Environment Research Foundation (WERF) research effort has historically been the benchmark from which potable reuse projects in the state of California have pursued pathogen credits for wastewater treatment (Rose, 2004). Agencies have proposed conservative estimates of pathogen removal based on accepted values within the literature (e.g., Rose, 2004). Alternatively, agencies have also conducted pathogen monitoring programs involving measurements of pathogen concentrations (or approved surrogates) through wastewater treatment. Either approach must be reviewed by DDW and is accepted on a case-by-case basis. The following section discusses the previous pathogen crediting approaches for wastewater treatment in California, and feasible avenues for crediting the RTP with pathogen inactivation/removal.

4.1 Literature-Based Crediting Approaches in California

The four projects that have approved for literature-based pathogen crediting of wastewater treatment are the Water Replenishment District of Southern California (WRD) Alamitos Barrier Recycled Water Project (Leo J. Vander Lans Advanced Water Treatment Facility Expansion), the Cambria Community Services District (CCSD) Emergency Water Treatment Facility Recycled Water Re-injection Project, the City of Los Angeles Bureau of Sanitation (LASAN) Terminal Island Water Reclamation Plant AWPF Expansion, and Sanitation Districts of Los Angeles County (LACSD) Montebello Forebay Spreading Project. The WRD project received pathogen removal credits for the Long Beach Water Reclamation Plant (LBWRP) and the Los Coyotes Water Reclamation Plant. (LCWRP); the CCSD project received credits for the CCSD Wastewater Treatment Plant; the LASAN project received credit at the Terminal Island Water Reclamation Plant (TIWRP); and the LACSD project received credits at San Jose Creek Easè (SJCE), San Jose Creek West (SJCW), the Pomona Water Reclamation Plant (PWRP), and the Whittier Narrows Water Reclamation Plant (WNWRP). All projects relied on data from the Rose et al. (2004) study which investigated the concentrations of pathogens and indicators in the raw influent and secondary effluent of six wastewater treatment facilities across the United States. Five to six samples were collected at each process (e.g., raw influent, secondary effluent) for each plant. A summary of the plants surveyed in that study, as well as those that have received credit, and RTP, is shown in Table 4-1.

Table 4-1 Process details for wastewater treatment plants surveyed in Rose et al. (2004), other CA reuse plants that have received literature-based credit, and the RTP

Facility	Capacity (mgd)	Primary Clarifiers	Biological Treatment	Solids Retention Time (days)	Additional Treatment
Rose Study Facility A	0.9-2.6	No	Conventional Activated Sludge	6-8	NA
Rose Study Facility B	13.9-16.2	No	Conventional Activated Sludge	3.5-6	NA
Rose Study Facility C	9.6-10.3	Yes	Conventional Activated Sludge	1.6-2.7	NA
Rose Study Facility D	11-25	No	Conventional Activated Sludge	3-5	NA
Rose Study Facility E	1.2-2.1	No	Nitrification-Denitrification	8.7-13.3	NA
Rose Study Facility F	1.3-2.4	No	Nitrification-Denitrification	8-16	NA
LBWRP	25	Yes	Nitrification-Denitrification	>9	Filtration, Disinfection
LCWRP	37.5	Yes	Nitrification-Denitrification	>9	Filtration, Disinfection
CCSD WTP	1.0	No	Nitrification-Denitrification	>9	Disinfection, Soil Aquifer Treatment
TIWRP	30	Yes	Nitrification-Denitrification	7-8	Filtration
SJCE	62.5	Yes	Nitrification-Denitrification	12	Filtration
SJCW	37.5	Yes	Nitrification-Denitrification	12	Filtration
PWRP	15	Yes	Nitrification-Denitrification	12	Filtration
WNWRP	15	Yes	Nitrification-Denitrification	12	Filtration
RTP	29.6	Yes	Trickling Filters / Solids Contact	1.2-1.6 (solids contact)	None (O_3 Optional)

The focus of pathogen crediting analyses was directed at the raw influent and secondary effluent enteric virus[1], *Giardia* cyst[2], and *Cryptosporidium* oocyst[3] concentrations from the Rose et al. (2004) study. Analysis was conducted following methods laid out by a Water Environmental Research Foundation study by Soller et al. (2008), which used the pathogen data produced by Rose and colleagues to estimate risk due to exposure to reclaimed water. In that study, the raw influent and secondary effluent pathogen data from each of the six facilities in the Rose et al. (2004) study were ranked and paired by ranking (rather than pairing by sampling date) for use in the microbial risk assessment model.

In the analysis done for the WRD and CCSD projects, Rose et al. (2004) pathogen data from only Facilities C and D were used on the basis that the chosen facilities operated at a lower solids retention time (SRT) than the LBWRP and LCWRP, which was presumed to provide conservative estimates of removal (WRD, 2013, CCSD 2014). The raw influent and secondary effluent pathogen data from Facilities C and D were ranked and paired by ranking; subsequently, LRVs were calculated between each ranked pair and the 10th percentile LRV was chosen for each pathogen. DDW approved this approach and accepted the calculated 2-log reduction of virus, 2-log reduction of *Giardia* cysts, and 1-log reduction of *Cryptosporidium* oocysts for the LBWRP, LCWRP and CCSD WTP.

The approach for LASAN's TIWRP and the Montebello Forebay project followed a similar methodology, however the complete dataset (Facilities A through F) was used in the analysis because a clear relationship between SRT and pathogen removals was thought to be lacking for the plants surveyed in the Rose et al. (2004) dataset (LASAN, 2015). The 10th percentile LRV from the ranked influent and effluent resulted in the DDW-approved 1.9-log reduction of virus, 0.8-log reduction of *Giardia* cysts, and 1.2-log reduction of *Cryptosporidium* oocysts through the TIWRP, SJCE, SJCW, PWRP, and WNWRP secondary processes.

All credited wastewater treatment plants have activated sludge (AS) systems operated at sufficiently high SRTs to accomplish nitrification (and denitrification) in the biological process. It is well established throughout the industry that NDN plants produce a high-quality secondary effluent, superior to that of conventional activated sludge in terms of consistent reduction of biochemical oxygen demand, total suspended solids, turbidity, and total organic carbon. Fixed-film processes such as trickling filters (TF) are often considered less desirable in terms of effluent quality. The Orange County Sanitation District's Plant (OCSD) 1 has both NDN facilities and trickling filters with solids contact (TF/SC) which feed the AWPF. In the crediting effort's for OCSD's Plant 1 as part of Orange County Water District's (OCWD) Groundwater Replenishment System (GWRS) project, a literature review concluded that the TF process generally attains lower levels of pathogen reduction than an AS process. OCWD presented two approaches for

[1] Infectivity assay for cytopathic effects on cell lines was analyzed for viruses.
[2] Analyzed using USEPA Method 1623
[3] Analyzed using USEPA Method 1623

crediting Plant 1: a) flow-weighted averages of LRVs based on AS and TF/SC flows and literature-based removals (including a similar approach to WRD for the AS contribution), and b) taking the more conservative value between the literature-based AS and TF LRVs (OCWD, 2014). Ultimately, DDW was reluctant to approve any credit for Plant 1 due to the uncertainty associated with the pathogen removal efficiency of the TF/SC process.

All credited facilities also have additional uncredited treatment following secondary treatment (e.g., filtration, disinfection, soil aquifer treatment). These treatment processes provide an added layer of conservatism towards meeting the credited removals. M1W does not filter or disinfect the water prior to the AWPF source water pump station (ozonation is discussed later), which is expected to make DDW less willing to credit the wastewater treatment process without a site-specific study.

Based on OCWD's TF/SC experience, and because M1W does not provide additional treatment after secondary prior to the AWPF, it is likely that DDW will not accept literature-based values for the RTP. Therefore, a well-run monitoring program documenting pathogen concentrations in the RTP raw influent and secondary effluent would be the recommended approach for M1W.

4.2 Monitoring-Based Crediting Approaches in California

Two recent potable reuse pathogen crediting monitoring studies at wastewater treatment facilities in California include the site-specific work for the City of San Diego's Pure Water Program ("San Diego Pathogen Study") and the City of Oceanside's Pure Water Oceanside project ("Oceanside Pathogen Study"). The Pure Water Oceanside work was conducted at the San Luis Rey Water Reclamation Facility (SLRWRF) and the City of San Diego work was conducted at the North City Reclamation Plant (NCWRP).

The removal of pathogenic microorganisms at the RTP has been studied during two projects: the Recycled Water Food Safety Study ("Food Safety Study") and the Pure Water Monterey Advanced Water Purification Pilot Study ("AWP Pilot Study"). Process summaries for the SLRWRF and NCWRP (with RTP for reference) are shown in Table 4-2.

Table 4-2 Process details for wastewater treatment plants with site-specific monitoring studies

Plant	Capacity (mgd)	Primary Clarifiers	Biological Treatment	Solids Retention Time (d)
SLRWRF	13.5	Yes	Conventional Activated Sludge	2-4
NCWRP	30	Yes	Nitrification-Denitrification	10
RTP	29.6	Yes	Trickling Filters + Solids Contact	1.2-1.6 (solids contact)

The Food Safety Study was conducted by Bahman Sheikh (consultant), Bob Cooper (University of California at Berkeley and BioVir Laboratories), and Rick Danielson (BioVir Laboratories) from 1997 to 1998 and included seven samples collected on the raw wastewater entering the RTP and from the secondary effluent, and enumeration of *Giardia* cysts, *Cryptosporidium* oocysts, and fecal coliform. *Giardia* cysts and *Cryptosporidium* oocysts were enumerated by following USEPA Information Collection Request (ICR) methodologies (1996), which uses phase separation with a Percoll-sucrose solution instead of the immunomagnetic separation (IMS) technique in USEPA method 1623. The AWP Pilot Study conducted by Trussell Technologies from 2013 to 2014 included six samples collected from each the raw wastewater entering the RTP and from the secondary effluent, with enumeration of *Giardia* cysts and *Cryptosporidium* oocysts on each sample. Laboratory analyses were conducted by BioVir, using the fluorescent microscopy analysis detailed in USEPA Method 1623 and USEPA Method 1693 (which allows for the omission of filtration for samples that are difficult to filter). No virus data were collected during these studies. The results from these studies are plotted in Figure 4-1 and Figure 4-2.

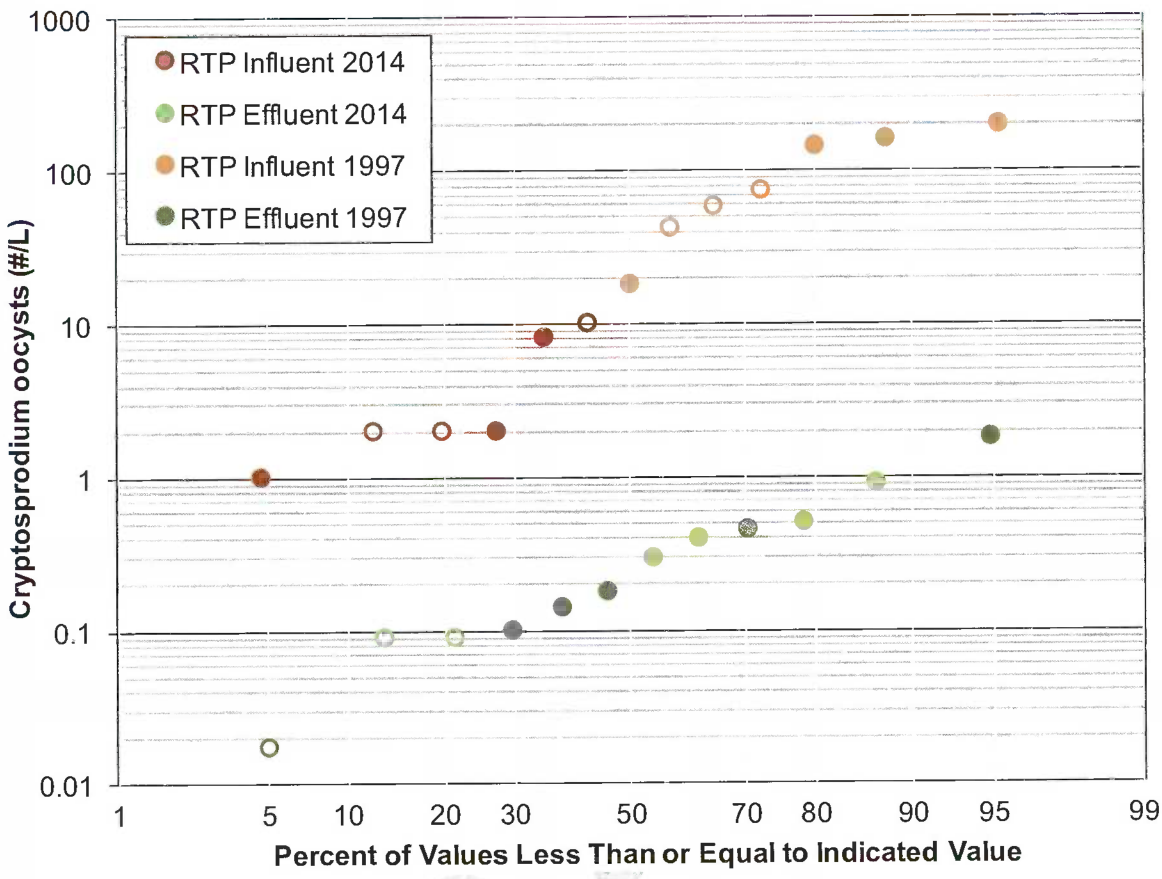

Figure 4-1 RTP *Cryptosporidium* oocyst distributions (open circles indicate the concentration was below the plotted value)

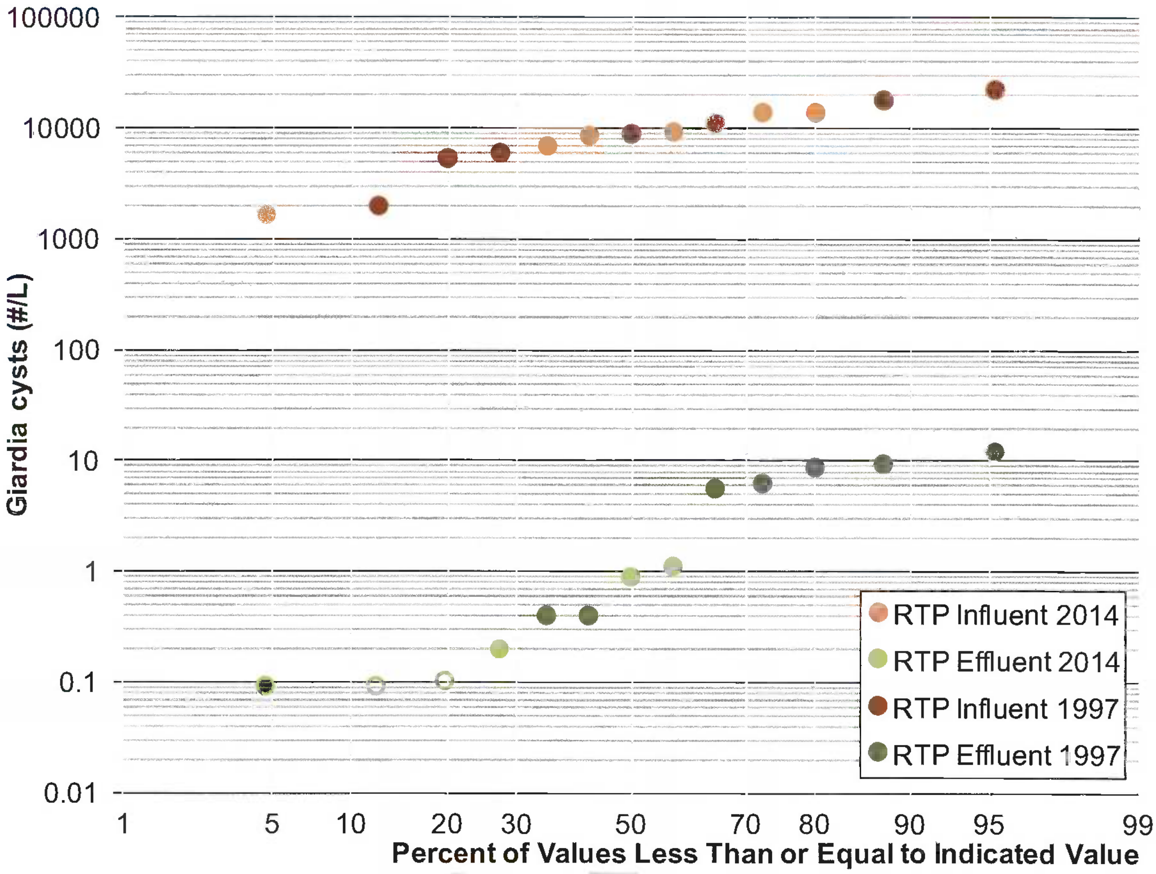

Figure 4-2 RTP *Giardia* cyst distributions (open circles indicate the concentration was below the plotted value)

The Oceanside Pathogen Study and San Diego Pathogen Study were conducted by Trussell Technologies in 2015 to 2016 and 2016 to 2017, respectively. In the Oceanside Pathogen Study, 12 to 17 samples of cultured enteric virus (USEPA Method 1615), *Giardia* cysts (USEPA Method 1623), and *Cryptosporidium* oocysts (USEPA Method 1623) were analyzed. The study also included samples for coliphage, enterovirus by quantitative polymerase chain reaction (qPCR), *Salmonella*, and an integrated cell culture approach with qPCR (ICC-qPCR). All analyses for the Oceanside Pathogen Study were conducted by Dr. Joan Rose at the Water Quality, Environmental, and Molecular Microbiology Laboratory at Michigan State University. The San Diego Pathogen Study included additional samples, with similar assays to the Oceanside and RTP studies.

Through involvement with both the Oceanside Pathogen Study and San Diego Pathogen Study, Trussell Technologies has been closely engaged with DDW regarding site-specific monitoring for wastewater pathogen reduction credit. It is imperative that the data analysis of the gathered influent and effluent pathogen concentrations reflects a conservative estimate of removal to ensure the protection of public health. A statistical analysis approach has been presented to and tentatively approved by DDW as an acceptable methodology for calculating LRVs through secondary treatment. This approach requires the use of DDW-approved assays, a minimum number of samples, and a statistical analysis of the resulting data.

Using this method, credit values have been estimated for the RTP and Rose et al. (2004) facilities, as shown in Table 4-3. For this analysis, large facilities from the Rose et al. (2004) study with flows larger than 10 mgd were analyzed. The analysis for the RTP was performed by combining data from the Food Safety Study and AWPF Pilot Study, which, due to differences in time and analytical methods, may not be acceptable to DDW. In addition, the number of RTP and selected Rose samples may not yet be sufficient for DDW. However, these data provide meaningful insights for the purposes of this feasibility investigation.

The RTP is observed to achieve better levels of *Giardia* cyst and *Cryptosporidium* oocyst removal than the Rose et al. (2004) facilities. Data from Oceanside and San Diego suggest that virus removals up to 2 logs can be achieved; thus, the RTP might reasonably achieve 0.7 to 2.0 log-reduction of enteric virus if a well-run monitoring study was conducted at the facility.

Table 4-3 Pathogen LRVs through secondary treatment at M1W and facilities from Rose et al. (2004) via the statistical analysis approach accepted by DDW

Pathogen	RTP (M1W)	Rose et al. (2004)[4]
Enteric virus[1]	No data	0.67
Giardia cysts[1]	2.49[3]	0.85
Cryptosporidium oocysts[1]	0.34[3]	0.17

1 – All non-detects are included in the analysis at the detection limit
3 – Deviates from the DDW-approved approach since non-USEPA Method 1623/1693 data is included.
4 – Only facilities larger than 10 mgd were analyzed

4.3 Cost Estimate for RTP Pathogen Crediting Alternative

A planning level cost estimate of the effort to conduct a DDW-approved pathogen monitoring study at the RTP is $150,000 to $200,000. This effort would include a DDW-approved test plan, labor and direct costs for sampling, direct costs for virus assays, including potentially optional alternative virus assays, data analysis and coordination, and final report for DDW. An optional additional $50,000 could also provide enough information on *Giardia* cyst and *Cryptosporidium oocyst* removal to support redundant credits for *Giardia* cysts and *Cryptosporidium oocysts*. An RTP pathogen monitoring study is estimated to demonstrate 0.7 to 2.0 log reduction of enteric virus credit, 2.5 log reduction of *Giardia* cysts credit, and 0.3 log reduction of *Cryptosporidium* oocysts credit for the M1W RTP.

5 - OZONE PATHOGEN CREDIT BASED ON O3:TOC RATIO

5.1 Ozonation for Reuse in California

Ozonation is increasingly being used for non-potable and potable reuse due to its ability to simultaneously disinfect (pathogen inactivation/removal) and oxidize wastewater (chemical abatement/pretreatment). As shown in Table 5-1, there are multiple reuse sites in California currently using or considering ozonation for reuse.

Table 5-1 Ozone Reuse Installations in CA

Site	Application	Project Status	Comments
Anaheim	• Decentralized treatment facility • MBR and ozone • Title 22 unrestricted reuse	Operating since 2010	• Granted 5-log reduction credit for virus based on Title 22 validation • APTwater HiPOx System
San Simeon	• Small conventional WWTP • Tertiary treatment • Cloth filtration and ozone • Title 22 unrestricted reuse	Operating since 2012	• Granted 5-log reduction credit for poliovirus based on Title 22 validation • APTwater HiPOx System
West Basin Water District	• Full Advanced Treatment (GWR) • MF/RO/AOP • ozone pre-treatment to minimize fouling of membranes	Operating since 2012	• Pathogen log reduction credit not requested • Ozonia/Suez ozone generator
Monterey One Water	• Full Advanced Treatment (GWR) • MF/RO/AOP • ozone pre-treatment to minimize fouling of membranes	In construction	• Pathogen log reduction credit not originally needed • Wedeco/Xylem ozone generator
North City Pure Water Facility (San Diego)	• Full Advanced Treatment (SWA) • Ozone-BAC pre-treatment to minimize fouling of membranes, disinfect and abate chemicals	In design	• Requesting 6-log pathogen reduction credit based on EPA CT approach
Donald C. Tillman Water Reclamation Plant (Los Angeles)	• Alternative Advanced Treatment (GWR) • Ozone-BAC followed by UV and SAT	In piloting/pre-design	• Evaluating O_3:TOC ratio as design and operational approach
Notes: MBR is membrane bioreactor; WWTP is wastewater treatment plant; GWR is groundwater replenishment; MF/RO/AOP is membrane filtration/reverse osmosis/advanced oxidation process; SWA is surface water augmentation; BAC is biological active carbon; O_3:TOC is ozone to total organic carbon ratio; Full Advanced Treatment is MF/RO/AOP; Alternative Advanced Treatment is alternatives to MF/RO/AOP; and ATPWater is now a part of Ultura.			

5.2 Ozone Pathogen Crediting in Reuse Applications

Potable reuse projects require validation of treatment processes used to meet pathogen log reduction requirements. Validation is achieved by submitting a report to DDW for review and/or by challenge testing after DDW approval. The report and/or testing must provide evidence of the treatment process's ability to reliably and consistently achieve log reduction. On-going monitoring of a microbial, chemical, or physical surrogate parameter that verifies the performance of the process's ability to achieve credit log reduction must be included in the Operation Optimization Plan.

Three ozone manufacturers, APTwater, in 2008 (now Ultura), H2O Engineering, in 2014, and Wedeco, in 2015, have submitted ozone disinfection validation reports to DDW. These reports sought to demonstrate how the ozonation technologies can reliably achieve at least 5 logs of poliovirus or F-specific bacteriophage MS2. APTwater's validation report has received conditional acceptance from DDW, and two installations are operating with virus disinfection credit (for non-potable reuse). These installations meet on-going CT (residual x time) monitoring requirements that are based on the validation study results.

Another approach is to utilize the USEPA's SWTR Guidance Manual and the resulting equations derived from the drinking water CT tables for virus, *Cryptosporidium* oocysts, and/or *Giardia* cyst log reduction credit. Trussell Technologies is helping the City of San Diego pursue this option for Phase I their Pure Water San Diego Project at the North City Water Reclamation Plant. DDW has tentatively accepted disinfection credit with ozonation in the City of San Diego's draft Engineering Report.

5.3 O_3:TOC Ratio versus CT for Reuse Disinfection Credit

The concept of CT has long been used for chemical disinfectants such as chlorine and ozone for drinking water applications. Sufficient chemical is added to the process stream to generate residual after a specified amount of time to achieve log reduction credit according to USEPA disinfection tables. With ozone, the monitoring approach accounts for the rapid decay of ozone by allowing integration under the ozone decay curve (as determined by three or more residual analyzers) to determine measured CT.

The CT approach leads to two challenges for secondary and tertiary wastewater matrices. The first challenge is that ozone demand in wastewater is high, so it can be difficult to sustain a dissolved ozone residual (necessary to do a CT calculation). The second challenge is that the high ozone doses necessary to generate sufficient residuals can form disinfection by-products (e.g., bromate, NDMA, formaldehyde).

An example of the CT approach for wastewater is the APTwater disinfection validation study. As shown in their report, significant virus inactivation occurs at low CT values (e.g., 6.5-log inactivation of MS2 at a CT of 0.20 mg*min/L). A CT as low as 0.20 mg*min/L can be difficult to measure in wastewater matrices due to the rapid decay of ozone. DDW granted conditional acceptance for 6.5-log inactivation of MS2 at a CT of 1.00 mg*min/L (due to the additional need to remove total coliform to <2.2 MPN/100 mL for non-potable applications).

The M1W design ozone dose does not yield significant ozone residuals; applying the drinking water CT concept might require an increase in ozone dose, with associated drawbacks. Instead, the ozone system was designed based around an ozone to total organic carbon (O_3:TOC), which correlates to CEC destruction and improvement of water quality for downstream membrane operations.

Wedeco (the ozone system supplier for the PWM AWPF) conducted a disinfection validation study for DDW in 2014 and 2015. The results confirmed the findings of the APTwater study on CT. An analysis was also done comparing virus inactivation with O3:TOC ratio, utilizing past validation studies done by Wedeco, APTwater, and H2O Engineering in California. A correlation was found to exist between virus inactivation and O3:TOC ratio (see Figure 5-1), and it was confirmed that significant virus inactivation occurs rapidly, before generating a measurable CT. The report is pending DDW review.

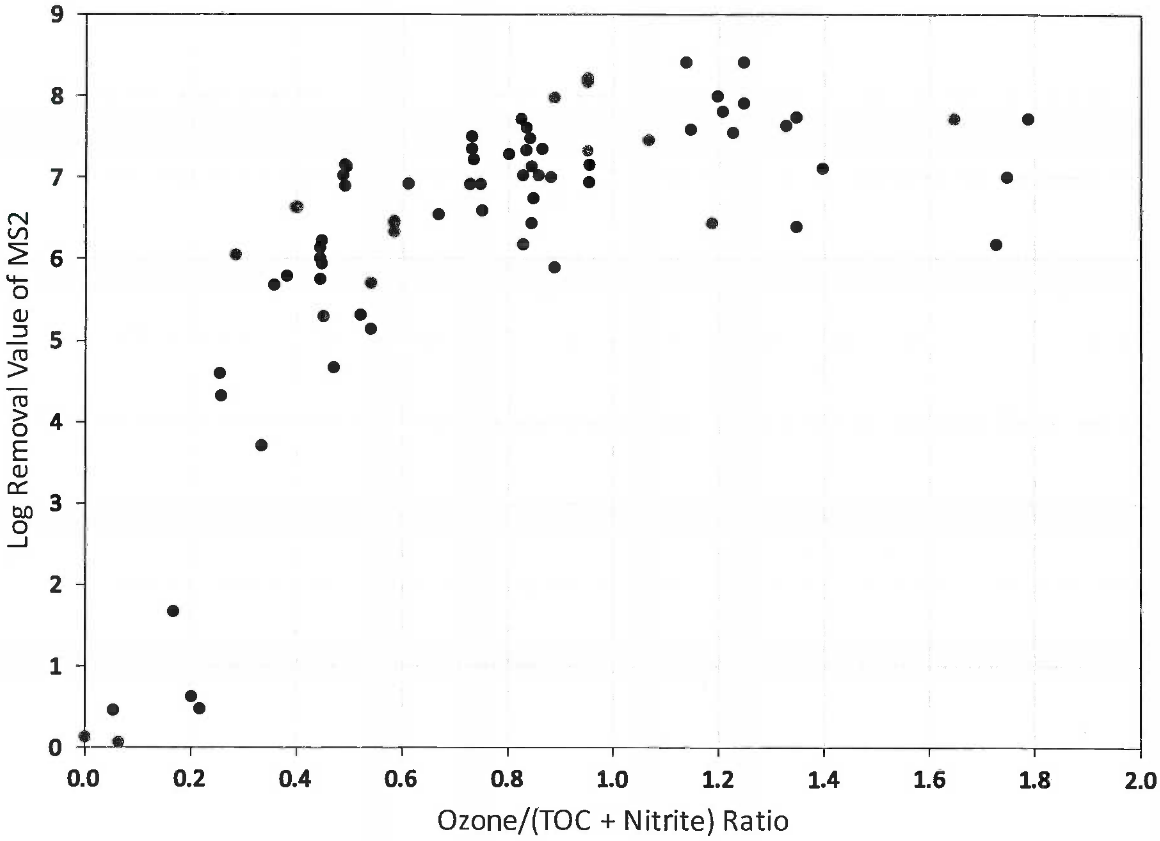

Figure 5-1 Compilation of Ozone Validations Studies for O3:TOC vs. MS2 (note that nitrite demand was incorrectly accounted for; however, the error is small for low nitrite concentrations)

5.4 Knowledge Gaps on Virus Inactivation in Wastewater

A challenge for the M1W project is that ozonation at the AWPF is being applied to unfiltered secondary effluent. DDW typically requires filtration prior to disinfection. Therefore, additional testing will be required to demonstrate the disinfectability of unfiltered secondary.

5.5 The O3:TOC Ratio Approach for Monterey One Water

O_3:TOC ratio was used as the basis of design for the M1W's AWPF ozonation system based on results of the pilot testing and historical water quality monitoring of the RTP secondary effluent. Based on these design assumptions, the ozonation system will initially be operated at an O_3:TOC ratio of approximately 0.5 g/g including correction for additional ozone demand exerted by nitrite. This O_3:TOC ratio was determined to be sufficient to minimize fouling of microfiltration membranes while also providing significant removal of constituents of emerging concern (CECs). Pilot testing also indicated that ozonation could be performed at O_3:TOC ratios higher than 0.5 g/g without increasing bromate formation, NDMA formation, or the size of the ozone contactor. However, pilot data also indicated that increasing the ozone dose could increase the TOC concentration in the RO permeate resulting in exceedances above the effluent goal of 0.5 mg/L (Figure 6-2) (Trussell Technologies, 2016).

With the O3:TOC design point of 0.5 g/g, ozonation is expected to provide approximately 6.5-log reduction of MS2. In order to achieve the required log reduction of 1.7 logs, an O3:TOC ratio of approximately 0.25 g/g would be required.

6.5 Cost Estimate of Ozone Disinfection Credit Implementation

Implementing ozone disinfection credits requires (1) a DDW-demonstration study, (2) full-scale bioassay, and (3) the addition of nitrite analyzers on the AWPF ozone system. The estimated cost of these components is approximately $150,000 to $300,00, $50,000, and $60,000, respectively.

The DDW-demonstration study would include review of the Wedeco report, a test plan for testing of the unfiltered secondary effluent for DDW review, calibration of Demonstration Facility ozone equipment, procurement of a secondary effluent TOC and nitrite analyzer, and monitoring of native phage disinfection, if possible, and/or challenge tests with seeding of MS2 virus, and a final report to submit to DDW. The cost is dependent on the viability of native phage monitoring, which depends on the secondary effluent concentration. The bioassay is typically required of DDW for full-scale implementation and consists of challenge testing with seeded MS2 of the full-scale system during startup. The nitrite analyzer is required to calculate the O3:TOC ratio accounting for initial nitrite demand.

6 - STRONTIUM RO REJECTION MEASUREMENT CREDIT

Demonstrating pathogenic microorganism control in the reverse osmosis (RO) process involves the use of surrogate parameters for performance and integrity monitoring. Most facilities measure total organic carbon (TOC) or electrical conductivity (EC) reduction across the RO membranes as surrogates for pathogen log reduction. PWM is approved for a log removal credit of 1 through the RO system, using daily average reduction of EC (TOC monitoring is also included in the AWPF design, as a backup strategy). The City of San Diego recently completed a monitoring program at their 1 mgd North City Demonstration Pure Water Facility (NCDPWF) to test alternative surrogate molecular markers for RO integrity monitoring and pathogen crediting. The City of San Diego pursuit of alternative RO monitoring surrogates is discussed below.

6.1 City of San Diego's RO Monitoring Approach

The City of San Diego is pursuing a multi-phased program, known as the Pure Water San Diego Program, to expand and diversify its sources for domestic drinking water supply. The North City Pure Water Program is the first phase of this program. This is a surface water augmentation (SWA) project that will treat municipal wastewater filter effluent at an AWPF to augment a reservoir that supplies a drinking water treatment plant. The North City Pure Water Facility (NCPWF) is the program's advanced water purification facility, and will have capacity to produce up to 34 million gallons a day of purified water. The program is scheduled to be operational by late 2021.

The NCPWF will produce purified water using a five-step treatment process consisting of: ozone/biological activated carbon (O_3/BAC), membrane filtration (MF), reverse osmosis (RO), and ultraviolet/advanced oxidation process (UV/AOP). Each of the treatment processes serves as a barrier and represents a critical control point, designated to mitigate, prevent, or eliminate a human health hazard. Each of the critical points are monitored using surrogate parameters to assess performance and ensure pathogen LRVs are being achieved.

The NCPWF is expected to provide significantly more pathogenic microorganism control than the required minimum levels by SWA regulations for added redundancy and reliability of operation and treatment. The expected LRVs for each NCPWF process, cumulative, and required minimum levels prior to release into the reservoir are provided in Table 6-1.

Table 6-1 Expected Pathogen Log Reduction Values for the North City Pure Water Facility. Adapted from North City Pure Water Project Draft Title 22 Engineering Report.

Pathogen	Anticipated LRV Credits for the Project					Total Required LRV Credits Prior to Release into Reservoir
	O_3/BAC	MF	RO	UV/AOP	Total prior to Release into the Reservoir[1]	
Virus	6	0	2.5	6	14.5	9
Giardia	6	4	2.5	6	18.5	8
Cryptosporidium	1	4	2.5	6	13.5	9

1 – Does not account for log removal values achieved by the Water Reclamation Plant (primary and secondary treatment followed by tertiary filters) nor by the Cl_2 pipeline from the AWTF to the reservoir.

With the philosophy of exceeding minimum pathogen LRV requirements, part of the Pure Water San Diego Program has been to enhance the awarded pathogen removal credit for processes that are potentially under credited, such as reverse osmosis. Typically, reverse osmosis integrity monitoring via TOC or EC provide no greater than 2-logs of treatment credit, yet studies have shown that RO membranes can reject as much as 6-logs of virus, the smallest in size of the regulated pathogens. Microbial surrogates, specifically male-specific bacteriophage (MS2), are often used to validate pathogen removal across RO membranes due to their similarities to enteric virus, (Pype et al., 2016a). Table 6-2 provides a summary of recent studies evaluating removal of MS2 by RO membranes.

Table 6-2 Log removal values of studies evaluating removal of MS2 by RO.

MS2 Log Removal Value (LRV)	Reference
3 – 4.8	Kruithof et al. (2001)
4	Lozier et al. (2003)
5.4	Mi et al. (2004)
7	Casani et al. (2005)
4.2 – > 6	Pype et al. (2016a)
> 6.2	Antony et al. (2016)
4.6 – 7.3	Trussell Technologies (2017)

At a minimum, RO membranes are able to provide at least 3-logs of removal of MS2, and that a number of studies showed greater than 6-logs of removal. Given this gap of what EC and TOC can demonstrate and what RO membranes are capable of providing, the San Diego Pure Water Program explored options to enhance RO pathogen removal credit. Several new surrogates—both spiked and naturally occurring—were tested for their ability to demonstrate higher degrees of pathogen removal while still remaining conservative in the event of integrity breaches.

Table 6-3 provides a summary of select findings from the RO integrity testing with two different RO membrane products, conducted as part of the San Diego Pure Water Program. Naturally occurring strontium showed promising results, being able to demonstrate approximately 3.5 logs of removal, or approximately 1.5-logs more than with TOC rejection. At the time of testing, RO feed strontium was 1,006 ± 48 µg/L. Furthermore, strontium did not overestimate MS2 rejection under both intact and compromised membranes (e.g., removal of o-rings). Testing also showed that strontium provided greater resolution of membrane failure making it able identify breaches with greater confidence than EC and TOC. More specifically, strontium was able to detect a vessel breach at the train level, whereas EC was only able to detect this breach at the vessel where the compromise took place. This means that strontium is a more sensitive surrogate, requiring fewer monitoring locations than EC to have equal assurance of catching integrity breaches.

Table 6-3 Results from RO Integrity Testing as part of the Pure Water San Diego Program

Membrane Product	Surrogate	Intact Membrane LRV	Compromised[1] Membrane LRV
Hydranautics ESPA2 LD	MS2	6.5 ± 1.2	0.8 ± 0.1
	Strontium	3.3 ± 0.2	0.9 ± 0.1
	TOC	2.2 ± 0.1	0.8 ± 0.1
	EC	1.7 ± 0.1	0.8 ± 0.1
Toray TMG20D-400	MS2	5.3 ± 0.2	1.1 ± 0.1
	Strontium	3.3 ± 0.3	1.1 ± 0.1
	TOC	2.3 ± 0.1	1.1 ± 0.1
	EC	1.9 ± 0.1	1.1 ± 0.1

Note: Reported LRVs are from samples taken from the permeate of a single vessel in the first stage of a 2-stage RO train.

1 – Represents removal of o-rings from the feed end-cap of a single pressure vessel.

Given the advantages of using a more sensitive surrogate for RO integrity monitoring, the City of San Diego has developed a tiered approach with DDW using strontium, TOC, and EC to demonstrate RO pathogen removal. Strontium is the proposed surrogate for Tier 1 for RO surrogate monitoring. This tier is expected to provide at least 2.5 LRV for all regulated pathogens (i.e., virus, *Cryptosporidium* oocysts, and *Giardia* cysts). The awarded credit for this tier will be based on actual removal determined by monitoring locations at the combined feed and combined permeate of each operating train. Demonstration of membrane integrity for Tier 1 (i.e., measured strontium rejection) will occur no less frequent than once every 24 hours of operation.

The second tier will serve as a backup to the first one, utilizing continuous TOC monitoring (15-min data) to assess membrane integrity. This tier will be monitored at the combined feed and combined permeate (overall). This tier is expected to provide at least 2.0 LRV based on historical performance at the NCDPWF.

The third and final tier will consist of continuous EC monitoring (15-min data) to assess membrane integrity. Monitoring for this tier will be analogous to Tier 1, measuring EC at the combined feed and combined permeate of each train. Tier 3 will be applied to the entire RO system if strontium and TOC monitoring are not operational. Table 6-4 provides a summary of the tiered approach to monitor the RO system at the NCPWF.

Table 6-4 Summary for Tiered Approach to Monitor RO System Integrity at the NCPWF

RO Monitoring Approach	Tier 1	Tier 2	Tier 3
Marker used to monitor integrity	Strontium	TOC	TDS as EC
Frequency	No less than once every 24 hours of operation	Continuous (15-min data)	Continuous (15-min data)
Monitoring location	Combined RO feed & combined permeate of each train	Combined RO feed & combined permeate (overall)	Combined RO feed & combined permeate of each train
Expected LRV[1]	at least 2.5	at least 2.0	no less than 1.0
Proposed awarded LRV[1]	Based on actual removal determined by tiered methodology (must meet 1.0 minimum to run at normal operation)		
Notes	Supersedes all other tiers under normal operation. Lowest train LRV will be used and inputted into the facility's SCADA.	Is applied if Tier 1 is not operational.	Is applied if Tier 1&2 are not operational.

1 – Expected and proposed awarded LRV for regulated pathogens (i.e., virus, *Giardia* cysts, and *Cryptosporidium* oocysts)

In addition to offering a tiered approach to monitor RO integrity, the NCPWF RO monitoring program will include scheduled vessel EC probing (i.e., vessel integrity) to identify small breaches before they become a compliance concern. Each vessel will have its conductivity measured on quarterly basis and kept in an electronic logbook to establish a historical dataset and profile on vessel conductivity. Control limits will be established to trigger a breach response whenever the vessel's conductivity is discernibly higher than a historical baseline. By combining the tiered approach with periodic vessel probing, the RO monitoring program at NCPWF is expected to pick up both severe plant-wide and minor vessel level breaches in order to ensure awarded pathogen log removal credit are safely met.

6.2 Source Water Strontium for PWM AWPF

In order to assess the feasibility of using naturally occurring strontium to monitor integrity of the RO system at the PWM AWPF, it is important to know both historical and expected levels of strontium in the feed water to the facility. This is important since strontium concentrations must be high enough to demonstrate the desired levels of surrogate removal.

The RTP will receive flow from various sources, including the municipal wastewater, agricultural wash water from the City of Salinas, and agricultural tile drainage water from the Reclamation Ditch and Blanco Drain. Strontium removal through the RTP is not expected. Table 6-5 summarizes the minimum, mean, and maximum strontium concentrations expected in the AWPF influent from the different sources based on measured concentrations during source water sampling (July 2013 to June 2014) and Demonstration Facility sampling (December 2017).

Table 6-5 Strontium Concentrations from Sources that will feed the PWM AWPF

Source Water	Strontium concentrations (µg/L)			
	Min	Mean	Max	Count
RTP	290	433	740	7
Ag Wash Water	510	760	1300	3
Blanco Drain	990	1423	2200	4
Reclamation Ditch[1]	990	1423	2200	4

1 – No data is recorded for the Reclamation Ditch, therefore Blanco Drain values have been assumed due to similarities in drainage characteristics

Using the strontium values for each source water, a blending calculator was used to estimate concentrations of strontium using flow weighted averages with all the projected source water flows that will feed the RTP and then AWPF once the plant is online. This analysis assumes that strontium is not removed through the RTP. The blending calculator considers best-case (highest strontium concentration recorded), worst-case (lowest strontium concentration recorded) and typical-case (average of the strontium concentrations) for the sources. The blending calculator considers projected variations in source water flows throughout the year, using projected monthly averages. Table 6-6 presents the range of strontium concentrations in the AWPF feed, on a monthly basis.

Table 6-6 Outputs from Blending Calculator on Projected Monthly Strontium Concentrations for PWM AWPF feed

Strontium (µg/L)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Best-case	740	740	740	1089	1067	1096	1081	1055	1002	974	740	740
Worst-case	290	290	290	446	435	449	445	434	409	397	290	290
Typical-case	433	433	433	657	642	662	655	639	603	587	433	433

Table 6-7 Strontium Concentration Summary for Best, Worst, and Typical Cases in PWM AWPF Feed

Strontium (µg/L)	Min	Max	Mean	Selected Value
Best-case	740	1096	922	1096
Worst-case	290	449	372	290
Typical-case	433	662	551	551

In Table 6-7, the minimum, maximum, and mean are summarized for each of the three strontium scenarios. The best-case strontium concentration is recorded as the maximum of the best-case strontium monthly concentrations over the year. The worst-case strontium concentration is recorded as the minimum of the worst-case strontium concentrations over the year of flow-weighted values. The typical-case strontium concentration is recorded as the mean of the typical-case strontium concentrations over the year of flow-weighted values. The projected best-, worst-, and typical-case strontium concentrations in the AWPF feed water are 1096 µg/L, 290 µg/L, and 551 µg/L, respectively. Because strontium is not removed by ozone or hollow-fiber membrane filtration, the AWPF feed water strontium levels are accurate estimates for RO feed water.

6.3 Projected Strontium Removals for PWM

Water quality sampling campaigns performed during pilot testing for PWM included measurable naturally occurring strontium in both the RO feed and permeate. The RO membranes in place during the 2014 pilot testing were CSM-RE4040-FE 4-inch elements. The measured strontium concentrations for the combined RO feed and combined RO permeate, including calculated removals through RO, are shown in Table 6-8. A one-time strontium sampling event was conducted at the Demonstration Facility in December of 2017 to support this analysis. The Demonstration Facility has Hydranautics ESPA2-LD-4040 membrane elements installed – the same as the full-scale facility, except with a smaller diameter. The combined RO feed and combined RO permeate strontium concentrations and corresponding LRVs from the Dec 2017 data from the demo facility are summarized in Table 6-9.

Table 6-8 Strontium concentrations in RO feed and permeate during 2014 pilot testing. System fitted with CSM-RE4040-FE elements (new in October 2013)

Date	Strontium (µg/L)		Log Removal Value
	RO Feed	RO Permeate	
12/10/2013	318	1.3[1]	2.4
12/17/2013	386	1.3[1]	2.5
01/14/2014	390	1.1[1]	2.5
01/28/2014	336	0.9[1]	2.6
02/11/2014	356	1.2[1]	2.5
02/25/2014	426	1.2[1]	2.6
03/11/2014	393	1.0[1]	2.6
04/01/2014	351	1.7[1]	2.3
04/08/2014	369	2.6[1]	2.2
04/22/2014	351	2.5[1]	2.1
05/13/2014	346	2.4[1]	2.2
05/27/2014	333	2.7[1]	2.1
06/24/2014	367	2.2[1]	2.2
Mean	**363**	**1.7**	**2.4**

1 – Raw result shown is above the laboratory's former Method Detection Limit of 0.13 µg/L and below the former Practical Quantification of 5 µg/L. Analyses performed by Monterey Bay Analytical Services, Inc.

Table 6-9 Strontium concentrations in RO feed and RO permeate during 2017 demonstration facility testing. System fitted with Hydranautics ESPA2-LD-4040 elements (1.2-year-old)

Date	Strontium (µg/L)		Log Removal Value
	RO Feed	RO Permeate	
12/11/2017	410	0.2[1]	3.3
12/12/2017	408	0.2[1]	3.3
12/13/2017	455	0.2[1]	3.4
Mean	424	0.2[1]	3.3

1 – Raw result shown is above the laboratory's current Method Detection Limit of 0.1 µg/L and below the current Practical Quantification of 1 µg/L. Analyses performed by Monterey Bay Analytical Services, Inc.

Strontium removals from the 2014 testing with the CSM-RE4040-FE elements achieved a mean removal of 2.4-log (2.1-log minimum and 2.6-log maximum). In the 2017 testing with the ESPA2 LD elements, the strontium rejection increased, with a mean value of 3.3-log (3.3-log minimum and 3.4-log maximum). As an aside, note that the strontium concentrations in the RO feed increased by 16% from 2014 to 2017 (this is not expected to a significantly impact rejection; however, higher feed concentrations help ensure detectable permeate concentrations). The ESPA2 LD removals from the M1W demo also align closely with the removals demonstrated in the San Diego study. Because the full-scale M1W AWPF will utilize Hydranautics ESPA2 LD elements, strontium rejection performance observed in the 2017 M1W demonstration facility sampling and in the San Diego study is the performance expected for the full-scale M1W AWPF.

Another important factor to consider when estimating RO rejection is the of element age. The City of San Diego expects to achieve a minimum of 2.5 LRV with strontium, and the same lower bound is assumed here. If strontium were to be pursued, strontium monitoring of the Demonstration Facility would be recommended to identify trends in strontium rejection over time.

Because the 2017 demo facility sampling does not reflect the new source waters that will come into the RTP, the projected best-case, worst-case, and typical-case strontium concentrations can be used in tandem with the 2017 observed demonstration facility rejection data to more accurately characterize expected strontium removals. For low feed water concentrations (i.e., worst-case) credited removals can be limited by the method reporting limit (MRL) for strontium in the RO permeate. Eurofins Eaton Analytical has an MRL for strontium (USEPA Method 200.8) of 0.3 µg/L. The projected creditable strontium removals for PWM, accounting for all source waters, are summarized in Table 6-10. If M1W were to pursue RO strontium rejection monitoring, the range of expected log reduction credit for pathogens are expected to range from 2.5-log (old membranes) to approximately 3.3 (based on data from 1-year old membranes). These LRV estimates could be improved via strontium sampling at the Demonstration Facility if strontium crediting were to be pursued.

Table 6-10 Projected strontium removal credits at PWM with projected source water blends

Condition	Projected RO Feed Strontium (μg/L)	Maximum detectable log removal with 0.3 μg/L MRL	Expected log removals	Expected log removal credits
Best-case	1096	3.6	2.5 – 3.3	2.5 – 3.3
Worst-case	290	3.0	2.5 – 3.3	2.5 – 3.0
Typical-case	551	3.3	2.5 – 3.3	2.5 – 3.3

The AWPF is already credited with 1 log removal through RO based on conductivity monitoring. Conductivity removals of 1.5 logs are expected in operation, and the Demonstration Facility currently achieves removals of approximately 1.6 logs. DDW would be expected to credit the AWPF with approximately 2.5 log removal in a revised Engineering Report. Thus, strontium monitoring is expected to yield an additional 1.5 log of creditable removal for planning purposes, which falls short of the estimated 2.6 log removal credits that are estimated for the 6.5 and 7.0 mgd expansion. However, strontium monitoring can provide added reliability and redundancy when paired with any of the other crediting options described in this TM, to help minimize downtime and reduced production time treatment or treatment monitoring failures.

6.4 Cost Estimate for RO Strontium Rejection Monitoring

DDW has tentatively accepted the use of strontium rejection as a surrogate for pathogen credit for the City of San Diego Pure Water Project. If M1W were to also implement strontium monitoring, the following would have to be implemented for the full-scale AWPF:

- Strontium rejection measurement and calculation no less than once every 24 hours
- Collection of 5 daily samples (combined RO feed and RO permeate for each train)
- Sample analysis using inductively coupled plasma mass spectrometry (ICP-MS) analysis by EPA Method 200.8

To meet these monitoring requirements, an estimated cost of $35 per sample[4] and 5 samples per day, a year of external laboratory analysis would cost approximately $64,000, not including inflation. A possible alternative would be for M1W to purchase an ICP-MS instrument and run the samples in-house.

4 Estimate received from Monterey Bay Analytical Services, Inc. on February 12, 2018, who has an MRL of 0.3 µg/L, as of Mach 13, 2018

7 - SUMMARY AND CONCLUSIONS

Expansion of the AWPF from 5 mgd to 6.5 mgd or 7.0 mgd will require additional virus removal crediting due to the reduced detention time in the aquifer (and associated credits). The estimated virus log removal deficit to meet the minimum virus log removal requirements in the Groundwater Reuse Regulations is 1.7 logs for 7.0 mgd.

The following treatment alternatives were considered to obtain the required additional credit:

- Chloramine disinfection credit in the conveyance pipeline
- Preozonation disinfection credit
- Wastewater treatment credit
- Enhanced reverse osmosis removal credit

These treatment alternatives do not require additional treatment; rather, the approach is to make use of existing facilities through further characterization of the existing treatment facilities and validation of these facilities as pathogen treatment barriers; thus, the alternatives can be implemented with minimal costs. A summary of the crediting options, expected credit, and implementation requirements is provided in Table 7-1.

All options have the potential to independently meet the target virus log removal requirements. Each option carries pros and cons, including more or less certainty related to DDW approval and more or less operational flexibility, as well as additional pathogen removal credits for *Giardia* cysts and *Cryptosporidium* oocysts.

The recommended approach is to pursue multiple crediting options. Multiple crediting options provides redundancy of treatment crediting, which enhances reliability of operation. Redundant credits allow for treatment failures to occur, or failure of treatment monitoring to occur, without impacting production.

In order to support further development of the crediting alternatives, the following next, initial steps are recommended:

- Conceptual design of chloramine disinfection crediting in conveyance pipeline
- Proof-of-concept bench-scale evaluation of ozone virus inactivation in the unfiltered secondary effluent, and/or select sampling of native phage removal through ozonation at the Demonstration Facility
- Proof-of-concept sampling of enteric virus in the influent and effluent of the Regional Treatment Plant
- Routine sampling of strontium removal through the Demonstration Facility RO membranes

These next steps will provide further information and certainty regarding cost effective pathogen crediting options for the expanded AWPF.

Table 7-1 Summary of treatment alternatives considered for additional virus treatment credit

Treatment Alternative	Estimated Attainable Virus Credit: Attainable Credit	Estimated Attainable Virus Credit: Conditions	Precedence Set with DDW	Study Required	Feasibility Level Estimate of Cost ($/yr)
Final Disinfection with Chloramines	1.9 to 3.9logs, 15°C 3.9 to 4.0 logs, 25°C	6.5 mgd with chloramine residual of 2 to 4 mg/L	Yes, drinking water CT tables in Surface Water Treatment Rule Guidance Manual (USEPA, 1991)	No	$60k ($Cl_2$ monitors at Well Site #4) $10k/yr (Ops)
	1.8 to 3.6 logs, 15°C 3.6 to 4.0 logs, 25°C	7.0 mgd with chloramine residual of 2 to 4 mg/L			
Ozone Disinfection Based on O3:TOC Ratio	1.7-log to 6.5-log	O3:TOC ratio 0.25 to 0.5	No. Wedeco has submitted validation report for O3:TOC ratio, but approach does not yet have approval	Yes. Pilot study required as well as a full-scale bioassay	$100k ($NO_2$ monitors) $10k/yr (Ops) $150-300k study $50k bioassay
Strontium Rejection through RO Membranes	Additional 1.5-log to 2.3-log over current RO credit (based on conductivity)	Old to new ESPA-2 membrane elements	Yes. Accepted by DDW for the City of San Diego Pure Water Project in Engineering Report	No. But monitoring at demo recommended	$64k/yr (lab costs)
Pathogen Removal Through RTP	0.7-log to 2.0-log	Range observed at other facilities	Yes. Accepted by DDW for the City of San Diego Pure Water Project in Engineering Report	Yes	$150-200k study

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Attachment F

Technical Memorandum - Geo-Logic Associates, Inc.– Comparison Study between HDPE Liner versus Bentonite Admix Soils and Conceptual Design Update Memo, April 2018.

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Geo-Logic
ASSOCIATES

DRAFT

TECHNICAL MEMORANDUM

TO: Alison Imamura, AICP – Project Manager, Monterey One Water (M1W)

FROM: Monte Christie – Project Manager, Geo-Logic Associates (GLA)

DATE: April 30, 2018

RE: Comparison Study between HDPE Liner versus Bentonite Admix Soils and Conceptual Design Update Memo

1 INTRODUCTION

This technical memorandum presents the results of a cursory study to assess alternative lining options associated with the storage ponds associated with the Salinas Industrial Wastewater Treatment Facility (SIWTF) pond lining project for Monterey One Water (M1W). The current ponds are unlined and receive and store industrial wastewaters from the City of Salinas and surrounding areas. The pond sizes are as follows: Pond 1 is approximately 39 acres, Pond 2 is approximately 27 acres, and Pond 3 is approximately 36 acres. M1W is currently considering lining the pond(s) to reduce infiltration in order to store more water for reuse purposes. The current plan is to consider lining either Ponds 2 or 3 or both, but not Pond 1. The ponds are regulated by the Regional Water Quality Control Board (RWQCB), and the current permit allows for 4 million gal/day disposal via percolation and evaporation from the ponds. Hence, it is critical to note that the proposed lining of the ponds is not for regulatory compliance, but rather for water reuse and optimization. Therefore, these liners are not environmental liners. Furthermore, because the ponds are used for temporary storage and not for regulatory compliance, they are not required to be double lined.

Currently, is it not clear whether these ponds are regulated by the California Division of Safety of Dams (DSOD). The DSOD requires water storage reservoirs/ponds that have embankment heights greater than 6 feet that have storage capacity if 50 acre-feet or more to be designed to more rigorous standards to reduce risks of the embankment collapsing and flooding downstream. It appears that these ponds would fall under DSOD regulations from both embankment heights exceeding 6 feet and the storage capacity exceeding the 50 acre-feet value. However, this memo comparing liner options does not address the DSOD requirements in any further detail, but rather just the comparison of two liner types.

The two alternatives to be considered consist of:

1 – Place a 60-mil thick high density polyethylene (HDPE) liner over prepared site soils, or

2 – Admix bentonite clay with on-site native soils.

Both alternatives have advantages and disadvantages, which are discussed in this memo for M1W's cost analyses for funding considerations. No field investigation has been completed at this time. Our Project Manager, Monte Christie, visited the site in September of 2017. For cost comparison purposes, we have only focused on the lining of Pond 3. Therefore, the costs discussed below are for Pond 3 only.

2 HDPE LINER ALTERNATIVE

2.1 Liner Material – Why HDPE Over Other Materials

For geomembrane liner alternative, the new liner material has several options from which to choose, the most likely choice being high density polyethylene (HDPE), as it is currently the most common pond liner in the industry. To support selection of HDPE, attributes of other liner materials appropriate for the ponds application are discussed.

The other alternative synthetic liner materials include linear low density polyethylene (LLDPE), reinforced polypropylene (RPP), asphalt-infused geosynthetics, and polyvinyl chloride (PVC). PVC is not nearly as UV resistant as HDPE and is therefore readily dismissed. Similarly, LLDPE is not as UV resistant as HDPE. Furthermore, an exposed pond is not the right application for the benefits of LLDPE over HDPE. LLDPE has better elongation properties making it more resistant to differential settlements, which is not a design consideration for a liquids storage pond.

As for asphaltic-infused geomembranes, there may be some worthy considerations for their use, but they are more costly. Therefore, they are not considered as part of this comparison study.

The remaining choice is RPP, which has sufficient UV resistance, has lower expansion and contraction with temperature fluctuations, is more flexible, and has fewer field seams than HDPE. However, further comparison shows that RPP has factory seams, which means that ultimately RPP liner will have more seams than an HDPE liner. Our experience has shown that failures occur more frequently on seams (both factory and field seams) than the liner panel itself, as the seams are slightly stiffer than the panel. Stress from expansion and contraction during thermal changes concentrates at the seams, causing them to crack. Therefore, fewer seams are better. The manufacturing process of RPP requires the factory to seam material together in the factory. The factory can control the quality of these seams, but the fact is they are still seams. Furthermore, it is more difficult to control the quality of RPP field seams than HDPE field seams. RPP uses a chemical glue to seam the material, whereas HDPE uses a controllable machine to fusion weld the majority of the seams. Testing of the machine controlled seams is easier and better than the testing process for chemically glued seams.

As for costs, RPP material costs are higher than HDPE, though installation is slightly less expensive. To compare prices, one must compare material and installed costs. For 60-mil HDPE the material and installed costs are approximately $0.70/sf whereas 45-mil RPP costs approximately $1.00/sf, an approximate 43% increase over HDPE. The installation differences along with the higher material costs of RPP still show that HDPE is the correct material to use for exposed pond applications. In fact, both RPP and HDPE have similar warranties of 20 years. HDPE Lining materials are a cost-effective choice for exposed lining projects. This product has been used in landfills, wastewater treatment lagoons, animal waste lagoons, and mining applications.

2.2 HDPE Considerations

Another issue to consider is thickness of the HDPE geomembrane. Either 60-mil or 80-mil is generally accepted thicknesses for HDPE-lined liquid containment facilities. HDPE geomembranes can last 20 years or more, depending upon wear and tear during maintenance and operations. 80-mil HDPE by its shear increased thickness over 60-mil would resist punctures during operations, last longer when subjected to UV degradation, and overall outperform 60-mil. However, an 80-mil liner would cost approximately 25% more than a 60-mil liner ($0.70/sf versus $.88/sf). Unfortunately, quantifiable data is not available providing a long-term comparison of longevity and durability of the two thicknesses.

Creases from the manufacturing process of HDPE have been a source for failures. Creases are left in the liner from the blown film manufacturing process of HDPE. Whereas the flat die manufacturing process does not leave creases in the liner. The flat die produces a liner with slightly inferior elongation properties. Elongation mitigates punctures and other tears, but is not absolutely essential for a pond application. M1W should consider the reduction in material properties before absolutely requiring flat die produced sheet. In addition, fewer manufacturers provide flat die produced sheet, so limiting competition may increase material prices.

Another consideration is textured liner on the side-slopes to help prevent slipping on liner, but texturing does slightly increase the cost. Smooth liner would be placed on the floor to reduce costs and simplify cleaning. Because the increase in textured costs is minimal, it would be our recommendation to at least have the liner textured on the underside surface to help mitigate wrinkles from shrinking/swelling, as well as the top surface on the side-slopes for access. Plus, the cost differential between 60-mil single-sided textured liner and double-sided textured liner is approximately $1.00/sf to $1.05/sf, respectively, or approximately 5% increase. In addition to the textured liner on the side-slopes, emergency escape ladders (or other) should be installed to assist anyone who has fallen in the pond. Even textured liner on a 2H:1V slope is slippery when wet, the ladders would assist accessing the ponds.

One remaining consideration is the use of white liner. HDPE geomembrane can be manufactured with a thin layer of white resin over the black core of the sheet. Not many other colors are available for consideration, other than green, which would defeat the purpose of wrinkle mitigation due to the darker color. The white reflects the sun's rays rather than absorbing them, which allows the white liner to maintain a more constant temperature and not undergo large temperature variations. These temperature variations on black sheet cause the liner to expand and contract from one extreme to the other. Thereby causing wrinkles during the warm summer days and the trampoline affect during cold periods. White liner helps reduce these affects, but does not completely eliminate the temperature changes. The disadvantages to white sheet are the UV stabilization of white liner is less understood than black sheet, the obvious brighter surface may be less desirable in the Salinas Valley setting, it cannot be constructed with a flat die process, and it is slightly more expensive than black liner. As for the UV resistance, there is sufficient evidence to suggest that the white sheet is stable, but just not as many exposed ponds have white liner to make conclusive statements. And white sheet is 5% to 10% more expensive than black liner. It is our suggestion to stay with black sheet and cover with an overliner/ballast/UV-protection layer, but M1W could consider white liner.

2.3 Pond Access

If M1W wishes to maintain vehicular access to the pond they have two alternatives. M1W can either install a soil operations layer over the liner or a concrete access ramp. An operations layer offers pros and cons as well, as it would help protect the liner. However it is costly to install. There is also loss of pond volume, but that may not be a critical consideration. The operations layer over the entire pond would add an additional ~$970,000 of earthfill material costs. M1W should consider if the soils would interfere with the operations of the ponds. A reinforced concrete access ramp would provide access and would also maintain pond volume, but there would also be a significant cost. Ramp dimensions would be approximately 100 feet long by 10 feet wide with a thickness of 4 inches of reinforced concrete. An estimate of $50,000 for each ramp seems reasonable and is included in the cost estimates for each alternative. Therefore, M1W must decide if vehicular access is necessary or not.

3 BENTONITE ADMIX ALTERNATIVE

Adding bentonite to the on-site soils is the second option under consideration. Bentonite would have to be imported from either Oregon or Wyoming, which adds costly shipping costs. The Oregon bentonite is not as high of quality as the bentonite from Wyoming, so the Design Engineer would have to evaluate suitability of both sources. Furthermore, there are varying amounts of bentonite added to be considered under further detail, as well as whether the chemical environment is suitable for bentonite, but that is not part of this scope of work.

3.1 Chemical Compatibility

First and foremost, the environment must be suitable for bentonite to function properly. High saltwater environments and other hard water impurities can adversely affect the hydraulic conductivity properties of bentonite. The site soils and wastewater properties must be tested to assure they would not adversely affect the bentonite. The best bentonites are sodium bentonites, and it is this sodium that can be replaced by magnesium or calcium from the hard waters, causing the bentonite to deteriorate. A properly designed and buried bentonite layer may last only 8 to 15 years and provides a moderate seepage loss of 0.2 to 0.25 m^3/m^2/day; an HDPE liner is just a fraction of that seepage depending upon installation quality control and operations/maintenance.

3.2 Amount of Bentonite

The US EPA produced a guidance document, *Principles of Design and Operations of Wastewater Treatment Pond Systems for Plant Operators, Engineers, and Managers* (USEPA, August 2011), that summarizes the bentonite admix option in a concise description of issues. The first of which is the amount of bentonite and application methods.

The easiest method is adding the bentonite to the water and allowing it to settle into the subgrade, thereby producing a thin layer on the top of the soils that limits infiltration. This is easily discarded in the SIWTF pond scenario, as the ponds are not always full of water and when emptied,and the bentonite would desiccate and crack, rendering it ineffective.

The second method is to place the bentonite in a thin layer (approximately 1 lb/sf) on the surface of the site soils or on a geosynthetic clay liner (GCL), which are commonly used in the landfill liner industry as a replacement for compacted clay liners. Again, if the bentonite/GCL are left unprotected, the bentonite will swell and shrink/desiccate with moisture changes throughout the seasons and render the liner ineffective. These two scenarios could be circumvented by placing a layer of protective soil over the bentonite/GCL that is at least 6 inches thick, but preferably 12 inches.

The third and final method is to physically mix (admix) the bentonite with the upper 12 inches of on-site soils. The procedure can vary, but we anticipate that the bentonite would be placed on top of the soil, and then mixed into the 12 thickness via an asphalt reclaimer or similar equipment. There are specialty contractors who have "one-pass" equipment that rips, adds and mixes the bentonite, and places it all in one pass. This method produces a liner that can significantly lower infiltration if the soils are suited for such. Therefore, the site soils must be sampled and tested to verify suitability from a physical standpoint, as well as chemical compatibility. The amount of bentonite can vary from 3 to 6 lbs/sf, if found to be chemically stable and suitable environment for application of bentonite. The previous study by E2 Engineering assumed approximately 4.5 lbs/sf, therefore GLA has updated the cost estimate to show the potential variation in required bentonite amounts.

4 ALTERNATIVES COMPARISON

In addition to the qualitative comparisons above, Table 1attached provides a more detailed cost comparison of the two alternatives. GLA started with the cost estimates previously provided by E2 Engineering and updated and fine-tuned some of the unit costs based upon our experiences. Please note that these costs are for comparison purposes only. A more detailed engineer's cost estimate will be completed during detailed design. The comparison shows that to construct HDPE for Pond 3 would cost slightly less than the bentonite admix. Within the range of accuracy for this comparison study, these two alternatives are similar in cost. Therefore, the cost difference between the two alternatives does not favor one alternative or the other.

GLA has prepared opinions of construction costs for the implementation of the two alternatives evaluated using the preliminary construction quantities and components. The estimate should be considered a Class 4 cost estimate that is appropriate for projects that are conceptual. The expected accuracy of this cost estimate will provide budgetary cost ranging from -30% to +50%. This information is based on the criteria set by the Association for the Advancement of Cost Engineering International (AACE).

Not included in this comparison study scope, but should be considered are the following:

Groundwater Monitoring – No comparison between alternatives is made with respect to groundwater monitoring.

Leak Testing – One option to assure a geomembrane liner has been stalled to the highest standards is to leak test and find potential holes in the geomembrane. This survey costs about $0.05/sf, therefore only adding about $80,000 to the costs as a sort of insurance against leaks. Should M1W like to hear more about leak testing, we could provide further information.

Soil-Cement Alternative - One other alternative that was not part of this scope of work is rather than costly bentonite, but to add cement, making a soil-cement mixture. Cement is more readily available in Monterey and has the added benefit of providing a wearing surface and not requiring an operations layer to maintain bentonite quality. We can provide further information and costing information regarding this alternative upon request.

5 CONCLUSIONS AND RECOMMENDATIONS

This alternatives evaluation presented the key factors to consider for pond(s) liner design and operations. The two alternatives compared HDPE geomembrane liner vs. bentonite admixed soils. The comparative evaluation considered key components of each alternative. A cost comparison shows the potential range of the bentonite admix being more expensive than the HDPE liner by a range of 5% to 20% more, due to the uncertainty of amount of bentonite to be required. However, this range of difference is within the level of accuracy for these cost comparisons. Furthermore, both alternatives have advantages and disadvantages over the other, therefore M1W must consider their operational uses and ease to which each alternative may effect operations, as well as maintenance of each alternative, to decide which option would be best.

See Appendix A for cost estimates and Appendix B for conceptual (~30%) design plan drawing of the preferred pond lining option. This cost estimate and design supercedes the designs presented in the E2 Technical Memorandum dated September 14, 2018 (see Appendix C) that presented costs and design information for multiple pond lining options, including one for lining only Pond 3 with HDPE.

6 LIMITATIONS

This report was prepared in accordance with generally accepted geotechnical and geosynthetic engineering practices applicable at the time the report was prepared. GLA makes no other warranties, either expressed or implied, as to the professional advice provided under the terms of this agreement, and as described in this report. Our recommendations consist of professional opinions and conclusions based on our testing and inspection program performed during construction.

APPENDIX A

Cost Comparison between Two Alternatives

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Table 1 - HDPE vs. Bentonite Admix Liners
Monterey One Water
SIWTF Cost Comparisons
<u>Pond 3</u>

Level of Accuracy -30% to +50%

Liner Alternative

Range of Bentonite

	HDPE Liner	3% Bentonite		6% Bentonite
Mob & Demob	$ 300,000	$ 300,000		$ 300,000
Construction Costs	$ 4,425,571	$ 4,673,124		$ 5,424,489
Ancillary Facilities	$ 476,800	$ 476,800		$ 476,800
Contractor OH - included above	$ -	$ -		$ -
Construction Costs	**$ 5,202,371**	**$ 5,449,924**		**$ 6,201,289**
Contingency @ 20%	$ 1,040,474	$ 1,089,985		$ 1,240,258
Including Contingency	**$ 6,242,845**	**$ 6,539,909**		**$ 7,441,547**
<u>Owners Costs:</u>				
Admin & PM @ 2%	$ 124,857	$ 130,798		$ 148,831
Engineering @ 6%	$ 374,571	$ 392,395		$ 446,493
ESCD & CM @ 5%	$ 312,142	$ 326,995		$ 372,077
TOTAL =	**$ 7,054,415**	**$ 7,390,097**	**to**	**$ 8,408,948**
		4.8%	to	19% more for bentonite

Notes:

1 - If the bentonite functions properly. Site soils must be sampled and tested to verify viability.
2 - These cost estimates assume the perimeter berms are stable and no retrofitting required by DSOD.

Summary:
Liner vs. bentonite are similar costs within this study's Level of Accuracy.
So, it comes down to pros and cons of each to compare.

Monterey One Water

SIWTF Cost Comparisons

HDPE vs. Bentonite Admix Liners

Note: The highlighted cells are significant variations from the previous cost estimate by E2 Engineering.

Pond 3 HDPE Liner

Construction Costs:

Item#	Description	Quantity	Units	Unit$	Total Cost
1	Mob & Demob ~5% of total construction costs	1	Lump Sum	$ 300,000	$ 300,000
	POND LINING ITEMS:				
2A	Clearing & Grubbing	1,750,000	SF	$ 0.15	$ 262,500
2B	Bottom and Embankment Excavation	59,472	CY	$ 4.15	$ 246,809
2C	Bottom and Embankment Backfill	65,274	CY	$ 15.00	$ 979,110
2D	Access Ramps	2	Each	$ 50,000	$ 100,000
3A	Liner Anchor Trench - excavate and backfill	706	CY	$ 30.00	$ 21,180
3B	Slope protection - riprap or other	2,000	LF	$ 200.00	$ 400,000
4	~~Backfill - Liner anchor trench~~				$ -
5	HDPE Liner - material and installation (and vents)	1,750,000	SF	$ 0.70	$ 1,225,000
5B	Wind uplift protection - 1 ft thick soil	64,815	CY	$ 15.00	$ 972,222
6	**Subdrain**				
6A	Geocomposite strips or perforated piping - ~1/8 of area	218,750	SF	$ 1.00	$ 218,750
	~~Pressure relief valves~~				
6B	~~Excavation & backfill~~				
6C	~~Concrete pad~~				
				Subtotal =	**$ 4,425,571**
	ANCILLARY FACILITIES:				
7	Perimeter Roadway - 8-inch Class II AB	64,000	SF	$ 1.77	$ 113,280
8	Perimeter Curb-Asphalt	6,352	LF	$ 10.00	$ 63,520
9	Transfer Piping Connections	1	Each	$ 50,000	$ 50,000
10	Miscellaneous items	1	Lump Sum	$ 250,000	$ 250,000
				Subtotal =	**$ 476,800**
				Total Construction Costs =	**$ 5,202,371**
	Contractor Overhead - included in costs above	0% of subtotal			$ -
				Subtotal =	**$ 5,202,371**
	Contingency	20% of subtotal			$ 1,040,474
				Subtotal =	**$ 6,242,845**

Owner's Costs:

Adminstration and Project Management	2%	of subtotal		$ 124,857
Engineering and Bidding Phase	6%	of subtotal		$ 374,571
ESCD and CM Services	5%	of subtotal		$ 312,142
			TOTAL =	**$ 7,054,415**

Assumptions:

1 - These cost estimates assume the perimeter berms are stable and no retrofitting required by DSOD.

Monterey One Water

SIWTF Cost Comparisons
HDPE vs. Bentonite Admix Liners

Note: The highlighted cells are significant variations from the previous cost estimate by E2 Engineering.

Pond 3 — 3% Bentonite

Construction Costs:

Item#	Description	Quantity	Units	Unit$	Total Cost
1	Mob & Demob ~5% of total construction costs	1	Lump Sum	$ 300,000	$ 300,000
	POND LINING ITEMS:				
2A	Clearing & Grubbing	1,750,000	SF	$ 0.15	$ 262,500
2B	Bottom and Embankment Excavation	59,472	CY	$ 4.15	$ 246,809
2C	Bottom and Embankment Backfill	65,274	CY	$ 15.00	$ 979,110
2D	Access Ramps	2	Each	$ 50,000	$ 100,000
3	Liner Anchor Trench - excavate and backfill (and vents)			$ -	$ -
5	Bentonite Clay Lining and Installation	1,750,000	SF		
5A	Bentonite - sandy loam soil (~3 lbs/SF)	2,888	Tons	$ 350.00	$ 1,010,625
5B	Installation - mixing and support	64,815	CY	$ 13.00	$ 842,595
5C	Installation - compacting	64,815	CY	$ 4.00	$ 259,260
5D	Protective Soil Cover - 1 ft thick (reduce dessication)	64,815	CY	$ 15.00	$ 972,225
6	~~Pressure Relief Valves~~				
6A	~~Pressure relief valves~~				
6B	~~Excavation & backfill~~				
6C	~~Concrete pad~~				
				Subtotal =	$ 4,673,124
	ANCILLARY FACILITIES:				
7	Perimeter Roadway - 8-inch Class II AB	64,000	SF	$ 1.77	$ 113,280
8	Perimeter Curb-Asphalt	6,352	LF	$ 10.00	$ 63,520
9	Transfer Piping Connections	1	Each	$ 50,000	$ 50,000
10	Miscellaneous items	1	Lump Sum	$ 250,000	$ 250,000
				Subtotal =	$ 476,800
				Total Construction Costs =	$ 5,449,924
	Contractor Overhead - included in costs above	0%	of subtotal		$ -
				Subtotal =	$ 5,449,924
	Contingency	20%	of subtotal		$ 1,089,985
				Subtotal =	$ 6,539,909

Owner's Costs:

Adminstration and Project Management	2%	of subtotal		$ 130,798
Engineering and Bidding Phase	6%	of subtotal		$ 392,395
ESCD and CM Services	5%	of subtotal		$ 326,995
			TOTAL =	$ 7,390,097

Assumptions: 1 -
Dry weight of soil = 110 pcf
Bentonite = 3%
Amount of bentonite = 3.3 psf

1 - These cost estimates assume the perimeter berms are stable and no retrofitting required by DSOD.

6% Bentonite

Construction Costs:

Item#	Description	Quantity	Units	Unit$	Total Cost
1	Mob & Demob ~5% of total construction costs	1	Lump Sum	$ 300,000	$ 300,000
	POND LINING ITEMS:				
2A	Clearing & Grubbing	1,750,000	SF	$ 0.15	$ 262,500
2B	Bottom and Embankment Excavation	59,472	CY	$ 4.15	$ 246,809
2C	Bottom and Embankment Backfill	65,274	CY	$ 15.00	$ 979,110
2D	Access Ramps	2	Each	$ 50,000	$ 100,000
3	Liner Anchor Trench - excavate and backfill (and vents)			$ -	$ -
5	Bentonite Clay Lining and Installation	1,750,000	SF		
5A	Bentonite - sandy loam soil (~6 lbs/SF)	5,775	Tons	$ 350.00	$2,021,250
5B	Installation - mixing and support	64,815	CY	$ 13.00	$ 842,595
5C	Installation - compacting	64,815	CY	$ 4.00	
5D	Protective Soil Cover - 1 ft thick (reduce dessication)	64,815	CY	$ 15.00	$ 972,225
6	~~Pressure Relief Valves~~				
6A	~~Pressure relief valves~~				
6B	~~Excavation & backfill~~				
6C	~~Concrete pad~~				
				Subtotal =	$5,424,489
	ANCILLARY FACILITIES:				
7	Perimeter Roadway - 8-inch Class II AB	64,000	SF	$ 1.77	$ 113,280
8	Perimeter Curb-Asphalt	6,352	LF	$ 10.00	$ 63,520
9	Transfer Piping Connections	1	Each	$ 50,000	$ 50,000
10	Miscellaneous items	1	Lump Sum	$ 250,000	$ 250,000
				Subtotal =	$ 476,800
				Total Construction Costs =	$6,201,289
	Contractor Overhead - included in costs above	0%	of subtotal		$ -
				Subtotal =	$6,201,289
	Contingency	20%	of subtotal		$1,240,258
				Subtotal =	$7,441,547

Owner's Costs:

Adminstration and Project Management	2%	of subtotal		$ 148,831
Engineering and Bidding Phase	6%	of subtotal		$ 446,493
ESCD and CM Services	5%	of subtotal		$ 372,077
			TOTAL =	$8,408,948

1 -
Dry weight of soil = 110 pcf
Bentonite = 6%
Amount of bentonite = 6.6 psf

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APPENDIX B

Conceptual Design Plans for Lining Pond #3 at the Salinas Industrial Wastewater Treatment Facility

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TECHNICAL MEMORANDUM

GROUNDWATER REPLENISHMENT (GWR) PROJECT

SALINAS INDUSTRIAL WASTEWATER TREATMENT FACILITY (SIWTF)

SOURCE WATER EXPANSION PROJECT

CONCEPTUAL DESIGN – LINING OF EXISTING PONDS

Prepared for

MONTEREY REGIONAL WATER POLLUTION CONTROL AGENCY

14 September 2017

Prepared by

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TECHNICAL MEMORANDUM
SALINAS INDUSTRIAL WASTEWATER TREATMENT FACILITY (SIWTF)
SOURCE WATER EXPANSION PROJECT
CONCEPTUAL DESIGN – LINING OF EXISTING PONDS

BACKGROUND

The Monterey Regional Water Pollution Control Agency (MRWPCA/Agency) is the wastewater treatment agency for Northern Monterey County, California. In this capacity, the MRWPCA operates a 29.6 MGD secondary treatment facility (Regional Treatment Plant/RTP) at a site north of Marina and adjacent to the regional landfill site. The RTP provides treatment of wastewater flows generated from homes and businesses in the Monterey Peninsula, Salinas and North Monterey County area. At the same site as the RTP the Agency also operates a tertiary treatment facility (the Salinas Valley Reclamation Project/SVRP) that provides recycled water for food crop irrigation on more than 12,000 acres of agricultural land in north Monterey County.

Most recently the MRWPCA has embarked on another groundbreaking water treatment project with the Monterey Peninsula Water Management District (MPWMD), the design and construction of the Pure Monterey Groundwater Replenishment Project (GWR). The objective of the GWR project is to provide advanced treatment to secondary effluent from the RTP for producing a clean, safe and sustainable source of water for injection into the Seaside Groundwater Basin. The injected water will mix with groundwater present in the aquifers and later be extracted for use by California American Water Company (CAW) for delivery to its customers in the Monterey District service area. This water supplied by the MRWPCA and stored in the Seaside Basin will enable CAW to reduce its historical diversions from the Carmel River basin as it is mandated to do by a cease and desist order issued by the State Water Resources Control Board.

The success of the GWR Project requires the Agency to develop additional source waters to ensure and maximize sustainability of the water volume that can be sent to the Seaside Basin on a year-round basis. The MRWPCA is currently contracted with the farmers in North Monterey County to provide them nearly 100 percent of the tertiary treated secondary effluent from the RTP during the irrigation season, April through October. The volume and continuity of the alternative source waters is therefore critical. The alternative source waters investigated by the MRWPCA for development include but not limited to diversion of:

1. Industrial Wastewater (principally produce wash water) to the MRWPCA Salinas Pump Station (SAPS) at the City of Salinas TP1 site,
2. Flow in the Blanco Drain to the RTP through a pumping and pipeline system,
3. Flow from the Monterey County Water Resources Agency (MCWRA) Reclamation Ditch to the RTP via the City of Salinas Davis Road trunk sewer flowing to the SAPS, and
4. A blend of industrial wastewater and storm water stored at the Salinas Industrial Treatment Facility (SIWTF) pond system returned to the SAPS. This last alternative source water is the subject of this specific RFP.

The alternative source waters listed above not only ensure continued supply to the GWR Project during the summer months when the historical secondary effluent flows are diverted to tertiary treatment and agricultural irrigation, but the alternative source waters are also forecast to produce flows more than that required for the GWR Project and this excess can be diverted to tertiary treatment to expand the agricultural irrigation acreage.

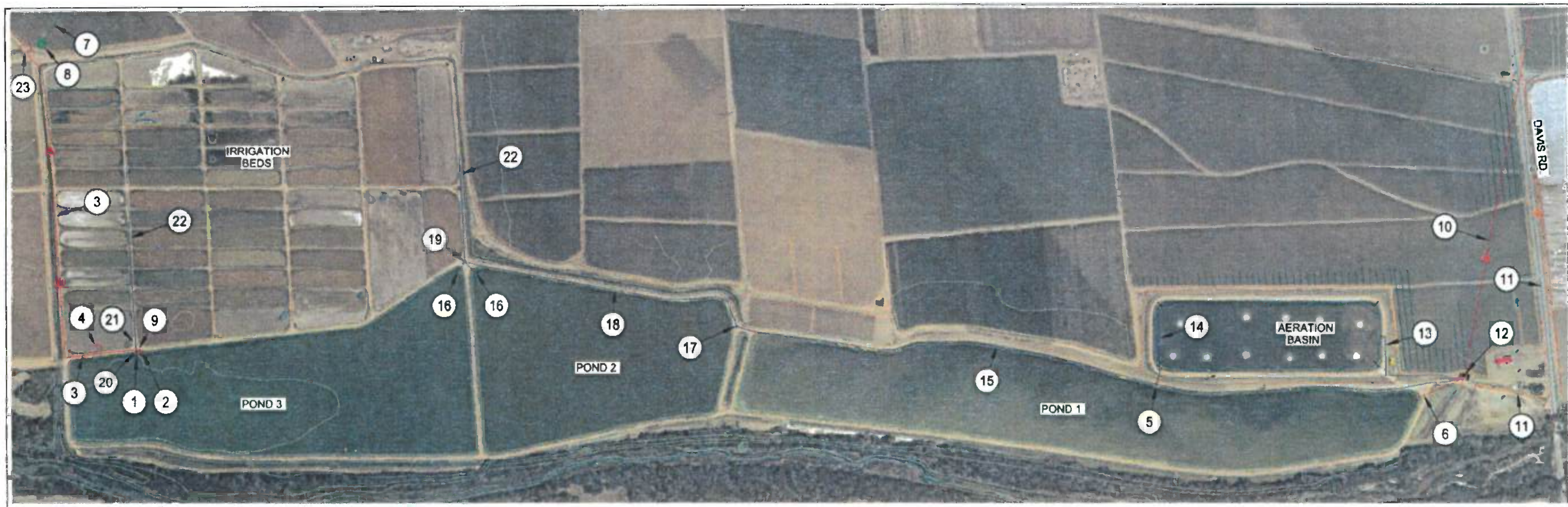
The City of Salinas (Salinas) operates an industrial wastewater collection, conveyance and treatment system that serves approximately 25 agricultural processing and other related businesses located east of Sanborn Road and south of U.S. Highway 101. The industrial wastewater collection system is separate from the domestic wastewater collection system in Salinas. Over 80 percent of the collected industrial wastewater flows are from fresh vegetable packing facilities (typically wash water used on harvested row crops), with the remaining 20 percent originating from businesses associated with seafood processing, refrigerated warehousing, and manufacture of ice, preserves (frozen fruits, jams and jellies) and corrugated paper boxes.

The industrial collection sewer flows toward the Salinas TP1 site (once the site of the Salinas Treatment Plant and now site of the SAPS), at which point the flow passes through an IW Diversion Structure and into a recently constructed (2015) 42-inch diameter trunk sewer that continues to the Salinas Industrial Wastewater Treatment Facility (SIWTF) located on the north side of the Salinas River and west of Davis Road.

In 2016 MRWPCA completed construction of piping and structures that enabled the industrial wastewater flows to be routed from the IW Diversion structure into the SAPS in a controlled and intentional manner. The IW flows diverted to the SAPS are conveyed to the RTP for eventual tertiary treatment and used for agricultural irrigation.

The 42-inch pipeline conveying the industrial wastewater (IW) flows discharges into an existing influent pump station (Figure 1), which then lifts the flows into an Aeration Pond for treatment. Treated effluent from the Aeration Pond is then distributed to a series of 3 ponds, identified as Ponds 1, 2 and 3, where the flow either evaporates or percolates into the groundwater. The more common distribution of the treated effluent is to Pond 1. With a slight gradient in the existing topography, rising flow in Pond 1 will eventually pass into Pond 2 and then into Pond 3. If the water level fills all 3 ponds, Pond 3 will overflow into a drainage ditch at the far west end that drains to the Salinas River. Salinas also has a pump station in Pond 3 that will lift the stored volume into Rapid Infiltration Beds (RIBs) that are to the northwest of Pond 3. Existing distribution piping system that is aligned along an access road on the north side of the ponds, can send effluent from the aeration pond to any of the three ponds.

Since in the past summer (2016) period almost 100 percent of the IW flows were directly diverted to the SAPS, at the end of summer the ponds were practically dry with very little wastewater stored in the ponds. Per the City of Salinas 2016 Annual Report for the SIWTF, the IW flows conveyed to the SIWTF from January through March and November and December 2016 totaled approximately 410 million gallons, or approximately 1260 acre feet of IW. It is anticipated that this condition will exist every year going forward. The consequence of this operational condition is that there should be adequate capacity in the pond storage system. The storage volume available (Aeration Basin, Pond 1, Pond 2, and Pond 3) at the SIWTF ranges from 944 to 1064 acre feet. This does not include the existing RIBs. Even accounting for percolation and evaporation, it appears that development of additional storage capacity may be advisable to store storm water



KEY NOTES:

1. NEW POND 3 PUMP STATION INLET BOX
2. NEW POND 3 PUMP STATION WET WELL AND VALVE VAULT
3. NEW 24" FORCE MAIN TO EXIST. 36" SALINAS FORCE MAIN
4. NEW ELECTRICAL BUILDING
5. EXISTING PRESSURE M.H. ON 30" LINE
6. NEW 33" IWW PIPELINE EXTENSION TO POND NO. 1
7. EXISTING 36" SALINAS FORCE MAIN
8. EXIST. PRESSURE M.H. ON 36" SALINAS FORCE MAIN
9. NEW FLOW METER VAULT
10. EXIST. 33" IWW PIPELINE TO IWTP
11. EXIST. 42" IWW PIPELINE
12. EXIST. IWW PUMP STATION
13. EXIST. 24" IWW INLET PIPELINE
14. EXIST. 18" IWW OUTLET PIPELINE
15. EXIST. 30" IWW DISTRIBUTION PIPELINE
16. EXIST. INLET TO POND
17. EXIST. RISER MANHOLE
18. EXIST. 24" IWW DISTRIBUTION PIPELINE
19. EXIST. POND INLET STRUCTURE
20. EXIST. POND 3 PUMP STATION
21. EXIST. IRRIGATION BEDS DISTRIBUTION STRUCTURE
22. EXIST. DISTRIBUTION PIPELINES TO IRRIGATION BEDS
23. NEW VALVE VAULT

LEGEND

- EXISTING MANHOLES
- EXISTING STORM DRAIN
- EXISTING SANITARY SEWER
- EXISTING IWW PIPELINE
- NEW PIPING
- NEW STRUCTURE

0 300' 600'
SCALE: 1"=600'

MRWPCA

E2 Consulting Engineers, Inc.

Job No. WH-MRW-Z65
Designed by
Drawn by
Checked by
Approved

SALINAS STORMWATER STORAGE AND CONVEYANCE PROJECT - PHASE 1B

CONCEPTUAL SITE PLAN AT IWTP

FIG. 13

C:\CAD\dwg\MRWPCA\figures\Source Water\6-17\Figure-1-3.dwg, 6/30/2017 4:13:24 PM flows diverted to the SIWTF for later return to the SAPS. This analysis would favor consideration of a 4th storage pond at the location of the existing RIBs north of Pond 3. Lining of one or more of the existing ponds would reduce percolation losses and thereby make more water available for recovery, but will also support the need for additional storage capacity at the SIWTF.

The existence of this potential available reserve capacity in the SIWTF pond system has lead the Agency to undertake the design of a storm water diversion project at the Salinas TP1 site. Storm water flows from the southern side of Salinas are captured in a gravity collection system, separate from the wastewater collection and IW collection piping systems, that drains to a Storm Water Pump Station located at the TP1 Site. These flows then either pass or are pumped, depending on hydraulic conditions, into a 66-inch outfall line that discharges into the Salinas River east of Davis Road.

Industrial Wastewater and Stormwater Storage and Recovery Project (Phase 1B) is currently under design phase. This project will be able to direct storm water flows (some portion, not 100 percent of all flow) either directly to the SAPS or to the 42-inch IW pipeline that goes to the SIWTF. The IW flow in the 42-inch pipeline is less in the winter period, when most the storm water flow is available for diversion; the capacity of the 42-inch IW pipeline has been estimated as much as 15 MGD.

OBJECTIVES

Regarding Ponds 1, 2 and 3 and the construction of a Pond 4 should be analyzed in the context of ensuring adequate storage capacity for the IW flows normally conveyed to the SIWTF and the additional volume of urban storm water that can be or is wanted to be diverted to the SIWTF and storage ponds for later recovery.

Lining one or more of the storage ponds is a topic closely related to the evaluation of the potential storage capacity in the ponds for diverted IW and urban storm water flows. At present the naturally occurring percolation from the ponds serves to reduce overland discharge from the ponds. Lining one or more ponds will obviously increase the volume of flows conveyed to the SIWTF that can be recovered. Lining ponds and constructing more pond storage volume are therefore closely interconnected. Ground water level at the SIWTF site is high, well above the bottom of all three ponds. Use of flexible (HDPE or Hypalon Liner) with pressure relief valves would allow ground water to enter ponds and would help to reduce percolation of stored water.

The technical objectives for this conceptual study are:

1. Estimate the storage volumes of the existing ponds (Aeration Pond, Ponds 1,2 and 3);
2. Review the water balance model developed by MRWPCA to assure adequate storage at SIWTF is available;
3. Size the additional storage pond (Pond 4); and
4. Estimate construction costs for each pond.

STORAGE REQUIREMENTS AND STORAGE CAPACITIES

MRWPCA has estimated total source water requirements for the Advance Water Treatment Facility (AWTF) to be constructed at Regional Treatment Plant (RTP). Maximum total flow to the RTP from the SIWTF to meet AWTF demand was estimated at 1406 AF. To meet this demand, it was concluded that all three ponds (Ponds 1, 2 and 3) must be lined to reduce percolation into the ground and additional storage of approximately 170 AF would be required. To meet this additional storage requirement, existing Rapid Infiltration Beds (RIBs) will be converted in to a lined storage pond (Pond 4) having storage capacity of approximately 127AF with 2-feet of free board and 170 AF with 1-foot of free board. Storage capacity calculations are provided in **Appendix B** – Table 2.5. Water balance model, developed by MRWPCA is included in **Appendix B** – Table 2.1 and Table 2.2.

In developing flow recovery demand from SIWTF storage ponds, following information is used:

1. Agricultural Wash Water to SIWTF Pond – AF (Values are estimated by MRWPCA)
2. Urban (Stormwater) Runoff to SIWTF Ponds – AF (Values are Estimated by MRWPCA)
3. Rain Fall over SIWTF Ponds – AF (Values are Estimated by MRWPCA)
4. Evaporation from SIWTF Ponds – AF (Values are Estimated by MRWPCA)
5. Percolation – AF. This values are assumed to be zero, since all ponds will be lined with HDPE liners.
6. It is assumed that at the beginning of October, total storage volume will be close to zero.
7. Maximum recovery of flow from SIWTF Ponds to RTP is estimated for each case.
   a. Ponds 1,2 and 3 are lined (Appendix A -Table 1.1)
   b. Ponds 1, 2, 3, and 4 are lined (Appendix A - Table 1.2)
8. Estimated flow to RIBs – AF
   a. Access water under 7a scenario, will be diverted to RIBs
   b. No access water will be available under scenario 7b

Estimated total storage capacity of each Pond at SIWTF are estimated at:

ESTIMATED STORAGE CAPACITY (AF)/MG

	2-feet Free Board	**1-ft. Free Board**
Aeration Pond	114 AF/37 MG	127 AF/41 MG
Pond 1	310 AF/101 MG	352 AF/115 MG
Pond 2	199 AF/ 65 MG	227 AF/74 MG
Pond 3	321 AF/105 MG	359 AF/117 MG
Total (Pond 1+2+3)	**944 AF/ 308 MG**	**1065 AF/347 MG**
Pond 4	**127 AF/41 MG**	**170 AF/55 MG**
Total (Pond 1+2+3+4)	**1071 AF/349 MG**	**1235 AF/402 MG**

Detailed calculations are provided in **Appendix B** -Tables 2.1 through 2.5

Lined storage ponds may come under Division of Safety of Dams (DSOD) jurisdiction and may require DSOD approval. This issue should be evaluated later.

ESTIMATED CONSTRUCTION COSTS

Conceptual Level Project costs for each pond to be lined with HDPE (60 mil) liner are estimated as follows:

ESTIMATED PROJECT COSTS			
	Construction Costs	Engineering Costs	Project Costs
Pond 1	$7, 670,000	$ 997,000	$ 8,667,000
Pond 2	$5,620,000	$ 728,000	$ 6,348,000
Pond 3	$ 7,325,000	$ 952,000	$ 8,277,000
Pond 4	$ 8, 479,000	$ 1,102,000	$ 9,581,000
Total Ponds 1 +2+ 3	$ 20,615,000	$ 2,677,000	$ 23,292,000
Total Ponds 1+2 + 3+4	$ 29,094,000	$ 3,779,000	$ 32,873,000

Engineering costs have been estimated based on percentage of construction costs. These costs may be revised based on actual final project components. Estimated percentages for each phase are as under:

- ✓ Administration and Project Management – 2% of Construction Costs
- ✓ Engineering and Bidding Phase – 6% of Construction Costs
- ✓ Engineering Services during Construction and Construction Management – 5% of Construction Costs.

General Contractor's Overhead and Profit is estimated at 18%

Project Contingency based on conceptual design is estimated at 25%.

Each of the presented cost estimates includes a twenty-five percent (25%) contingency and a Contractor's overhead and profit at eighteen percent (18%). The costs are based on the August 2017 Engineering News Record (ENR) construction cost index of 12037 for the San Francisco area.

E2 has no control over the cost of labor, materials or equipment, or the general inflation of prices, or over the contractor's methods of determining process and therefore cautions that the construction costs provided herein have been prepared on the basis of experience and judgment of engineering professional. Consequently, E2 does not and cannot guarantee that proposals for construction will not vary from opinions of probable cost prepared by E2.

Detailed cost estimates for each pond is provided in **Appendix C** – Table 3.1 through Table 3.4.

SITE PHOTOGRAPHS

Site photographs depicting existing conditions of existing ponds are included in **Appendix D**.

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APPENDIX A

WATER BALANCE TABLES

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SALINAS INDUSTRIAL WASTEWATER TREATMENT FACILITY

SOURCE WATER EXPANSION PROJECT

WATER BALANCE ANALYSIS - RECOVERY OF FLOW FROM SIWTF TO RTP

TABLE 1.1

Pond 1, 2 and 3 Lined - 1 Ft. Free Board (TOTAL STORAGE AVAILABLE = 1065 AF)

SOURCES	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total	
Agricultural Wash Water (AWW) to Ponds AF	156	158	201	0	0	0	0	0	0	410	329	223	1,477	
Urban runoff to ponds AF	52	41	34	0	0	0	0	0	0	8	23	47	205	
Rainfall - AF (121 acres of ponds)	26	24	21	11	3	1	0	0	2	6	14	24	132	
Evaporation - AF	12	16	29	41	46	52	45	43	32	14	15	12	358	
Percolation - AF	0	0	0	0	0	0	0	0	0	0	0	0	0	
Recovery of flow from SIWTF storage ponds to RTP	0	0	0	254	198	100	103	98	69	200	0	0	1,022	
Beginning Storage Capacity - AF	842	1,064	1,065	1,065	781	540	389	241	100	0	210	561	[illegible]	Storage at end of December
Pond In-Flow AF	234	223	256	11	3	1	0	0	2	424	366	294	1,814	
Pond Out- Flow AF	12	16	29	295	244	152	148	141	101	214	15	12	1,380	
SIWTF pond storage balance at end of month	1,064	1,272	1,292	781	540	389	241	100	0	210	561	842		
Flow to Rapid Infiltration Beds AF	0	-207	-227	0	0	0	0	0	0	0	0	0	-434	
SIWTF pond storage balance at end of month	1,064	1,065	1,065	781	540	389	241	100	0	210	561	842		

SALINAS INDUSTRIAL WASTEWATER TREATMENT FACILITY

SOURCE WATER EXPANSION PROJECT

WATER BALANCE ANALYSIS - RECOVERY OF FLOW FROM SIWTF TO RTP

TABLE 1.2

Pond 1, 2, 3 and 4 Lined - 1 Ft. Free Board (TOTAL STORAGE AVAILABLE = 1234 AF)

SOURCES	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total	
Agricultural Wash Water (AWW) to Ponds AF	156	158	201	0	0	0	0	0	0	410	329	223	1,477	
Urban runoff to ponds AF	52	41	34	0	0	0	0	0	0	8	23	47	205	
Rainfall - AF (121 acres of ponds)	32	29	26	14	4	1	0	0	2	7	17	29	162	
Evaporation - AF	15	19	36	50	56	64	55	53	40	17	19	15	438	
Percolation - AF	0	0	0	0	0	0	0	0	0	0	0	0	0	
Recovery of flow from SIWTF storage ponds to RTP	0	0	84	254	198	100	103	98	69	200	200	100	1,406	
Beginning Storage Capacity - AF	543	768	977	1,119	828	577	415	257	106	0	208	359	[illegible]	Storage at end of December
Pond In-Flow AF	240	228	261	14	4	1	0	0	2	425	369	299	1,844	
Pond Out- Flow AF	15	19	120	304	254	164	158	151	109	217	219	115	1,844	
SIWTF pond storage balance at end of month	768	977	1,119	828	577	415	257	106	0	208	359	543		
Flow to Rapid Infiltration Beds AF	0	0	0	0	0	0	0	0	0	0	0	0	0 0	
SIWTF pond storage balance at end of month	768	977	1,119	828	577	415	257	106	0	208	359	543		

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APPENDIX B

POND STORAGE VOLUME TABLES

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TABLE 2.1

Salinas Industrial Wastewater Treatment Plant - Aeration Pond								
Elev (FT)	Depth of Water (FT)	Estimated Surface Area (SF)	Estimated Surface Area (Acre)	Estimated Usable Volume (CF)	Estimated Cumulative Usable Volume (CF)	Estimated Cumulative Usable Volume (AF)	Estimated Cumulative Usable Volume (MG)	Remarks
37.00	0.00	457,005	10.0		0	0.0	0.00	Bottom of Aeration Basin
38.00	1.00	464,927	10.2	460,966	460,966	10.6	3.45	
39.00	1.00	472,888	10.4	468,908	929,874	21.3	6.96	
40.00	1.00	480,890	10.6	476,889	1,406,763	32.3	10.53	
41.00	1.00	488,933	10.7	484,912	1,891,675	43.4	14.16	
42.00	1.00	497,016	10.9	492,974	2,384,649	54.7	17.85	
43.00	1.00	505,141	11.1	501,078	2,885,728	66.2	21.60	
44.00	1.00	513,308	11.3	509,224	3,394,952	77.9	25.41	
45.00	1.00	521,520	11.4	517,414	3,912,365	89.8	29.28	
46.00	1.00	531,476	11.7	526,498	4,438,863	101.9	33.22	
47.00	1.00	543,671	11.9	537,573	4,976,436	114.2	37.24	2 FEET FREE BOARD
48.00	1.00	550,532	12.1	547,102	5,523,538	126.8	41.34	1-Foot Free Board
49.00	1.00	564,370	12.4	557,451	6,080,989	139.6	45.51	Top of Berm (Lowest El.)

TABLE 2.2

Salinas Industrial Wastewater Treatment Plant - Pond No. 1								
Elev (FT)	Depth of Water (FT)	Estimated Surface Area (SF)	Estimated Surface Area (Acre)	Estimated Usable Volume (CF)	Estimated Cumulative Usable Volume (CF)	Estimated Cumulative Usable Volume (AF)	Estimated Cumulative Usable Volume (MG)	Remarks
26.50	0.00							Bottom of Pond #1
27.00	0.50	1,286,173	28.2	0	0	0.0	0.00	
28.00	1.00	1,633,818	35.9	1,459,996	1,459,996	33.5	10.93	
29.00	1.00	1,670,775	36.7	1,652,296	3,112,292	71.4	23.29	
30.00	1.00	1,696,693	37.2	1,683,734	4,796,026	110.1	35.89	
31.00	1.00	1,718,383	37.7	1,707,538	6,503,564	149.3	48.67	
32.00	1.00	1,737,715	38.1	1,728,049	8,231,613	189.0	61.60	
33.00	1.00	1,755,448	38.5	1,746,582	9,978,195	229.1	74.68	
34.00	1.00	1,771,701	38.9	1,763,575	11,741,770	269.6	87.87	
35.00	1.00	1,786,768	39.2	1,779,234	13,521,004	310.4	101.19	2 FEET FREE BOARD
36.00	1.00	1,800,611	39.5	1,793,689	15,314,693	351.6	114.61	1-Foot Free Board
37.00	1.00	1,813,702	39.8	1,807,156	17,121,849	393.1	128.14	Top of Berm (Lowest El.)

TABLE 2.3

Salinas Industrial Wastewater Treatment Plant - Pond No. 2								
Elev (FT)	Depth of Water (FT)	Estimated Surface Area (SF)	Estimated Surface Area (Acre)	Estimated Usable Volume (CF)	Estimated Cumulative Usable Volume (CF)	Estimated Cumulative Usable Volume (AF)	Estimated Cumulative Usable Volume (MG)	Remarks
26.50	0.00	610,271	13.4	0	0	0.0	0.00	Bottom of Pond #2
27.00	0.50	610,271	13.4	305,135	305,135	7.0	2.28	
27.00	0.00	1,120,718	24.6					
28.00	1.00	1,146,067	25.2	1,133,392	1,438,528	33.0	10.77	
29.00	1.00	1,184,763	26.0	1,165,415	2,603,942	59.8	19.49	
30.00	1.00	1,196,094	26.3	1,190,429	3,794,371	87.1	28.40	
31.00	1.00	1,205,457	26.5	1,200,775	4,995,146	114.7	37.38	
32.00	1.00	1,213,672	26.6	1,209,564	6,204,711	142.4	46.44	
33.00	1.00	1,221,047	26.8	1,217,360	7,422,071	170.4	55.55	
34.00	1.00	1,228,171	27.0	1,224,609	8,646,680	198.5	64.71	2 FEET FREE BOARD
35.00	1.00	1,234,595	27.1	1,231,383	9,878,063	226.8	73.93	1-Foot Free Board
36.00	1.00	1,240,344	27.2	1,237,469	11,115,532	255.2	83.19	Top of Berm (Lowest El.)

TABLE 2.4

Salinas Industrial Wastewater Treatment Plant - Pond No. 3								
Elev (FT)	Depth of Water (FT)	Estimated Surface Area (SF)	Estimated Surface Area (Acre)	Estimated Usable Volume (CF)	Estimated Cumulative Usable Volume (CF)	Estimated Cumulative Usable Volume (AF)	Estimated Cumulative Usable Volume (MG)	Remarks
24.00	0.00	222,618	4.9	0	0	0.0	0.00	Bottom of Pond #3
25.00	1.00	597,452	13.1	410,035	410,035	9.4	3.07	
26.00	1.00	1,213,385	26.6	905,418	1,315,453	30.2	9.84	
27.00	1.00	1,475,345	32.4	1,344,365	2,659,818	61.1	19.91	
28.00	1.00	1,571,754	34.5	1,523,549	4,183,367	96.0	31.31	
29.00	1.00	1,606,116	35.3	1,588,935	5,772,302	132.5	43.20	
30.00	1.00	1,623,661	35.6	1,614,889	7,387,190	169.6	55.29	
31.00	1.00	1,636,198	35.9	1,629,930	9,017,120	207.0	67.48	
32.00	1.00	1,646,894	36.1	1,641,546	10,658,666	244.7	79.77	
33.00	1.00	1,656,644	36.4	1,651,769	12,310,435	282.6	92.13	
34.00	1.00	1,665,879	36.6	1,661,261	13,971,696	320.7	104.56	2 FEET FREE BOARD
35.00	1.00	1,674,651	36.8	1,670,265	15,641,961	359.1	117.06	1-Foot Free Board
36.00	1.00	1,683,302	36.9	1,678,976	17,320,938	397.6	129.63	Top of Berm (Lowest El.)

TABLE 2.5

Salinas Industrial Wastewater Treatment Plant - Pond No. 4 (9-feet total Depth)								
Elev (FT)	Depth of Water (FT)	Estimated Surface Area (SF)	Estimated Surface Area (Acre)	Estimated Usable Volume (CF)	Estimated Cumulative Usable Volume (CF)	Estimated Cumulative Usable Volume (AF)	Estimated Cumulative Usable Volume (MG)	Remarks
24.00	0	0	0.0	0	0	0.0	0.00	Bottom of Pond #4
25.00	1.00	0	0.0	0	0	0.0	0.00	
28.00	0.00	1,820,000	39.9	0	0	0.0	0.00	Bottom of Pond #4
29.00	1.00	1,830,816	40.2	1,825,408	1,825,408	41.9	13.66	
30.00	1.00	1,841,664	40.4	1,836,240	3,661,648	84.1	27.40	
31.00	1.00	1,852,544	40.7	1,847,104	5,508,752	126.5	41.23	2 FEET FREE BOARD
32.00	1.00	1,863,456	40.9	1,858,000	7,366,752	169.1	55.13	1-Foot Free Board
33.00	1.00	1,874,400	41.1	1,868,928	9,235,680	212.0	69.12	Top of Berm (Lowest El.)

SUMMARY TABLE 2.6

Salinas Industrial Wastewater Treatment Plant - STORAGE CAPACITY			
Storage Volume - Combinations	Estimated Cumulative Usable Volume (AF)	Estimated Cumulative Usable Volume (MG)	Remarks
Pond 1 + Pond 2 + Pond 3 + Aeration Pond	944	308	2-ft Free Board
Pond 1 + Pond 2 + Pond 3 + Aeration Pond	1064	347	1-ft Free Board
Pond 1 + Pond 2 + Pond 3 + Pond 4 + Aeration Pond	1070	349	2-ft Free Board
Pond 1 + Pond 2 + Pond 3 + Pond 4 + Aeration Pond	1233	402	1-ft Free Board

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APPENDIX C

PROJECT COST ESTIMATES

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TABLE 3.1					
SIWTP - Pond Liner Improvement Project					
Pond No. 1					
Item	Description	Estimated Quantity	Units	Unit Price	Total Cost
1	Mobilization & Demobilization	1	L.S.	$350,000	$350,000
2	Site Clearing and Grading				
	a. Site Clearing and grubing	1,850,000	SF	$0.15	$277,500
	b.Bottom and Embankment Excavation	62,849	CY	$4.15	$261,087
	c. Bottom and Embankment Backfill	70,778	CY	$15.00	$1,061,667
	d. Access Ramps	2	EA	$50,000	$100,000
3	Excavation-Liner Trench	960	CY	$15	$14,397
4	Backfill - Liner Trench	960	LS	$15	$14,397
5	Liner + Installation	1,850,000	SF	$1.34	$2,471,600
6	Pressure-Relief valves				
	a. Pressure Relief Valves	651	EA	$150	$97,610
	b. Excavation/Backfill	200	CY	$15	$3,000
	c. Concrete Pad	200	CY	$600	$120,000
7	Perimeter Roadway-8" Class 2 AB	46000	SF	$1.77	$81,550
8	Perimeter Curb-Asphalt	4600	LF	$10.00	$46,000
9	Transfer Piping Connections	1	Ea	$50,000	$50,000
10	Miscellaneous Items - Air Vents	1	LS	$250,000	$250,000
				Subtotal	$5,198,808
				Contractor's O/H + P @ 18%	$935,785
				Subtotal	$6,134,593
				Contingency @ 25%	$1,533,700
				Subtotal - Estimated Construction Cost (August 2017)	$7,668,293
				Administration and Project Management @ 2%	$153,366
				Engineering and Bidding Phase @ 6%	$460,098
				ESDC and CM Services @ 5%	$383,415
				TOTAL ESTIMATED PROJECT COST (August 2017)	$8,665,171

TABLE 3.2

SIWTP - Pond Liner Improvement Project

Pond No. 2

Item	Description	Estimated Quantity	Units	Unit Price	Total Cost
1	Mobilization & Demobilization	1	L.S.	$250,000	$250,000
2	Site Clearing and Grading				
	a. Site Clearing and grubing	1,300,000	SF	$0.15	$195,000
	b.Bottom and Embankment Excavation	44,641	CY	$4.15	$185,447
	c. Bottom and Embankment Backfill	48,870	CY	$15.00	$733,046
	d. Access Ramps	2	EA	$50,000	$100,000
3	Excavation-Liner Trench	516	CY	$15	$7,735
4	Backfill - Liner Trench	516	LS	$15	$7,735
5	Liner + Installation	1,300,000	SF	$1.34	$1,736,800
6	Pressure-Relief valves				
	a. Pressure Relief Valves	467	EA	$150	$70,059
	b. Excavation/Backfill	140	CY	$15	$2,100
	c. Concrete Pad	140	CY	$600	$84,000
7	Perimeter Roadway-8" Class 2 AB	49500	SF	$1.77	$87,755
8	Perimeter Curb-Asphalt	4641	LF	$10.00	$46,410
9	Transfer Piping Connections	1	Ea	$50,000	$50,000
10	Miscellaneous Items - Air Vents	1	LS	$250,000	$250,000
				Subtotal	$3,806,086
				Contractor's O/H + P @ 18%	$685,095
				Subtotal	$4,491,181
				Contingency @ 25%	$1,122,800
	Subtotal - Estimated Construction Cost (August 2017)				$5,613,981
	Administration and Project Management @ 2%				$112,280
	Engineering and Bidding Phase @ 6%				$336,839
	ESDC and CM Services @ 5%				$280,699
	TOTAL ESTIMATED PROJECT COST (August 2017)				$6,343,799

TABLE 3.3					
SIWTP - Pond Liner Improvement Project					
Pond No. 3					
Item	Description	Estimated Quantity	Units	Unit Price	Total Cost
1	Mobilization & Demobilization	1	L.S.	$325,000	$325,000
2	Site Clearing and Grading				
	a. Site Clearing and grubing	1,750,000	SF	$0.15	$262,500
	b.Bottom and Embankment Excavation	59,472	CY	$4.15	$247,062
	c. Bottom and Embankment Backfill	65,274	CY	$15.00	$979,115
	d. Access Ramps	2	EA	$ 50,000	$100,000
3	Excavation-Liner Trench	706	CY	$15	$10,587
4	Backfill - Liner Trench	706	LS	$15	$10,587
5	Liner + Installation	1,750,000	SF	$1.34	$2,338,000
6	Pressure-Relief valves				
	a. Pressure Relief Valves	617	EA	$150	$92,618
	b. Excavation/Backfill	200	CY	$15	$3,000
	c. Concrete Pad	200	CY	$600	$120,000
7	Perimeter Roadway-8" Class 2 AB	64000	SF	$1.77	$113,460
8	Perimeter Curb-Asphalt	6352	LF	$10.00	$63,520
9	Transfer Piping Connections	1	Ea	$50,000	$50,000
10	Miscellaneous Items - Air Vents	1	LS	$250,000	$250,000
				Subtotal	$4,965,448
				Contractor's O/H + P @ 18%	$893,781
				Subtotal	$5,859,229
				Contingency @ 25%	$1,464,900
	Subtotal - Estimated Construction Cost (August 2017)				$7,324,129
	Administration and Project Management @ 2%				$146,483
	Engineering and Bidding Phase @ 6%				$366,206
	ESDC and CM Services @ 5%				$439,448
	TOTAL ESTIMATED PROJECT COST (August 2017)				$8,276,266

TABLE 3.4					
SIWTP - Pond Liner Improvement Project					
Pond No. 4 - (Conversion of Rapid Infiltration Beds)					
Item	Description	Estimated Quantity	Units	Unit Price	Total Cost
1	Mobilization & Demobilization	1	L.S.	$400,000	$400,000
2	Site Clearing and Grading				
	a. Site Clearing and grubing	1,880,709	SF	$0.15	$282,106
	b.Bottom and Embankment Excavation	92,189	CY	$4.15	$382,974
	c. Bottom and Embankment Backfill	69,656	CY	$15.00	$1,044,838
	d. Access Ramps	2	EA	$50,000	$100,000
3	Excavation-Liner Trench	607	CY	$15.00	$9,100
4	Backfill - Liner Trench	607	LS	$15.00	$9,100
5	Liner + Installation	2,000,000	SF	$1.34	$2,672,000
6	Pressure-Relief valves				
0	a. Pressure Relief Valves	728	EA	$150.00	$109,200
0	b. Excavation/Backfill	225	CY	$15.00	$3,375
0	c. Concrete Pad	225	CY	$600.00	$135,000
7	Perimeter Roadway-8" Class 2 AB	54300	SF	$1.77	$96,264
8	Perimeter Curb-Asphalt	5430	LF	$10.00	$54,300
9	Transfer Piping Connections	1	Ea	$50,000	$50,000
10	Miscellaneous Items - Air Vents	1	LS	$400,000	$400,000
				Subtotal	$5,748,258
				Contractor's O/H + P @ 18%	$1,034,686
				Subtotal	$6,782,945
				Contingency @ 25%	$1,695,800
	Subtotal - Estimated Construction Cost (August 2017)				$8,478,745
	Administration and Project Management @ 2%				$169,575
	Engineering and Bidding Phase @ 6%				$423,937
	ESDC and CM Services @ 5%				$508,725
	Total Project Cost				$9,580,982

APPENDIX D

SITE PHOTOGRAPHS

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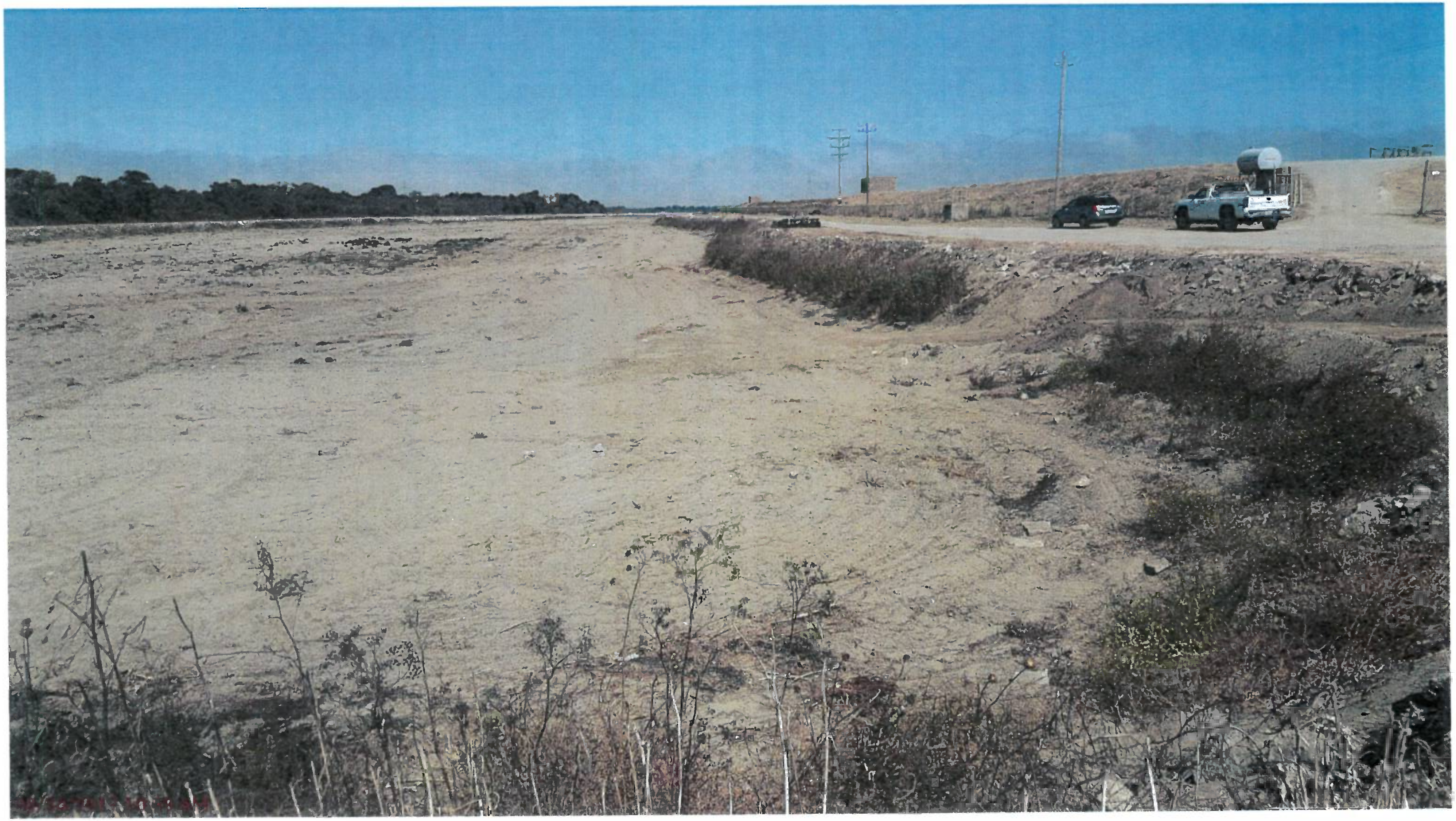
POND #1

PoND #1

POND #1



POND #1

POND #1

PoND #1

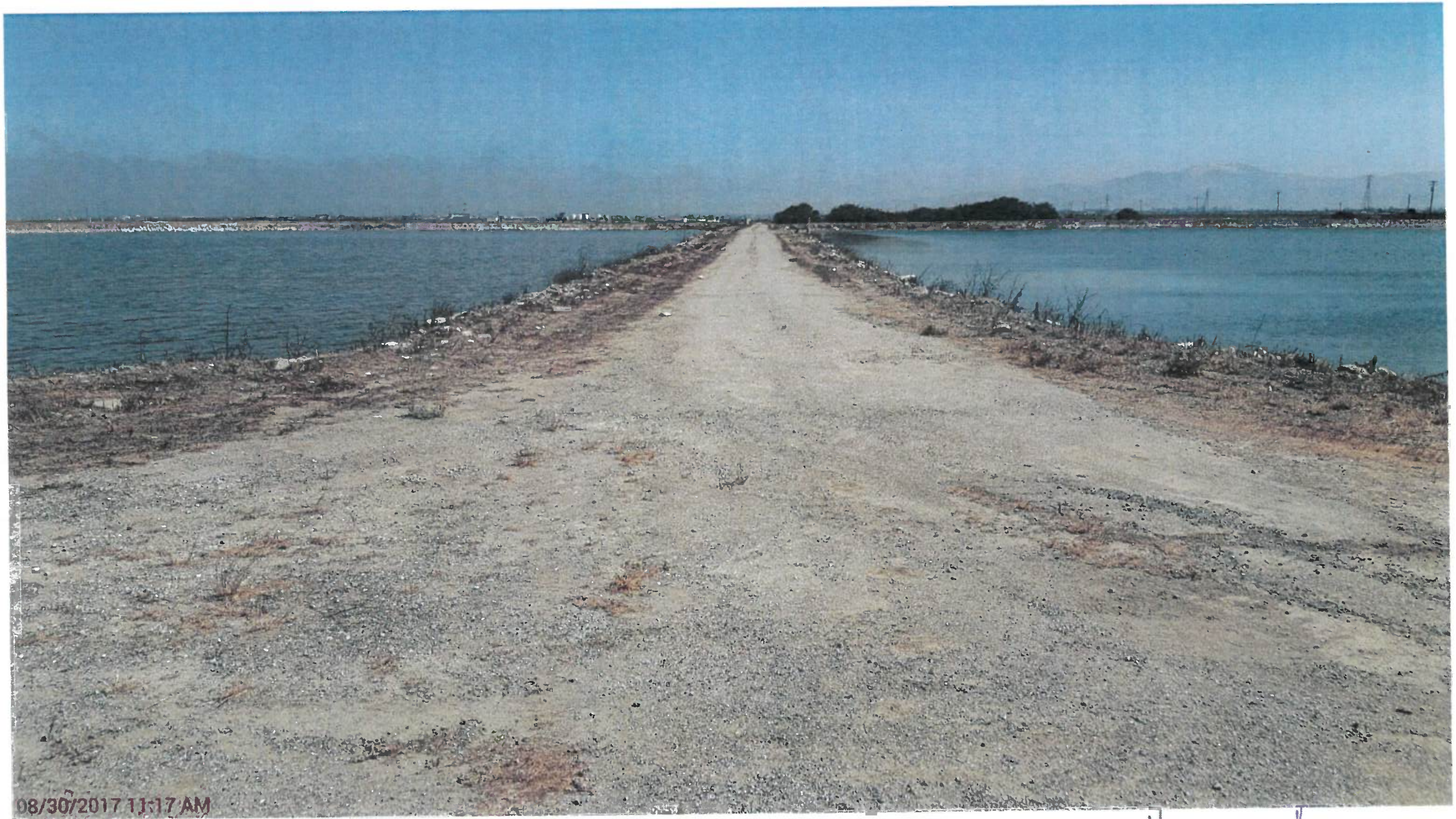
POND #1

POND #1

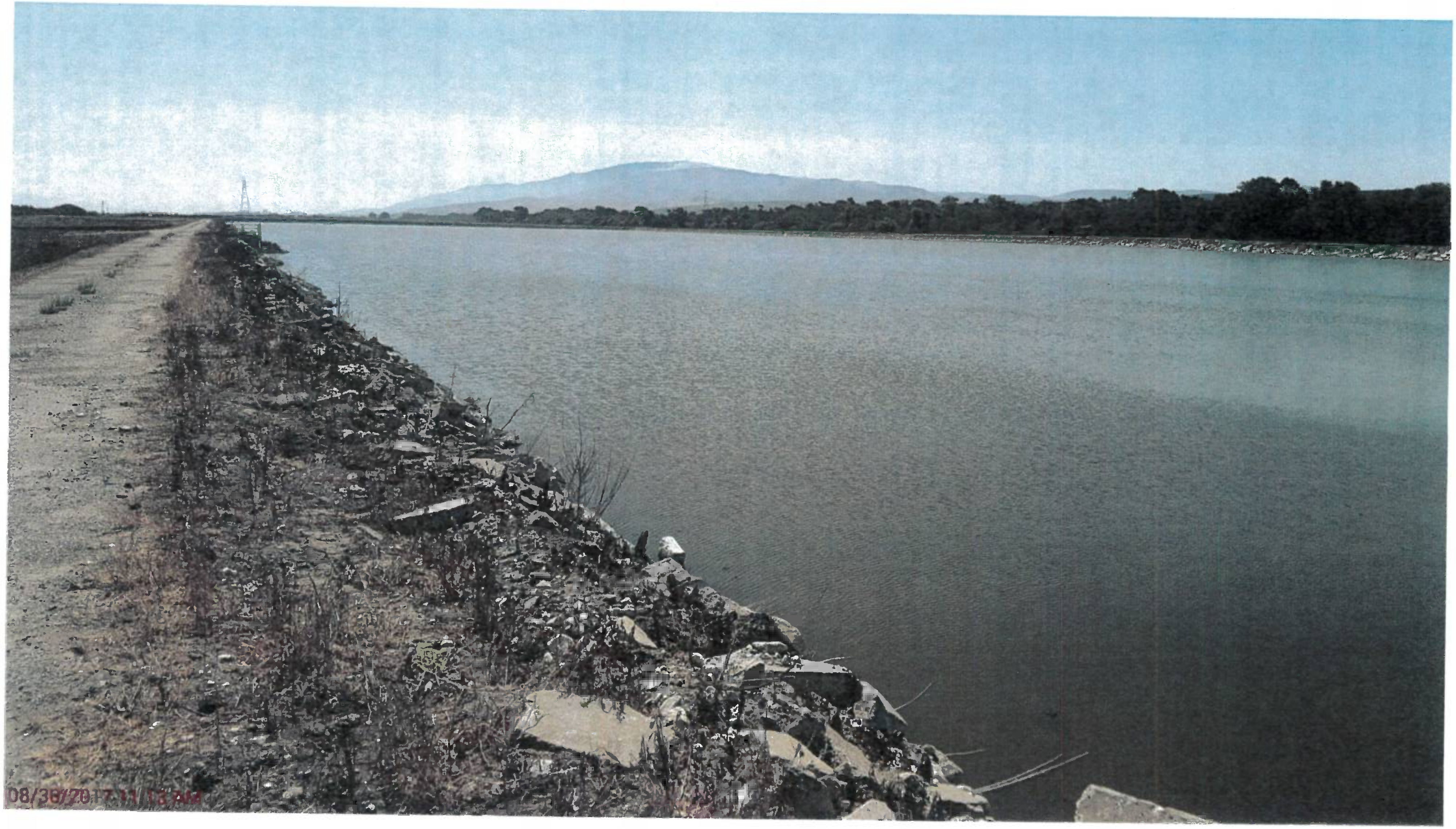
POND #1

POND #1

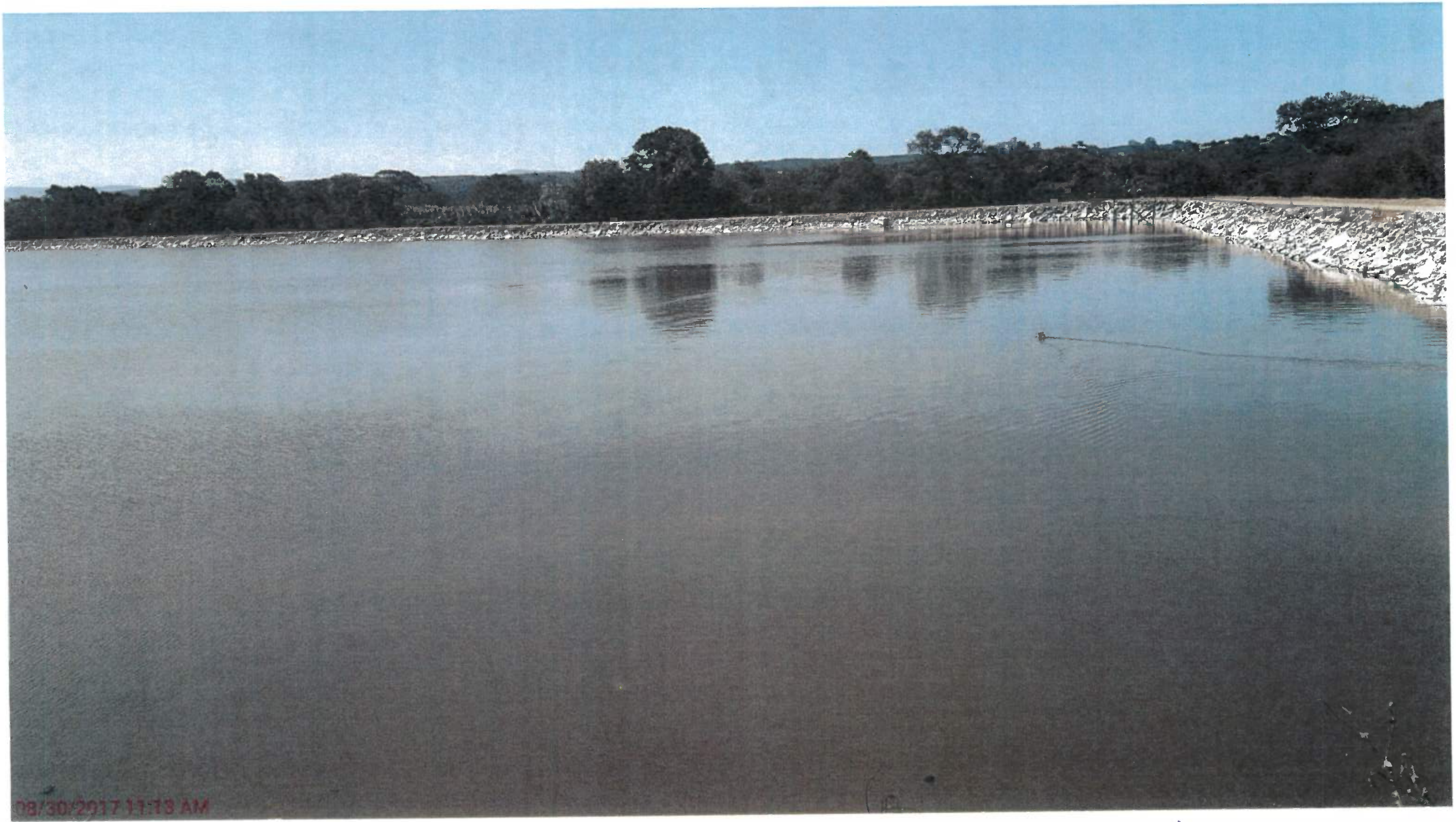
POND #1 & #2



POND # 2 & # 3



POND #3



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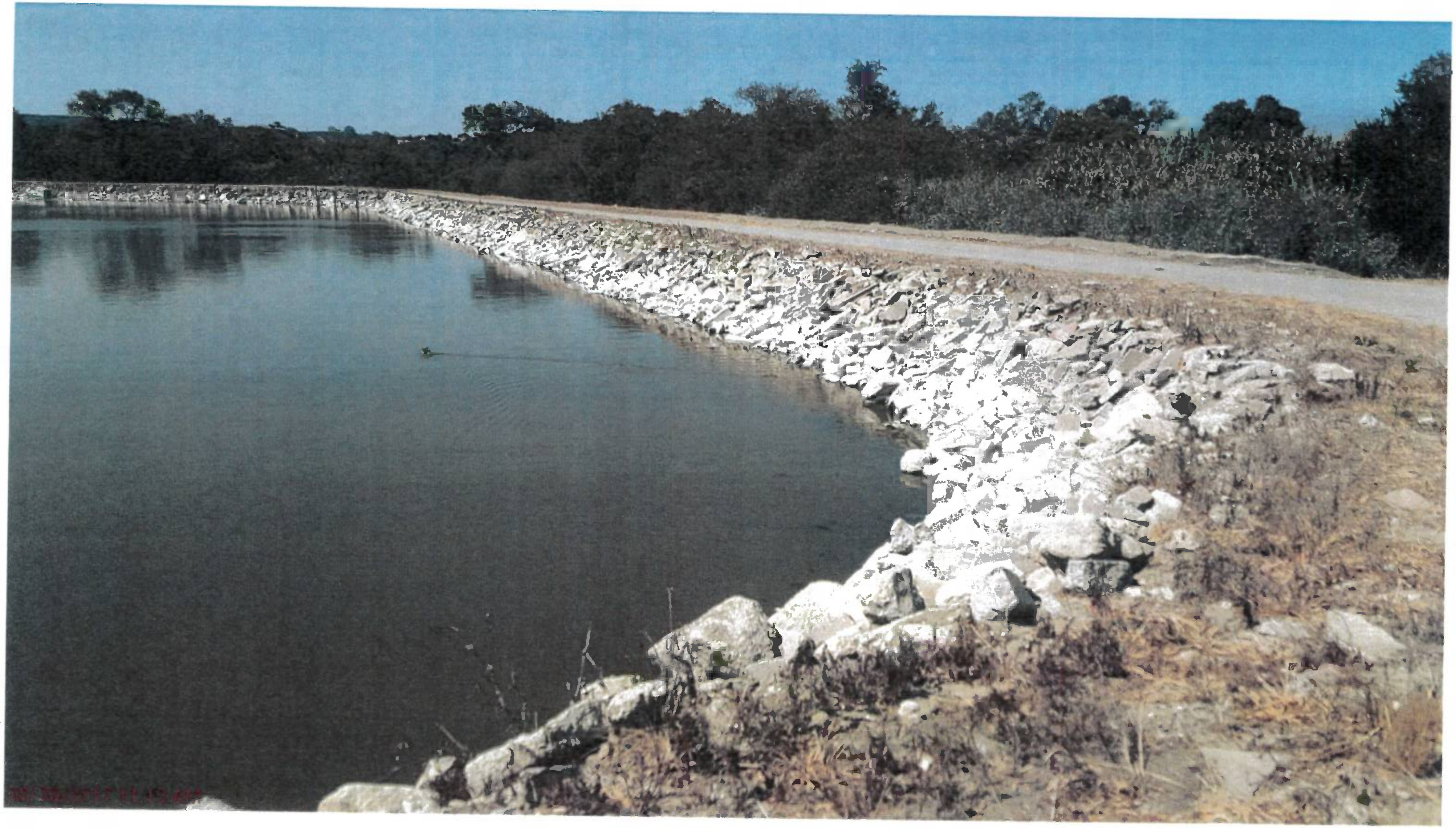

POND No. 3

POND #3

POND #3

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APPENDIX C

Conceptual Design - Lining Existing Ponds

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GRAPHIC SCALE

100' 0' 50' 100' 400' 200'

LEGEND

EXISTING MAJOR CONTOUR
EXISTING MINOR CONTOUR
PROPOSED MAJOR CONTOUR
PROPOSED MINOR CONTOUR
EXISTING PAVED ROAD
EXISTING UNPAVED ROAD
EXISTING FENCE
EXISTING WATER
EXISTING PIPE
PROPOSED LINER LIMITS

QUANTITIES

LINED AREA = ~1,715,585 SF

NOTES:
1. EXISTING TOPOGRAPHY BASED ON PHOTO MAPPING PERFORMED BY VERTICAL MAPPING SOLUTIONS, INC. ON SEPTEMBER 16, 2014.

REV. NO.	DATE	DESCRIPTION	DRAWN BY	DESIGNED BY	CHECKED BY	APPROVED BY
1	03/05/18	DRAFT	JMG	MAC	MAC	MAC

DATE OF ISSUE: 03/05/2018
DESIGNED BY: MAC
DRAWN BY: JMG
CHECKED BY: MAC
APPROVED BY: MAC

Geo-Logic
ASSOCIATES
143E Spring Hill Dr, Grass Valley, California 95945
geo-logic.com | 530.272 2448

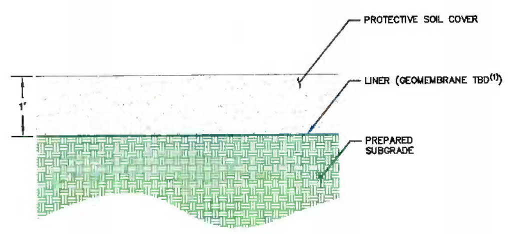
MONTEREY ONE WATER
SALINAS INDUSRIAL WASTEWATER TREATMENT FACILITY
SALINAS, CALIFORNIA

POND 3 LINER

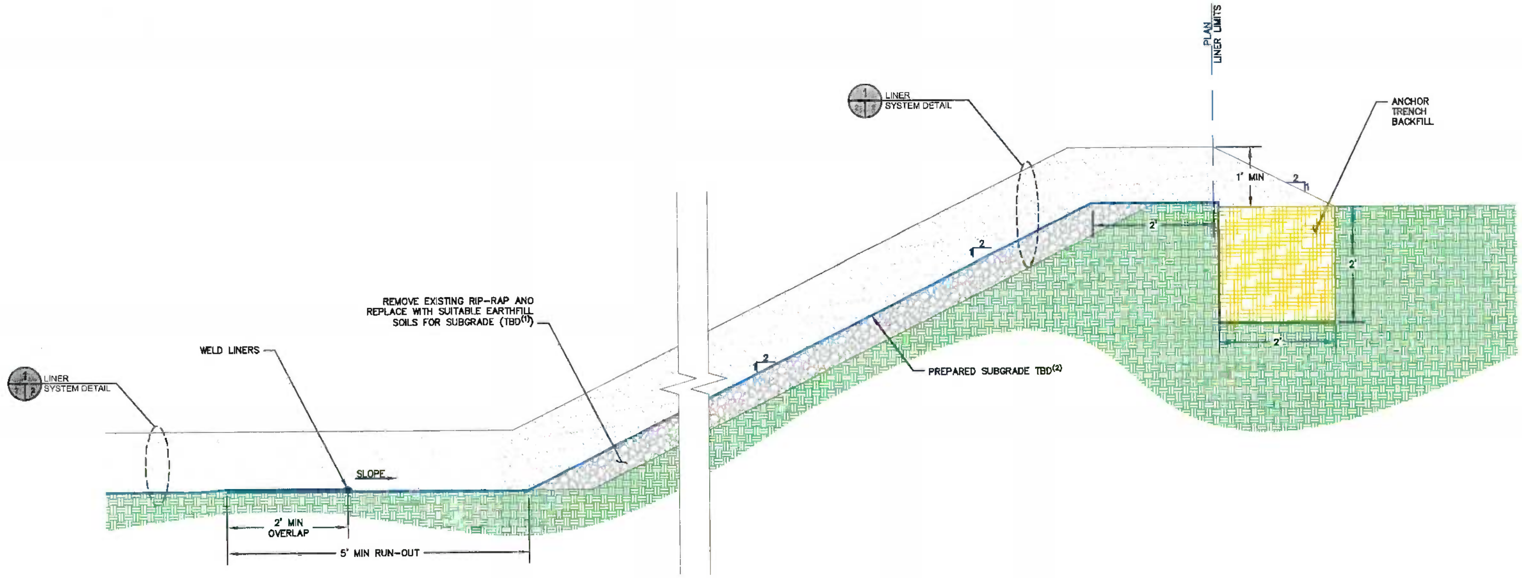
FIGURE
1

PROJECT NO.
AU18.1087.00

DRAFT



LINER SYSTEM
DETAIL 1
1" = 1'



POND SIDESLOPE
LINER SYSTEM
SECTION A
1" = 1'

NOTES:
1. TBD = TO BE DETERMINED.

REV. NO.	DATE	DESCRIPTION	DRAWN BY	DESIGNED BY	CHECKED BY	APPROVED BY
1	03/05/18	DRAFT	JMG	MAC	MAC	MAC

DATE OF ISSUE: 03/05/2018
DESIGNED BY: MAC
DRAWN BY: JMG
CHECKED BY: MAC
APPROVED BY: MAC

Geo-Logic ASSOCIATES
143E Spring Hill Dr, Grass Valley, California 95945
geo-logic.com | 530 272 2448

MONTEREY ONE WATER
SALINAS INDUSRIAL WASTEWATER TREATMENT FACILITY
SALINAS, CALIFORNIA
DETAILS

FIGURE 2
PROJECT NO. AU18.1087.00

DRAFT

Attachment G

Pure Water Monterey Expansion Schedule

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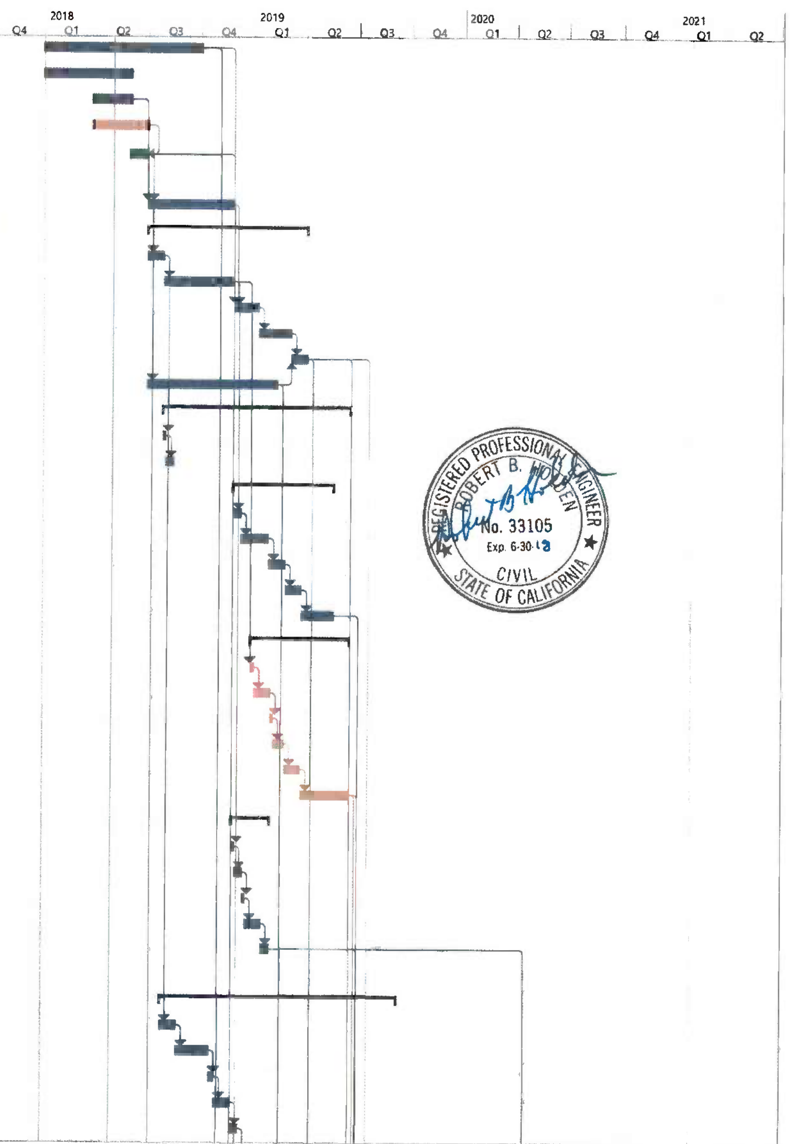
ID	Task Name	Duration	Start	Finish
1	Source Water Commitments by Other Agencies (L)	290 days	Mon 1/1/18	Sun 9/30/18
2	Initial Project Definition/Hydrogeology/Water Quality Studies (G,O)	160 days	Mon 1/1/18	Thu 5/31/18
3	Initial Supplemental EIR Scoping--Project Goal & Description (A,C,G,I,L,O,P)	70 days	Tue 3/27/18	Thu 5/31/18
4	**Funding for Soft Costs (CEQA/NEPA, design, legal, permits, etc.--A,G,I,O,P)**	**100 days**	**Tue 3/27/18**	**Fri 6/29/18**
5	**RWC & Board Approval of Funding Agreement and Consultant Contracts through bid phase (A,G,I,O,P)**	33 days	Tue 5/29/18	Fri 6/29/18
6	**Complete Project Definition/Hydrogeology/Water Quality Studies (G,O,P)**	157.88 da	Fri 6/29/18	Sat 11/24/18
7	**California Environmental Quality Act (CEQA-Plus) Review (A,C,I,L,P)**	**295 days**	**Fri 6/29/18**	**Tue 4/2/19**
8	Scoping, including Notice of Preparation and 30-day Review (P)	30 days	Fri 6/29/18	Fri 7/27/18
9	Admin, Screen-Check, and Draft Supplemental EIR (P)	130 days	Fri 7/27/18	Mon 11/26/18
10	Public Review Period for Draft Supplemental EIR (P)	45 days	Mon 11/26/18	Tue 1/8/19
11	Final EIR Preparation and Review (P)	60 days	Tue 1/8/19	Tue 3/5/19
12	M1W Certification and Project Approval (P)	30 days	Tue 3/5/19	Tue 4/2/19
13	**Engineering Assistance during Environmental (A, C, I & L)**	**240 days**	**Fri 6/29/18**	**Sat 2/9/19**
14	Federal Agency Permitting (A,I,L,P)	345 days	Fri 7/27/18	Mon 6/17/19
15	Prepare/Submit Letter to Fed. Action Agencies (EPA/SWRCB, USBR, U.S. Army, and MBNMS--P)	5 days	Fri 7/27/18	Wed 8/1/18
16	Federal Action Agencies Review Letter (P)	15 days	Wed 8/1/18	Wed 8/15/18
17	**National Historic Preservation Act Section 106 Compliance (L&P)**	**185 days**	**Mon 11/26/18**	**Sun 5/19/19**
18	Prepare/Submit Section 106 Compliance Documentation	15 days	Mon 11/26/18	Mon 12/10/18
19	Federal Action Agencies Review Section 106 Documents/Requests	50 days	Mon 12/10/18	Sat 1/26/19
20	Response to Federal Agencies' Info Requests	30 days	Sat 1/26/19	Sun 2/24/19
21	Federal Agencies conclude Section 106 Documentation is Adequate	30 days	Sun 2/24/19	Sun 3/24/19
22	Federal Agencies consult with SHPO to Issue Revised Letter of Concurrence	60 days	Sun 3/24/19	Sun 5/19/19
23	**Endangered Species Act Coordination with USFWS regarding Existing Biological Opinion (L&P)**	**182 days**	**Thu 12/27/18**	**Mon 6/17/19**
24	Prepare/Submit Draft BA Supplement for USFWS to Federal Action Agencies	7 days	Thu 12/27/18	Thu 1/3/19
25	SWRCB/USEPA/USACOE Review of Draft BA Supplement	30 days	Thu 1/3/19	Thu 1/31/19
26	Prepare/Submit Final BA Supplement for Fed. Action Agency Submittal to USFWS	5 days	Thu 1/31/19	Tue 2/5/19
27	USEPA submits BA Supplement to USFWS to Initiate Consultation	20 days	Tue 2/5/19	Sun 2/24/19
28	Respond to USFWS Info Requests	30 days	Sun 2/24/19	Sun 3/24/19
29	USFWS Prepares Response Letter or Biological Opinion Amendment & submits to Federal Agencies	90 days	Sun 3/24/19	Mon 6/17/19
30	**Endangered Species Act Consultation with NMFS (A)**	**70 days**	**Mon 11/26/18**	**Thu 1/31/19**
31	Prepare/Submit letter for Federal Agencies to Notify with NMFS	5 days	Mon 11/26/18	Sat 12/1/18
32	Federal Agencies sends letter notifying NMFS	15 days	Sat 12/1/18	Sat 12/15/18
33	Assist Federal Agencies with Responses to NMFS Info Requests	5 days	Sat 12/15/18	Thu 12/20/18
34	Federal Agencies coordinate on need for new letter or email confirmation of no letter needed	30 days	Thu 12/20/18	Thu 1/17/19
35	NMFS Prepares and Sends Letter of Concurrence Completing Consultation	15 days	Thu 1/17/19	Thu 1/31/19
36	State Agency Permitting			
37	**Title 22 - Water Recycling Requirements/Waste Discharge Requirements (A,G,I,P)**	**435 days**	**Fri 7/27/18**	**Mon 9/9/19**
38	Prepare/Submit 1st Draft Engineering Report to SWRCB-DDW and RWQCB	30 days	Fri 7/27/18	Fri 8/24/18
39	SWRCB-DDW and RWQCB Review Draft Amended Engineering Report	60 days	Fri 8/24/18	Sat 10/20/18
40	Prepare/Submit ROWD & 2nd Draft Amended Engineering Report to SWRCB-DDW and RWQCB	10 days	Sat 10/20/18	Mon 10/29/18
41	SWRCB Reviews 2nd Draft Amended Engineering Report	30 days	Mon 10/29/18	Mon 11/26/18
42	Prepares Hearing Notice, Distrib. List, Presentation; Final Draft ER	15 days	Mon 11/26/18	Mon 12/10/18

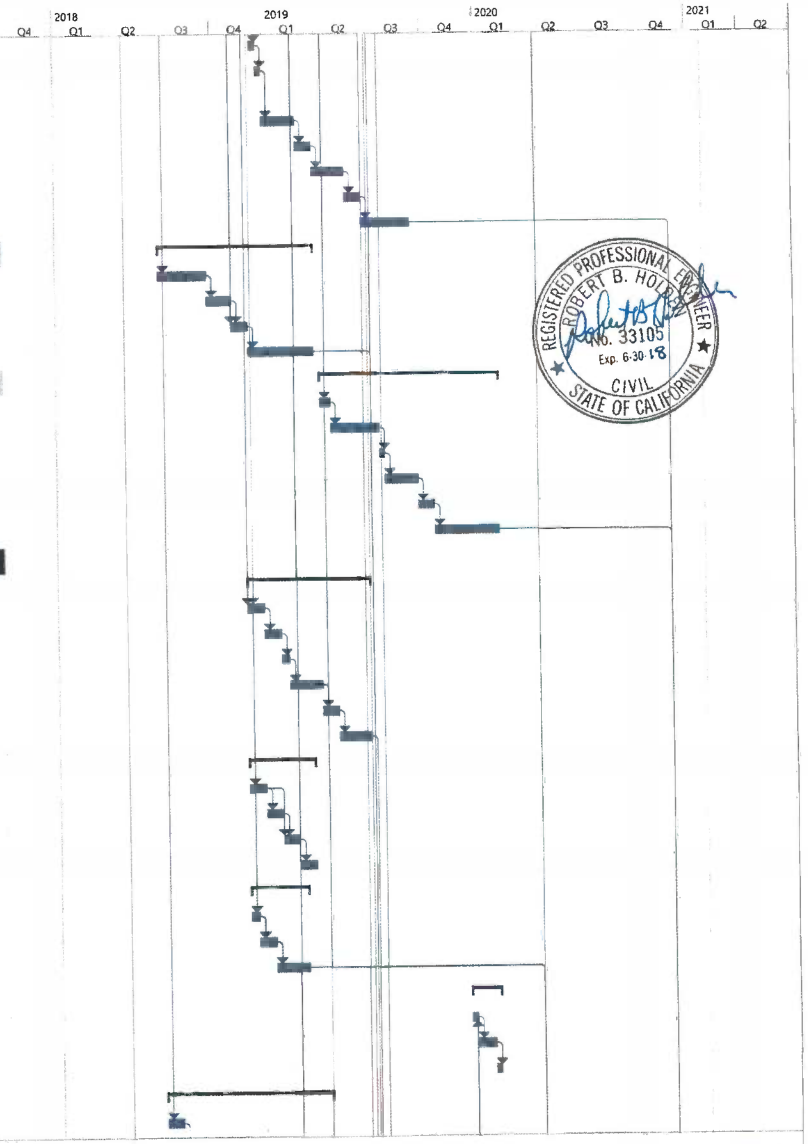


PWM Exp. Schedule 2May18
Printed: Wed 5/2/18
Page: 1

Task | Split | Milestone | Summary | Project Summary | Inactive Task | Inactive Milestone | Inactive Summary | Manual Task | Duration-only | Manual Summary Rollup | Manual Summary | Start-only | Finish-only | External Tasks | External Milestone | Deadline | Critical | Critical Split | Progress | Manual Progress

A=AWPF, C=Cal Am Only, G=Groundwater Modeling, I=Injection, L=Liner, O=Ocean Plan Compliance, P=CEQA+ and Permitting

ID	Task Name	Duration	Start	Finish
43	SWRCB Reviews Notice, List, Presentation; Confirms hearing date	10 days	Mon 12/10/18	Thu 12/20/18
44	Potential task: Notice Public Hearing to Well Owners (Direct Mailing), Stakeholders (Email), Public (Newspaper)	10 days	Thu 12/20/18	Sat 12/29/18
45	Potential task: M1W and SWRCB-DDW Conduct Public Hearing / Receive Comments	60 days	Sat 12/29/18	Sun 2/24/19
46	Potential Task: Respond to Comments; prepare Final Amended Engineering Report	30 days	Sun 2/24/19	Sun 3/24/19
47	RWQCB Prepares Draft Amended Permit/Tentative Order	60 days	Sun 3/24/19	Sun 5/19/19
48	M1W Reviews Draft Amended Permit/Tentative Order	30 days	Sun 5/19/19	Mon 6/17/19
49	RWQCB Issues Permit (WDR/WRR) Order	90 days	Mon 6/17/19	Mon 9/9/19
50	**Division of Safety of Dams Coordination for Pond Lining (L)**	**285 days**	**Fri 6/29/18**	**Sun 3/24/19**
51	Work with City to submit application for Pond 3 Lining	90 days	Fri 6/29/18	Fri 9/21/18
52	DSOD Reviews and Requests Information	45 days	Fri 9/21/18	Sat 11/3/18
53	Work with City to Complete DSOD Info. Needs Pond 3 Lining	30 days	Sat 11/3/18	Sat 12/1/18
54	DSOD Approval	120 days	Sat 12/1/18	Sun 3/24/19
55	**Waste Discharge Requirements/NPDES for RTP Outfall (A,O,P)**	**330 days**	**Tue 4/2/19**	**Fri 2/7/20**
56	Finalize Technical Info. for Permit Modification; Prepare/Submit ROWD to RWQCB	20 days	Tue 4/2/19	Sun 4/21/19
57	RWQCB/MBNMS Reviews request/ Respond with More Info	90 days	Sun 4/21/19	Mon 7/15/19
58	Prepare supplemental information for permit	10 days	Mon 7/15/19	Wed 7/24/19
59	RWQCB Prepares draft permit amendment; MBNMS NEPA review	60 days	Wed 7/24/19	Thu 9/19/19
60	M1W and stakeholder/public review of draft permit	30 days	Thu 9/19/19	Thu 10/17/19
61	Finalize Permit Modification (RWQCB Hearing may be required)	120 days	Thu 10/17/19	Fri 2/7/20
62	Local Permitting- (Seaside & Monterey County only)(A,I,L,P)			
63	City of Seaside Use Permit (I,P)	225 days	Mon 11/26/18	Wed 6/26/19
64	Prepare/Submit Use Permit Application for Project to City of Seaside	30 days	Mon 11/26/18	Mon 12/24/18
65	City reviews / requests add'l info. (i.e., application completion) (30 days)	30 days	Mon 12/24/18	Tue 1/22/19
66	M1W/MPWMD Respond to Requests for Additional Information	15 days	Tue 1/22/19	Tue 2/5/19
67	City reviews additional information and prepares staff reports for ARC, PC, and Council	60 days	Tue 2/5/19	Tue 4/2/19
68	Prepare for and assist with City Use permit approval	30 days	Tue 4/2/19	Tue 4/30/19
69	Public hearings to approve projects	60 days	Wed 5/1/19	Wed 6/26/19
70	**City of Seaside Grading and Excavation (Chapter 15.34, Ordinance Ordnance) Permit (I,P)**	**120 days**	**Mon 11/26/18**	**Tue 3/19/19**
71	Prepare/Submit Application	30 days	Mon 11/26/18	Mon 12/24/18
72	Review Application	30 days	Mon 12/24/18	Tue 1/22/19
73	Respond to Requests for Additional Information	30 days	Tue 1/22/19	Tue 2/19/19
74	Follow-up and coordinate to receive approval	30 days	Tue 2/19/19	Tue 3/19/19
75	**Monterey County - Use Permit Minor Modification(A,P)**	**105 days**	**Mon 11/26/18**	**Tue 3/5/19**
76	Prepare/Submit Applications	15 days	Mon 11/26/18	Mon 12/10/18
77	Respond to Requests for Additional Information	30 days	Mon 12/10/18	Tue 1/8/19
78	Follow-up and coordinate to receive approval	60 days	Tue 1/8/19	Tue 3/5/19
79	**City of Seaside Encroachment Permit (I, P, Injection Contractor)**	**54 days**	**Wed 12/11/19**	**Thu 1/30/20**
80	Prepare/Submit Application to Public Works	10 days	Wed 12/11/19	Fri 12/20/19
81	Respond to Requests for Additional Information (estimate)	34 days	Fri 12/20/19	Tue 1/21/20
82	Follow-up and coordinate to receive approval (estimate)	10 days	Tue 1/21/20	Thu 1/30/20
83	**Fort Ord Reuse Authority - Right of Entry and Easement (C,I,P)**	**305 days**	**Fri 6/29/18**	**Fri 4/12/19**
84	Agency requests Right of Entry; submits work plan	30 days	Fri 6/29/18	Fri 7/27/18

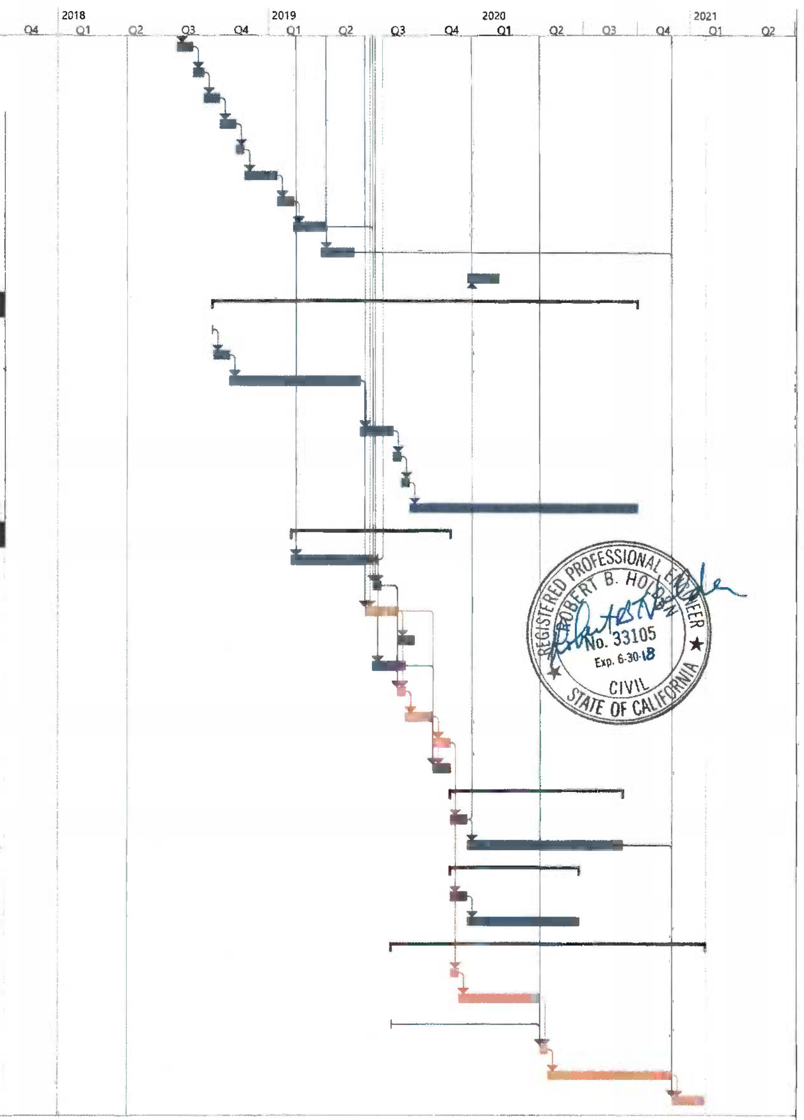


PWM Exp. Schedule 2May18
Printed: Wed 5/2/18
Page: 2

Task	Summary	Inactive Milestone	Duration-only	Start-only	External Milestone	Critical Split
Split	Project Summary	Inactive Summary	Manual Summary Rollup	Finish-only	Deadline	Progress
Milestone	Inactive Task	Manual Task	Manual Summary	External Tasks	Critical	Manual Progress

A=AWPF, C=Cal Am Only, G=Groundwater Modeling, I=Injection, L=Liner, O=Ocean Plan Compliance, P=CEQA+ and Permitting

ID	Task Name	Duration	Start	Finish
85	FORA notifies the Army and Regulators/requests UXO Awareness Training	30 days	Fri 7/27/18	Fri 8/24/18
86	M1W extends the existing reimbursement agreement to cover design activites	20 days	Fri 8/24/18	Wed 9/12/18
87	FORA executes agreement with Agency to reimburse for construction activities	30 days	Wed 9/12/18	Wed 10/10/18
88	FORA Board notified	30 days	Wed 10/10/18	Wed 11/7/18
89	FORA execute standard Change Order	15 days	Wed 11/7/18	Wed 11/21/18
90	Prepare Construction Support Documents	60 days	Thu 11/22/18	Thu 1/17/19
91	FORA Compiles Invoice/Reimbursement	30 days	Thu 1/17/19	Thu 2/14/19
92	FORA Approves ROE	60 days	Thu 2/14/19	Fri 4/12/19
93	**Watermaster Water Storage Permit (I)**	**60 days**	**Tue 4/2/19**	**Wed 5/29/19**
94	**Monterey County Health Department Well Drilling Permit Process (I)**	60 days	Wed 12/11/19	Wed 2/5/20
95	Cal Am Only Wells & Pipeline Construction (C)	782 days	Thu 9/27/18	Thu 10/1/20
96	CPCN	1 day	Thu 9/27/18	Thu 9/27/18
97	Contract Consultants	30 days	Fri 9/28/18	Sat 10/27/18
98	100% Design, Permits (106,USFWS,Seaside), and ROW (US Army, CA Lands Commission, FORA & Seaside)	240 days	Sat 10/27/18	Sun 6/9/19
99	Advertise and Bid Period	60 days	Mon 6/10/19	Mon 8/5/19
100	Notices of Award	15 days	Mon 8/5/19	Mon 8/19/19
101	Notice to Proceed	15 days	Mon 8/19/19	Mon 9/2/19
102	***Cal Am Only Wells (Including MCEHD Permit) & Pipeline Construction (C)***	420 days	Mon 9/2/19	Thu 10/1/20
103	M1W Final Design, Entitlements & Construction	293 days	Sun 2/10/19	Tue 11/12/19
104	100% Design Development (A, I, L)	150 days	Sun 2/10/19	Mon 7/1/19
105	M1W Review	15 days	Mon 7/1/19	Mon 7/15/19
106	**Funding for Construction Costs, ROW, Legal, etc.**	**60 days**	**Tue 6/18/19**	**Tue 8/13/19**
107	Award Contracts for ESDC (A, I, L)	30 days	Tue 8/13/19	Tue 9/10/19
108	RFPs for CM Services (A, I, L)	60 days	Mon 7/1/19	Mon 8/26/19
109	Final Procurement Documents (A, I, L)	15 days	Tue 8/13/19	Tue 8/27/19
110	Advertise for Bid / Bid Phase (A, I, L)	50 days	Tue 8/27/19	Sun 10/13/19
111	Notices of Award (A,I,L)	32 days	Sun 10/13/19	Tue 11/12/19
112	Award CM Contracts (A, I, L & C)	32 days	Sun 10/13/19	Tue 11/12/19
113	***Injection Wells and Booster Pump Station Construction (I)***	**317 days**	**Tue 11/12/19**	**Sun 9/6/20**
114	Notice to Proceed Injection	30 days	Tue 11/12/19	Tue 12/10/19
115	***Injection Wells and Booster Pump Station Construction (I)***	287 days	Wed 12/11/19	Sun 9/6/20
116	***Salinas Pond Lining Construction (L)***	**237 days**	**Tue 11/12/19**	**Mon 6/22/20**
117	Notice to Proceed: Salinas Pond Lining (L)	30 days	Tue 11/12/19	Tue 12/10/19
118	***Salinas Pond Lining Construction (L)***	207 days	Wed 12/11/19	Mon 6/22/20
119	***Construct AWPF Expansion (A)***	**577.13 days**	**Sat 8/3/19**	**Wed 1/27/21**
120	Notice to Proceed: Procure Equipment for AWPF (A)	15 days	Tue 11/12/19	Tue 11/26/19
121	Procure AWPF Equipment (A)	150 days	Tue 11/26/19	Thu 4/16/20
122	Anderson Pacific Completes 5 mgd AWPF	1 day	Sat 8/3/19	Sat 8/3/19
123	Notice to Proceed: Construction of AWPF (A)	14 days	Thu 4/16/20	Wed 4/29/20
124	***Construct AWPF Expansion (A)***	230 days	Wed 4/29/20	Tue 12/1/20
125	Start-up / Project Wrap-up (A, I & L) Expansion Completion	60 days	Tue 12/1/20	Wed 1/27/21



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Task · Split · Milestone · Summary · Project Summary · Inactive Task · Inactive Milestone · Inactive Summary · Manual Task · Duration-only · Manual Summary Rollup · Manual Summary · Start-only · Finish-only · External Tasks · External Milestone · Deadline · Critical · Critical Split · Progress · Manual Progress

A=AWPF, C=Cal Am Only, G=Groundwater Modeling, I=Injection, L=Liner, O=Ocean Plan Compliance, P=CEQA+ and Permitting

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Attachment H

Water Purchase Agreement for Pure Water Monterey Project

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EXECUTION COPY

WATER PURCHASE AGREEMENT FOR PURE WATER MONTEREY PROJECT

THIS WATER PURCHASE AGREEMENT ("Agreement") is made this 19th day of September, 2016 (the "Effective Date") by and between California-American Water Company, a California corporation, hereinafter referred to as the "Company," Monterey Regional Water Pollution Control Agency, hereinafter referred to as the "Agency," and Monterey Peninsula Water Management District, hereinafter referred to as the "District." The Company, the Agency, and the District are hereinafter referred to individually as a "Party" and collectively as the "Parties."

RECITALS

A. The Company has a statutory duty to serve water in certain cities on the Monterey Peninsula and in a portion of Monterey County for its service area, the boundaries of which are shown in Exhibit A attached hereto and incorporated herein.

B. The Company has been ordered by the State Water Resources Control Board in orders 95-10 and WR 2009-0060 to find alternatives to the Carmel River to fulfill its duty to serve, and the Company has applied to the California Public Utilities Commission ("CPUC") for an order seeking a Certificate of Public Convenience and Necessity for the construction of water supply facilities and authorizing the recovery of the costs for such construction in rates.

C. The Agency will be responsible for the design, construction, operation, and ownership of facilities for the production and delivery of advanced treated recycled water, such facilities to be part of the Pure Water Monterey groundwater replenishment project.

D. The District will buy advanced treated recycled water from the Agency for purpose of securing the financing of and paying the operating costs of the project. The District will sell the advanced treated recycled water to the Company subject to the terms of this Agreement.

E. The Company desires to buy advanced treated recycled water from the District for the purpose of fulfilling its duty to serve its customers within its service area and the District is willing to sell advanced treated recycled water to the Company for this purpose on the terms and conditions provided for herein.

F. The Agency contends, and has so advised the District and the Company, that based on advice of counsel, (1) Agency assets and revenue derived from Agency ratepayers are not available for satisfying claims and judgments for any liability arising from this water project Agreement, and (2) therefore, the single source for so satisfying is insurance coverage described as Required Insurance in this Agreement.

G. The Agency has separately entered into an agreement with the Monterey County Water Resources Agency in Section 4.05 of which, the Monterey County Water Resources Agency may request additional irrigation water from Agency sources. Pursuant to that agreement the Agency has committed to produce no more than 200 acre-feet per year, up to a total quantity of 1,000 acre-feet, for delivery to the District as a drought reserve. When such a request is made, the District may make available to the Company Drought Reserve Water in order to satisfy the Company Allotment. Additionally, in order to ensure delivery of the Company Allotment in the event of an interruption in project operations, the District has established an Operating Reserve. Together the two reserves are called the Reserve Account and will be paid for by the District until deemed delivered to the Company if needed at a future date.

NOW, THEREFORE, the Parties agree as follows:

1. Purpose of Agreement.

The purpose of this Agreement is to provide for the sale of advanced treated recycled water from the Agency to the District and from the District to the Company derived from the Pure Water Monterey groundwater replenishment project owned and operated by the Agency, and to serve the Company's customers within its service area. The Parties confirm that this Agreement constitutes a contractual right to purchase advanced treated recycled water, that no water right is conferred to the Company, and that no additional rights in the Seaside Groundwater Basin are conferred to the District or the Agency.

2. Definitions

The following terms shall, for all purposes of this Agreement have the following meanings:

"Additional Project Participant" means any public district, agency, or entity, or any private water company, other than the Company, that executes a water purchase agreement in accordance with Section 18 hereof, together with its respective successors or assigns.

"Affected Party" means a Party claiming the occurrence of a Force Majeure Event and seeking relief under this Agreement as a result thereof.

"Agreement" means this Water Purchase Agreement, as the same may be amended from time to time.

"Applicable Law" means any federal, state or local statute, local charter provision, regulation, ordinance, rule, mandate, order, decree, permit, code or license requirement or other governmental requirement or restriction, or any interpretation or administration of any of the foregoing by any governmental authority, which applies to the services or obligations of any of the Parties under this Agreement.

"AWT Facilities" means the advanced water treatment facilities portion of the Project that provides advanced treatment to source water that has undergone secondary treatment at the Regional Treatment Plant.

"AWT Water" means advanced treated recycled water produced by the AWT Facilities.

"Company Account" means the account managed by the District and the Company that tracks and records the quantity of Company Water delivered to the Delivery Point.

"Company Allotment" means 3,500 acre-feet of AWT Water, or another quantity of AWT Water as agreed to, in writing, by the Parties.

"Company Water" means the AWT Water delivered to the Delivery Point to be used and owned by the Company and will be counted toward the Company Allotment.

"Company Water Payments" means payments made by the Company to the District pursuant to Section 16 hereof for the furnishing of Company Water.

"Company Water Rate" means the dollar amount per acre-foot of Company Water that the Company pays the District for delivery of Company Water, as calculated pursuant to Section 16.

"CPUC" means the California Public Utilities Commission.

"Delivery Point" means any of the metered points of delivery identified in Exhibit C.

"Delivery Start Date" means the date that the District commences delivery of AWT Water to the Delivery Point.

"Drought Reserve" means one of the two sub-accounts that comprise the Reserve Account.

"Drought Reserve Minimum" means 1,000 acre-feet of Drought Reserve Water in the Drought Reserve.

"Drought Reserve Water" means Excess Water in the Drought Reserve Account at any given time.

"Event of Default" means each of the items specified in Section 20 which may lead to termination of this Agreement upon election by a non-defaulting Party.

"Excess Water" means a quantity of AWT Water in excess of the Company Allotment delivered by the District to the Delivery Point in any given Fiscal Year.

"Fiscal Year" means a twelve-month period from July 1 through June 30. Any computation made on the basis of a Fiscal Year shall be adjusted on a pro rata basis to take into account any Fiscal Year of less than 365 or 366 days, whichever is applicable.

"Fixed Project Costs" means all pre-construction, development, and capital costs of the Project, including debt service and reserves for the payment of debt service, incurred by the Agency or District in accordance with Section 6 hereof; provided, however, Fixed Project Costs shall not include any damages or other amounts paid by the Agency or the District to the Company as indemnification payments pursuant to Section 22 of this Agreement.

"Force Majeure Event" means any act, event, condition or circumstance that (1) is beyond the reasonable control of the Affected Party, (2) by itself or in combination with other acts, events, conditions or circumstances adversely affects, interferes with or delays the Affected Party's ability to perform its obligations under this Agreement, and (3) is not the fault of, or the direct result of the willful or negligent act, intentional misconduct, or breach of this Agreement by, the Affected Party.

"Injection Facilities" means the injection wells and appurtenant facilities portion of the Project used to inject AWT Water into the Seaside Basin.

"Minimum Allotment" means 2,800 acre-feet of AWT Water.

"Operating Reserve" means one of the two sub-accounts that comprise the Reserve Account.

"Operating Reserve Minimum" means 1,000 acre-feet of Operating Reserve Water in the Operating Reserve prior to the date that is three (3) years following the Performance Start Date, and 1,750 acre-feet of Operating Reserve Water in the Operating Reserve after the date that is three (3) years following the Performance Start Date.

"Operating Reserve Water" means Excess Water in the Operating Reserve at any given time.

"Performance Start Date" means the date set forth in a written notice provided by the District to the Company upon which the District's performance obligations with respect to the Water Availability Guarantee, the Water Delivery Guarantee, and the Water Treatment Guarantee shall commence, such date not to be more than six months following the Delivery Start Date.

"Product Water Facilities" means the product water conveyance facilities portion of the Project used to transport the AWT Water from the AWT Facilities to the Injection Facilities.

"Project" means the Pure Water Monterey groundwater replenishment project, including (a) Source Water Facilities, (b) AWT Facilities, (c) Product Water Facilities, and (d) Injection Facilities, all as additionally described in Exhibit B.

"Project Operation and Maintenance Expenses" means all expenses and costs of management, operation, maintenance, repair, replacement, renovation, or improvement of the Project incurred by the Agency and the District, including overhead costs, and properly chargeable to the Project in accordance with generally accepted accounting principles, including, without limitation (a) salaries, wages, and benefits of employees, contracts for professional services, power, chemicals, supplies, insurance, and taxes; (b) an allowance for depreciation, amortization, and obsolescence; (c) all administrative expenses; and (d) a reserve for contingencies, in each case incurred by the Agency or District with respect to the Project; provided, however, Project Operation and Maintenance Expenses shall not include any damages or other amounts paid by the Agency or the District to the Company as indemnification payments pursuant to Section 22 of this Agreement.

"Regional Treatment Plant" means the Agency's Regional Wastewater Treatment Plant.

"Required Insurance" means, with respect to the Agency and the District, the insurance each Party is required to obtain and maintain during the term of this Agreement as set forth in Exhibit D.

"Reserve Account" means the account managed by the District that tracks and records (a) quantities of Excess Water delivered to the Delivery Point, and (b) quantities of Reserve Water debited from the Reserve Account to satisfy the Company Allotment.

"Seaside Basin" means the Seaside Groundwater Basin.

"Service Area" means the Company's service area as of the Effective Date of this Agreement, as shown in Exhibit A, and as amended from time-to-time by the CPUC.

"Storage and Recovery Agreement" means the storage and recovery agreement among the Company, the District and the Watermaster that allows for injection of AWT Water into the Seaside Basin for purposes of continued storage or withdrawal.

"Source Water Facilities" means the source water diversion and conveyance facilities portion of the Project used to divert and convey new source waters to the Regional Treatment Plant.

"Watermaster" means the Seaside Groundwater Basin Watermaster.

"Water Availability Guarantee" means the water availability guarantee set forth in Section 13.

"Water Delivery Guarantee" means the water delivery guarantee set forth in Section 12.

"Water Treatment Guarantee" means the water treatment guarantee set forth in Section 14.

OPERATIVE PROVISIONS

3. Commencement of Service.

The Performance Start Date shall be no later than January 1, 2020. Failure of the Agency and the District to meet this deadline shall constitute an Event of Default upon which the Company may terminate this Agreement in accordance with Section 20. The Company shall not incur any costs or be responsible for any payments under this Agreement prior to the Performance Start Date.

4. Term of Agreement.

This Agreement shall be effective as of the Effective Date and shall remain in effect until the date that is thirty (30) years after the Performance Start Date (the "Expiration Date"), unless earlier terminated as provided in this Agreement.

5. Option for Continued Service.

The Company may extend the Expiration Date of this Agreement for one or more periods not to exceed ten (10) years, in total. The Company shall notify the Agency and the District, in writing at least 365 days prior to the then-applicable Expiration Date, of its intent to extend the Expiration Date and such notice shall indicate the new Expiration Date. At the election of any Party, the Parties will meet and confer to consider the Parties' interest in any additional extension or renewal of an arrangement similar to this Agreement. Such meet-and-confer sessions should take place approximately five (5) years prior to the then-applicable Expiration Date; provided, however, if pursuant to an extension under this Section 5 the new Expiration Date is less than five (5) years following the Company's notification of the extension, the Parties will meet and confer within a reasonable time prior to the new Expiration Date.

6. Agency and District to Develop Project.

Subject to all terms and conditions of the Agency's water rights, permits and licenses, and all agreements relating thereto, the Agency and District will cause and complete the design, construction, operation, and financing of the Project, the production and delivery of AWT Water, the obtaining of all necessary authority and rights, consents, and approvals, and the performance of all things necessary and convenient therefor. The Agency will own and operate the Project.

As consideration for funding environmental, permitting, design, and other pre-construction costs, as well as for pledging revenues for repayment of future costs under this Agreement in the event Company Water Payments are insufficient, the District shall (i) own AWT Water for sale and delivery to the Company, (ii) have the right to sell AWT Water to the Company or any Additional Project Participant (if approved by the Company pursuant to Section 19), (iii) have the right to bill the Company for Company Water Payments or to bill any Additional Project Participant for AWT Water, and (iv) have the right to apply all Company Water Payments to payment of Fixed Project Costs and Project Operation and Maintenance Expenses.

7. Obligation to Pay Design and Construction Costs.

The Agency shall be solely responsible for the design, construction, implementation and performance of the Project, and shall bear all costs associated with such design, construction, implementation and performance. Title to the structures, improvements, fixtures, machinery, equipment, materials, and pipeline capacity rights constituting the Project shall remain with the Agency and the Agency shall bear all risk of loss concerning such structures, improvements, fixtures, machinery, equipment, and materials.

8. Obligation to Pay Operation and Maintenance Costs.

The Agency shall be solely responsible for the operation, maintenance, repair and replacement of the Project, and shall bear all costs associated with such operation, maintenance, repair and replacement.

9. Point of Delivery and Ownership of AWT Water.

All AWT Water shall be delivered to the Delivery Point. Water utilized to backflush an injection well that percolates into the ground is considered delivered AWT Water.

The Agency shall own the AWT Water until the point it leaves the AWT Facilities. The District shall own the AWT Water from the point it leaves the AWT Facilities to the Delivery Point. After the Delivery Point, if the water is Company Water, it will be owned by the Company. If, however, the water is Excess Water after the Delivery Point, then ownership of such water shall remain with the District. The District shall own any water in the Reserve Account, until such time as Operating Reserve Water or Drought Reserve Water is used to satisfy the Water Availability Guarantee at which point it shall become Company Water and be owned by the Company.

The Company recognizes and agrees that it acquires no interest in or to any portion of the District's system or any Agency facilities.

Delivery by the District and withdrawal by the Company shall be governed by the Storage and Recovery Agreement.

10. Points of Withdrawal.

All AWT Water furnished pursuant to this Agreement shall be taken from storage by the Company at the points of withdrawal controlled by the Company and permitted by the California Department of Public Health. The Company shall be solely responsible for operating and maintaining all of its facilities for withdrawal of water.

11. Measurement.

All AWT Water furnished pursuant to this Agreement shall be measured by the Agency at the Delivery Point. Such measurement shall be with equipment chosen by the Agency, installed by the Agency on Agency facilities, and approved by the District and Company in writing. All measuring equipment shall be installed, maintained, repaired and replaced by the Agency. The Agency will provide annual meter calibration by an outside contractor and provide a copy of results of such calibrations to District and Company. The Agency shall have the primary obligation to measure the quantity of AWT Water delivered to the Delivery Point. The Company may request, at any time, investigation and confirmation by the District or Agency of the measurement being made as well as the charges associated with those measurements. Errors in measurement and charges discovered by the investigation will be corrected in a timely manner by the Agency and the District. The Company may, at its own expense, at any time, inspect the measuring equipment and the record of such measurements for the purpose of determining the accuracy of the equipment and measurements.

12. Water Delivery Guarantee.

(a) Beginning on the Performance Start Date and in every Fiscal Year throughout the term of this Agreement, the Agency shall use its best efforts to deliver AWT Water to the District in quantities at least equal to the Company Allotment.

(b) Beginning on the Performance Start Date and in every Fiscal Year throughout the term of this Agreement, the District shall use its best efforts to deliver Company Water to the Delivery Point in quantities at least equal to the Company Allotment.

(c) Beginning on the Performance Start Date and in every Fiscal Year throughout the term of this Agreement, the Agency shall deliver AWT Water to the District in quantities at least equal to the Minimum Allotment (the "Water Delivery Guarantee").

(d) Beginning on the Performance Start Date and in every Fiscal Year throughout the term of this Agreement, the District shall deliver Company Water to the Delivery Point in quantities at least equal to the Minimum Allotment (also, the "Water Delivery Guarantee").

(e) All AWT Water delivered by the District to the Delivery Point between the Delivery Start Date and the Performance Start Date shall be deemed Operating Reserve Water and allocated to the Operating Reserve. The Performance Start Date shall not occur until the Operating Reserve Minimum has been allocated to the Operating Reserve. Beginning on the Performance Start Date and in every Fiscal Year throughout the term of this Agreement, the first 3,500 acre-feet of AWT Water delivered to the Delivery Point each Fiscal Year shall be Company Water.

13. Water Availability Guarantee.

(a) Beginning on the Performance Start Date and throughout the term of this Agreement, the Agency must deliver enough AWT Water to the District so that the Company may draw AWT Water (including Company Water, Operating Reserve Water, and Drought Reserve Water released by the District to the Company) from the Seaside Basin every Fiscal Year in an amount at least equal to the Company Allotment (the "Water Availability Guarantee").

(b) Beginning on the Performance Start Date and throughout the term of this Agreement, the District must deliver enough AWT Water to the Delivery Point so that the Company may draw AWT Water (including Company Water, Operating Reserve Water, and Drought Reserve Water released by the District to the Company) from the Seaside Basin every Fiscal Year in an amount at least equal to the Company Allotment (also, the "Water Availability Guarantee").

(c) If in any Fiscal Year the District delivers Excess Water, any such amount shall be credited to the Reserve Account. The Reserve Account will have two sub-accounts: the Operating Reserve and the Drought Reserve. The District will allocate all Excess Water into either the Operating Reserve or the Drought Reserve as it shall determine in its sole discretion.

(d) If the amount of Operating Reserve Water in the Operating Reserve at any time is less than the Operating Reserve Minimum, then all Excess Water in a Fiscal Year must be allocated to the Operating Reserve until the Operating Reserve Minimum is achieved, except for up to 200 acre-feet of Excess Water that may, at the District's election, be allocated to the Drought Reserve but only if the balance in the Drought Reserve is less than the Drought Reserve Minimum. In no instance shall the District reduce Company Water deliveries to make available additional irrigation water to the Monterey County Water Resources Agency from Agency sources in an amount exceeding the balance available in the Drought Reserve.

(e) If in any Fiscal Year the District delivers Company Water to the Delivery Point in quantities less than the Company Allotment, the Company shall have the right, but not the obligation, to draw Operating Reserve Water from the Operating Reserve to make up for any such shortfall in Company Water. In addition, if a shortfall still exists after Operating Reserve Water is drawn by the Company, the District may, in its sole discretion, use Drought Reserve Water available in the Drought Reserve to satisfy the Water Availability Guarantee. Upon the occurrence of the Expiration Date, or the earlier termination of this Agreement as contemplated herein, the Company shall have the right to draw Drought Reserve Water from the Drought Reserve.

(f) Every three (3) months during the term of this Agreement, beginning on the Performance Start Date, the District will report to the Company the balances and activity in the Operating Reserve and Drought Reserve. In addition, the District shall, with ten (10) days following the Company's request, provide to the Company the balances and activity in the Operating Reserve and Drought Reserve.

14. Water Treatment Guarantee.

All AWT Water delivered by the Agency to the District and by the District to the Delivery Point must meet the water quality requirements set forth in Applicable Law (the "Water Treatment Guarantee"). If at any time the Agency or the District fails to meet the Water Treatment Guarantee, the Agency or the District shall give the Company immediate notice thereof and shall promptly meet with the Company to discuss the circumstances of such failure and the District's and the Agency's proposed action plan for remediation so that the Water Treatment Guarantee will be met. AWT Water delivered by the Agency to the District or by the District to the Delivery Point that does not meet the Water Treatment Guarantee shall not be considered Company Water or Excess Water.

15. Budgeting.

Not later than May 1 each year, the Fixed Project Costs and Project Operation and Maintenance Expenses shall be estimated by the Agency and the District for the following Fiscal Year. Such estimates shall be made available for review by the Parties at least fifteen (15) days prior to adoption by the Agency's or District's respective boards.

16. Rate of Payment for Company Water.

For Company Water furnished to the Company under this Agreement, the Company shall pay Company Water Payments to the District on a monthly basis determined as the Company Water Rate multiplied by the quantity of Company Water delivered the previous month. The Company shall not pay for deliveries to the Operating Reserve and the Drought Reserve until such reserves are designated by the Company or the District, as applicable, as Company Water.

The Company Water Rate in each Fiscal Year of the Agreement shall be the sum of the Fixed Project Costs and Project Operation and Maintenance Expenses budgeted for production and delivery of AWT Water in such Fiscal Year, divided by the amount of AWT Water expected to be produced during such Fiscal Year. The Parties agree that the fundamental rate-setting principles of this Agreement shall be (a) the Company does not pay for water it does not receive, (b) the cost of water shall only reflect the true cost of service consistent with California public agency laws and regulations, and (c) the Company shall pay only its proportionate share of the costs of the Agency and the District producing AWT Water.

In the first year following the Performance Start Date, the Company Water Rate shall not exceed $1,720 per acre foot (the "Soft Cap"). Prior to the Performance Start Date, if the first-year Company Water Rate as calculated is expected to exceed the Soft Cap, the Company shall apply to the CPUC through a Tier 2 advice letter for approval of such rate before the Company shall be required under this Agreement to pay an amount greater than the Soft Cap as the Company Water Rate. Unless and until the CPUC approves a Company Water Rate in an amount greater than the Soft Cap, the Company shall only be required to pay an amount equal to the Soft Cap as the Company Water Rate. In no circumstance shall the District's or the Agency's obligations under this Agreement to deliver Company Water to the Company be affected by the pendency of the Company's application to the CPUC for approval of a rate greater than the Soft Cap or a decision by the CPUC to deny any such application.

As Project Operation and Maintenance Expenses are projected or budgeted for an upcoming Fiscal Year, the Parties agree there will be a "true-up" or reconciliation at the end of every Fiscal Year following the Performance Start Date to ensure the principles set forth in this section are met. Such "true-up" shall mean: if actual Project Operation and Maintenance Expenses are more or less than budgeted Project Operation and Maintenance Expenses used to calculate the Company Water Rate paid during the Fiscal Year, a corresponding adjustment (up or down) will be provided against the subsequent Fiscal Year budget and computed Company Water Rate for that Fiscal Year.

The Parties agree that, given the status of the Agency and the District as governmental agencies and the requirements under law that they incur only reasonable and prudent costs and expenses for purposes related to their governmental duties and the fact that such costs and expenses are subject to public review and scrutiny, all Fixed Project Costs and Project Operation and Maintenance Expenses incurred by the Agency and/or the District in compliance with the terms of this Agreement shall reflect only the actual cost of service consistent with California public agency laws and regulations and shall be subject to CPUC review consistent with that used for existing water purchase agreements by CPUC-regulated Class A investor-owned water utilities.

The District covenants and agrees to pay to the Agency the revenues received from the Company from the Company Water Payments provided, however, it will reduce the payment amount by any portion of the Fixed Project Costs and Project Operation and Maintenance Expenses directly paid or incurred by the District.

17. Time and Method of Payments.

The District shall send the Company a detailed monthly statement of charges due for all Company Water delivered to the Delivery Point during the preceding month as measured by the Agency meters, which shall be read on a monthly basis, and all Operating Reserve Water and Drought Reserve Water used to satisfy the Water Availability Guarantee, The Company shall not be billed for Excess Water that goes into the Reserve Account.

The Company shall pay to the District all undisputed portions of statements, within forty-five (45) days after receipt. Statements shall be mailed to the Company at the following address:

California American Water Company
Director of Operations
511 Forest Lodge Rd # 100
Pacific Grove, CA 93950

The Agency shall send the District a monthly statement of charges due for all AWT Water actually delivered to the District during the preceding month as measured by the meters, which shall be read on a monthly basis. The District shall pay all statements within forty-five (45) days after receipt. Statements shall be mailed to the District at the following address:

Monterey Peninsula Water Management District
Administrative Services Division Manager
5 Harris Court, Building G
Monterey, CA 93940

If payment of any amount due hereunder is not made when due, excluding disputed amounts, simple interest will be payable on such undisputed amount at the legal rate of interest charged on California judgments, as provided in California Code of Civil Procedure Section 685.010, and shall be calculated on the basis of a 365-day year from the date such payment is due under this Agreement until paid.

The Company is obligated to pay to the District the undisputed amounts becoming due under this Agreement, notwithstanding any individual default by its water users or others in the payment to the Company of assessments or other charges levied by the Company.

GENERAL PROVISIONS

18. CPUC Rate Recovery Process.

All costs that the Company pays to the District pursuant to this Agreement shall be considered purchased water costs that are a pass-through to customers to be recovered via the Modified Cost Balancing Account ("MCBA") mechanism.

At least six (6) months prior to the Performance Start Date, at least one time between May 1 and June 1 of every year thereafter, and at any time throughout the term of this Agreement the District deems necessary, the District shall provide the Company with written notice of the Company Water Rate, supported by detailed information relating to the Fixed Project Costs and the estimated Operation and Maintenance Expenses to be incurred in the upcoming Fiscal Year that were used to determine the Company Water Rate. Within sixty (60) days following receipt of the written notice containing the Company Water Rate, the Company shall file a Tier 1 advice letter for rate recovery with the CPUC to update its rates and tariffs, and in doing so establish a surcharge rate to reflect the Company Water Rate.

All changes to the Company Water Rate resulting from annual increases or decreases to the Fixed Project Costs or Project Operation and Maintenance Expenses, as reflected in the Company Water Rate, shall be requested for rate recovery through a Tier 1 advice letter in accordance with Section 3.2 of Water Industry Rules in General Order 96-B, as amended from time to time, for processing expense offset rate changes. The rate change will be applied to the surcharge to ensure that the Company's customer rates remain aligned with the Company Water Rate under the Agreement.

The Company shall have no obligation to make Company Water Payments unless and until the CPUC approves payment and recovery of those payments in rates through the process set forth in General Order 96-B, including a Tier 1 advice letter, which is effective upon filing pending CPUC approval, or another process resulting in CPUC approval of such costs, which shall be diligently pursued by the Company. Failure of the Company to pay amounts in excess of the amount approved by the CPUC shall not constitute a breach, and the District and Agency shall not be relieved of any obligations hereunder as a result thereof.

Access to the books and records of the Agency and the District will be made available to the Company for purposes of reviewing the accuracy and reasonableness of all costs relating to the Project and determination of the Company Water Rate.

19. Additional Project Participants.

After giving sixty (60) days' prior written notice to the Company, the District and Agency may enter into water purchase agreements for AWT Water with Additional Project Participants subsequent to the Effective Date of this Agreement to the extent the District determines sufficient capacity exists (after accounting for the need to maintain the Operating Reserve Minimum and the Drought Reserve Minimum), to the extent there is no additional cost to the Company as a result of any such agreement, and to the extent any such agreement does not adversely affect the Agency's or the District's ability to meet their performance obligations under this Agreement.

In order to not diminish the source waters available to produce AWT Water under this Agreement, the Company shall have the right, prior to the District or the Agency entering into any water purchase agreement for AWT Water and in the Company's sole discretion, to approve or not approve in writing any Additional Project Participants deriving water from the water sources identified for the Project, specifically source waters identified in Sections 1.04 and 2.02 of the Amended and Restated Water Recycling Agreement between the Agency and Monterey County Water Resources Agency, dated November 3, 2015.

The Company shall not have the right to approve Additional Project Participants deriving water from prior existing rights to wastewater flows to the Regional Treatment Plant pursuant to Section 4.01 of the Agency's agreement with Monterey County Water Resources Agency or from future additional sources, as yet unidentified, such as wastewater systems annexed to the Agency's service area.

Any Additional Project Participant will pay for all additional capital costs necessitated by existence of the new water purchase agreement, its proportionate share of both the unamortized capital costs of the Project, and its proportionate share of future operation and maintenance expenses of the Project. The District and Agency will provide supporting documentation to the Company to ensure the Company Water Payments do not include any costs properly allocable to an Additional Project Participant.

20. Breach, Event of Default and Termination.

(a) Remedies for Breach – The Parties agree that, except as otherwise provided in this section with respect to termination rights, if any Party breaches this Agreement, any other Party may exercise any legal rights it may have under this Agreement and under Applicable Law to recover damages or to secure specific performance. No Party shall have the right to terminate this Agreement for cause except upon the occurrence of an Event of Default. If a Party exercises its rights to recover damages upon a breach of this Agreement or upon a termination due to an Event of Default, such Party shall use all reasonable efforts to mitigate damages. If a Force Majeure Event occurs, the Affected Party shall be entitled to relief from determination of a breach pursuant to Section 23 of this Agreement.

(b) If the District fails to exercise, and diligently pursue, any legal rights it may have against the Agency pursuant to subsection (a) of this section 20 within forty-five (45) days after the Company's written request that the District do so, the District shall be deemed to have assigned to the Company all such legal rights. The Agency shall not object to any such assignment, but shall not waive any defense it may otherwise assert to any claim brought by the Company.

(c) Event of Default – The following shall each constitute an "Event of Default" under this Agreement:

(1) The Delivery Start Date does not occur on or before July 1, 2019;

(2) The Performance Start Date does not occur on or before January 1, 2020;

(3) The failure of the Agency or the District to deliver Company Water to the Delivery Point in quantities at least equal to the Company Allotment in each of three consecutive Fiscal Years;

(4) The failure of the Agency or the District to meet the Water Delivery Guarantee in each of two consecutive Fiscal Years;

(5) The failure of the Agency or the District to deliver Company Water to the Delivery Point in quantities at least equal to 1,800 acre-feet in any Fiscal Year;

(6) The failure of the Agency or the District to meet the Water Availability Guarantee in any Fiscal Year;

(7) The failure of any Party to perform any material term, covenant, or condition of this Agreement, and the failure continues for more than thirty (30) days following the defaulting Party's receipt of written notice of such default from a non-defaulting Party; provided, however, that if and to the extent such default cannot reasonably be cured with such thirty (30) day period, and if the defaulting Party has diligently attempted to cure the same within such thirty (30) period and thereafter continues to diligently attempt to cure the same, then the cure period provided for herein shall be extended from thirty (30) days to one-hundred twenty (120) days;

(8) The failure of the Agency or the District to meet the Water Treatment Guarantee on a repeated basis; and

(9) The Company no longer has a statutory duty to serve water in the Service Area.

(d) Termination for Event of Default – If an Event of Default occurs, any non-defaulting Party may terminate this Agreement immediately upon written notice to the other Parties. A non-defaulting Party may enforce any and all rights and remedies it may have against a defaulting Party under Applicable Law.

21. Dispute Resolution.

Representatives from each Party shall meet and use reasonable efforts to settle any dispute, claim, question or disagreement (a "Dispute") arising from or relating to this Agreement. To that end, the Parties' representatives shall consult and negotiate with each other in good faith and, recognizing their mutual interests, attempt to reach a just and equitable solution satisfactory to the Parties. If the Parties do not reach such a solution within a period of thirty (30) days after the first notice of the Dispute is received by the non-disputing Parties, then the Parties shall pursue nonbinding mediation to be completed within one-hundred twenty (120) days after the notice of the Dispute is received by the non-disputing Parties. If the Parties do not settle the Dispute within the one-hundred twenty (120) day period, any Party may pursue any and all available legal and equitable remedies.

22. Indemnification.

Each Party (an "Indemnifying Party") shall fully indemnify the other Parties and their respective officers, directors, employees, consultants, contractors, representatives and agents (the "Indemnified Persons") against, and hold completely free and harmless from, all liability and damages including any cost, expense, fine, penalty, claim, demand, judgment, loss, injury and/or other liability of any kind or nature, including personal or bodily injury, death or property damage, that are incurred by or assessed against the Indemnified Persons and directly or indirectly caused by, resulting from, or attributable to the fault, failure, breach, error, omission, negligent or wrongful act of the Indemnifying Party, or its officers, directors, employees, consultants, contractors, representatives and agents, in the performance or purported performance of the Indemnifying Party's obligations under this Agreement, but only to the extent of and in proportion to the degree of fault, failure, breach, error, omission, negligent or wrongful act of the Indemnifying Party, or its officers, directors, employees, consultants, contractors, representatives and agents.

23. Force Majeure Event Relief.

(a) If a Force Majeure Event occurs, the Affected Party shall be entitled to (1) relief from its performance obligations under this Agreement to the extent the occurrence of the Force Majeure Event prevents or adversely affects Affected Party's performance of such obligations, and (2) an extension of schedule to perform its obligations under this Agreement to the extent the occurrence of the Force Majeure Event prevents or adversely affects Affected Party's ability to perform such obligations in the time specified in this Agreement. The occurrence of a Force Majeure Event shall not, however, excuse or delay the other Parties' obligation to pay monies previously accrued and owing to Affected Party under this Agreement, or for Affected Party to perform any obligation under this Agreement not affected by the occurrence of the Force Majeure Event.

(b) Upon the occurrence of a Force Majeure Event, Affected Party shall notify the other Parties in accordance with the notice provisions set forth herein promptly after Affected Party first knew of the occurrence thereof, followed within fifteen (15) days by a written description of the Force Majeure Event, the cause thereof (to the extent known), the date the Force Majeure Event began, its expected duration and an estimate of the specific relief requested or to be requested by the Affected Party. Affected Party shall use commercially reasonable efforts to reduce costs resulting from the occurrence of the Force Majeure Event, fulfill its performance obligations under the Agreement and otherwise mitigate the adverse effects of the Force Majeure Event. While the Force Majeure Event continues, the Affected Party shall give the other Parties a monthly update of the information previously submitted. The Affected Party shall also provide prompt written notice to the other Parties of the cessation of the Force Majeure Event.

24. Amendments.

No change, alteration, revision or modification of the terms and conditions of this Agreement shall be made, and no verbal understanding of the Parties, their officers, agents or employees shall be valid, except through a written amendment to this Agreement duly authorized and executed by the Parties.

25. Remedies Not Exclusive.

The use by any Party of any remedy for the enforcement of this Agreement is not exclusive and shall not deprive the Party using such remedy of, or limit the application of, any other remedy provided by law.

26. Mitigation of Damages.

In all situations arising out of this Agreement, the Parties shall attempt to avoid and minimize the damages resulting from the conduct of another Party.

27. Failure of CPUC Approval.

If this Agreement is not approved by the CPUC in a manner acceptable to the Parties, any Party may, within sixty (60) days after the effective date of the decision or order of the CPUC relating to the approval of this Agreement, give written notice to the other Parties that the Agreement will terminate ten (10) days after receipt of such notice. Those acts and obligations that are to be performed on or after the Execution Date shall be discharged and no Party shall thereafter be obligated to continue to perform this Agreement or any provision hereof. Whether this Agreement is approved by the CPUC in a manner acceptable to the Parties or not, those acts and obligations performed prior to the date of termination shall be final and no party shall have any claim to be restored to its pre-Execution Date status with regard to any of those acts or obligations.

28. Insurance.

The Agency and District will each obtain the applicable Required Insurance, as set forth in Exhibit D. If insurance proceeds fail to satisfy the obligations of the Agency or the District under this Agreement, the District and the Agency will utilize their own resources, including Prop 218 revenue raising capacity, to the extent allowable by law, to satisfy their obligations.

29. No Waiver.

Failure by a Party to insist upon the strict performance of any of the provisions of this Agreement by another Party, irrespective of the length of time for which such failure continues, shall not constitute a waiver of such Party's right to demand strict compliance by such other Party in the future. No waiver by a Party of any default or breach shall affect or alter this Agreement, and each and every covenant, term, and condition hereof shall continue in full force and effect to any existing or subsequent default or breach.

30. Successors in Interest, Transferees, and Assignees.

(a) This Agreement and all the rights and obligations created by this Agreement shall be in full force and effect whether or not any of the Parties to this Agreement have been succeeded by another entity, or had their interests transferred or assigned to another entity, and all rights and obligations created by this Agreement shall be vested and binding on any Party's successor in interest, transferee, or assignee. If the Company, the Agency or the District is succeeded by another entity, it shall assign this Agreement to its successor. If the District ceases to exist, the Agency and the Company shall continue their obligations hereunder in a manner that will substantively comply with the intent of this Agreement. Except as provided in subsection (b) of this Section 30, no succession, assignment or transfer of this Agreement, or any part hereof or interest herein, by a Party shall be valid without the prior written consent of the other Parties, such consent not to be unreasonably withheld.

(b) In the event of the creation of a local governmental agency duly established for the sole purpose of succeeding to, assuming, and performing all obligations and rights of Agency or District created by this Agreement, Agency or District may assign this Agreement and all those obligations and rights to such local governmental agency without consent, written or otherwise, of any other Party.

31. Covenants and Conditions.

All provisions of this Agreement expressed either as covenants or conditions on the part of the District, Agency, or the Company shall be deemed to be both covenants and conditions.

32. Governing Law.

This Agreement and the rights and obligations of the Parties shall be governed, controlled and interpreted in accordance with the laws of the State of California.

33. Headings.

All headings are for convenience only and shall not affect the interpretation of this Agreement.

34. Construction of Agreement Language.

The provisions of this Agreement shall be construed as a whole according to its common meaning and purpose of providing a public benefit and not strictly for or against any Party. The Agreement shall be construed consistent with the provisions hereof, in order to achieve the objectives and purposes of the Parties. Wherever required by the context, the singular shall include the plural and vice versa, and the masculine gender shall include the feminine or neutral genders or vice versa.

35. Drafting Ambiguities.

This Agreement is the product of negotiation and preparation between the Parties. The Parties and their counsel have had the opportunity to review and revise this Agreement. The Parties waive the provisions of Section 1654 of the Civil Code of California and any other rule of construction to the effect that ambiguities are to be resolved against the drafting Party, and the Parties warrant and agree that the language of this Agreement shall neither be construed against nor in favor of any Party unless otherwise specifically indicated.

36. Partial Invalidity; Severability.

If any provision of this Agreement is held by a court of competent jurisdiction to be invalid, void or unenforceable, the remaining provisions will nevertheless continue in full force without being impaired or invalidated in any way.

37. No Third Party Beneficiaries.

Nothing in this Agreement is intended to create any third Party beneficiaries to the Agreement, and no person or entity other than the Parties and the permitted successors, transferees and assignees of either of them shall be authorized to enforce the provisions of this Agreement.

38. Relationship of the Parties.

The relationship of the Parties to this Agreement shall be that of independent contractors. Each Party shall be solely responsible for any workers compensation, withholding taxes, unemployment insurance, and any other employer obligations associated with the described work or obligations assigned to them under this Agreement.

39. Signing Authority.

The representative of each Party signing this Agreement hereby declares that authority has been obtained to sign on behalf of the Party such person is representing.

40. Further Acts and Assurances.

The Parties agree to execute, acknowledge and deliver any and all additional papers, documents and other assurances, and shall perform any and all acts and things reasonably necessary in connection with the performance of the obligations hereunder and to carry out the intent of the Parties.

41. Opinions and Determinations.

Where the terms of this Agreement provide for action to be based upon opinion, judgment, approval, review or determination of any Party hereto, such terms are not intended to be and shall never be construed as permitting such opinion, judgment, approval, review or determination to be arbitrary, capricious or unreasonable.

42. Interpretation of Conflicting Provisions.

If there is any conflict, discrepancy or inconsistency between the provisions of this Agreement and the provisions of any exhibit or attachment to this Agreement, the provisions of this Agreement shall prevail and control.

43. Integration.

This Agreement, including the exhibits, represent the entire Agreement between the Parties with respect to the subject matter of this Agreement and shall supersede all prior negotiations, representations, or agreements, either written or oral, between the Parties as of the Effective Date.

44. Counterparts.

All signatures need not appear on the same counterpart of this Agreement and all counterparts of this Agreement shall constitute one and the same instrument.

45. Notices.

All notices to a Party required or permitted under this Agreement shall be in writing and shall be deemed delivered (i) when delivered in person; (ii) on the third day after mailing, if mailed, postage prepaid, by registered or certified mail (return receipt requested); or (iii) on the day after mailing if sent by a nationally recognized overnight delivery service which maintains records of the time, place, and recipient of delivery. Notices to the Parties shall be sent to the following addresses or to other such addresses as may be furnished in writing by one Party to the other Parties:

Monterey Peninsula Water Management District
5 Harris Court, Building G

Monterey, CA 93940
Attention: General Manager

Monterey Regional Water Pollution Control Agency
5 Harris Court, Building D
Monterey, CA 93940
Attention: General Manager

California American Water
Attn: President
655 W. Broadway, Suite 1410
San Diego, CA 92101

SIGNATURE PAGE FOLLOWS

IN WITNESS WHEREOF, the Parties hereto have executed this Agreement as of the date first above written.

MONTEREY REGIONAL WATER POLLUTION CONTROL AGENCY,

By: Gloria De La Rosa

Printed Name: Gloria De La Rosa

Board Chair, Agency Board of Directors

MONTEREY PENINSULA WATER MANAGEMENT DISTRICT,

By: Jeanne C. Byrne

Printed Name: Jeanne C. Byrne

Chair, District Board of Directors

CALIFORNIA-AMERICAN WATER COMPANY,

By: Robert G MacLean

Printed Name: Robert G MacLean

President

EXHIBIT A

Service Area

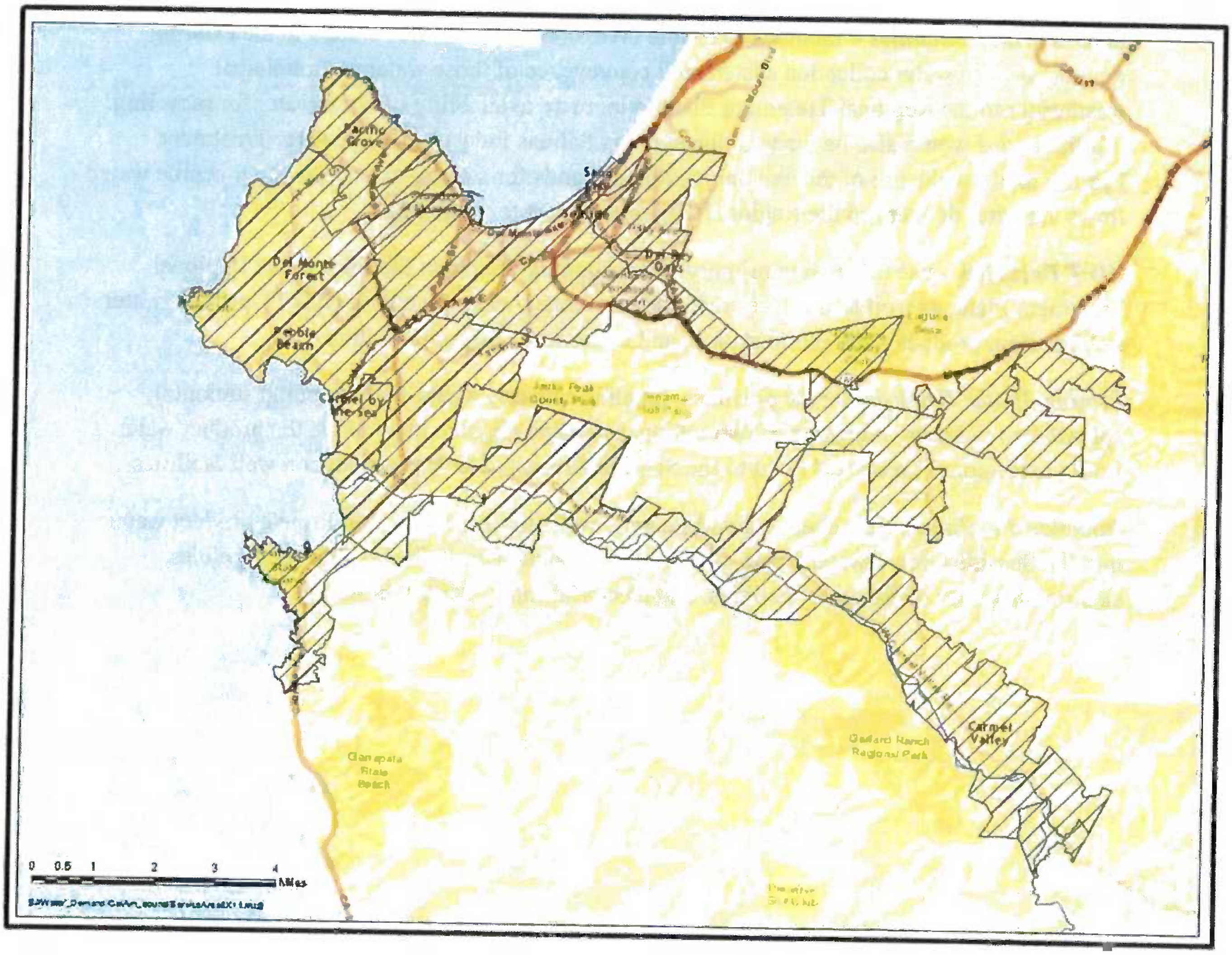

EXHIBIT B

Description of Project

Source Water Facilities – facilities to enable diversion of new source waters to the existing municipal wastewater collection system and conveyance of those waters as municipal wastewater to the Regional Treatment Plant to increase availability of wastewater for recycling. Modifications would also be made to the existing Salinas Industrial Wastewater Treatment Facility to allow the use of the existing treatment ponds for storage of excess winter source water flows and later delivery to the Regional Treatment Plant for recycling.

AWT Facilities – use of existing primary and secondary treatment facilities at the Regional Treatment Plant, as well as new pre-treatment, advanced water treatment (AWT), product water stabilization, product water pump station, and concentrate disposal facilities.

Product Water Facilities – new pipelines, pipeline capacity rights, booster pump station(s), appurtenant facilities along one of two optional pipeline alignments to move the product water from the Regional Treatment Plant to the Seaside Groundwater Basin injection well facilities.

Injection Facilities – new deep and vadose zone wells to inject Proposed Project product water into the Seaside Groundwater Basin, along with associated back-flush facilities, pipelines, electricity/ power distribution facilities, and electrical/motor control buildings.

EXHIBIT C

Delivery Point

AWT Water will be injected into the Seaside Groundwater Basin using new injection wells. The proposed new Injection Well Facilities will be located east of General Jim Moore Boulevard, south of Eucalyptus Road in the City of Seaside, including up to eight injection wells (four deep injection wells, four vadose zone wells, in pairs identified as #5, #6, #7, and #8 in the figure below), six monitoring wells, and back-flush facilities.

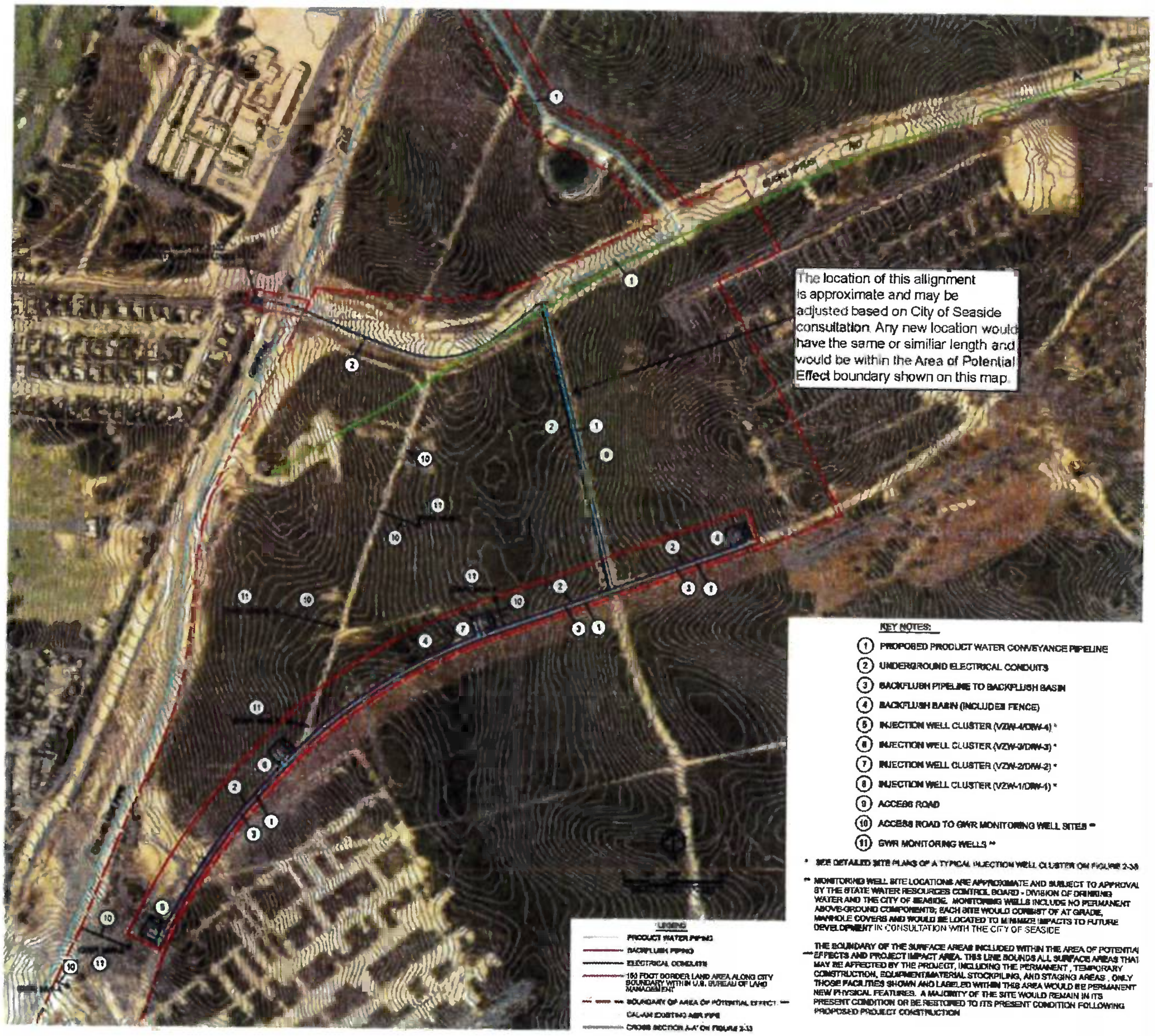

EXHIBIT D

Required Insurance

As provided in Section 28 of this Agreement, Agency and District shall, to the extent it continues to be available and applicable to the insured risk, obtain and keep in force during the term of this Agreement the following minimum insurance limits and coverage (or greater where required by Applicable Law). Such coverage will be in place not later than the inception of the covered activity, or such time as the Agency's and the District's insurable interest exists.

The cost of Project insurance obtained pursuant to this Exhibit is a Project Operation and Maintenance Expense as defined in Section 2 of this Agreement.

Upon request, Agency and District will provide Company with a certificate of insurance or memorandum of coverage as to any Project insurance and/or complete copies of policies.

Company shall be provided at least 30 days' written notification of cancellation, material reduction in coverage or reduction in limits.

Project insurance may be issued by a public agency Joint Powers Authority Program or insurance companies authorized to do business in California with a current A. M. Best rating of A or better.

All commercial general liability insurance, including completed operations-products liability, automobile liability, and pollution liability insurance obtained pursuant to this Agreement shall designate Company, its parent and affiliates, their respective directors, officers, employees and agents, as additional covered parties. All such insurance should be primary and non-contributory, and is required to respond and pay prior to any other insurance or self-insurance available to Company. In addition to the liability limits available, such insurance will pay on behalf or will indemnify Company for defense costs. Any other coverage available to Company applies on a contingent and excess basis. All such insurance shall include appropriate clauses pursuant to which the insurance companies shall waive their rights of subrogation against Company, its parent and affiliates, their respective directors, officers, employees and agents.

Agency shall require that the contractors and subcontractors of all tiers as appropriate provide insurance during the pre-construction and construction (as covered activities begin) of the AWT Facilities as described in "Pure Water Monterey – Insurance Requirements for Construction and Design Professional Contracts," attached to this Exhibit D as Attachment 1. Approval of any deviation or exception from these insurance requirements resides solely with the Agency.

Coverages:

i. The Agency will provide coverage as follows:

(a) General liability insurance, including coverage for auto, errors and omissions and employment practices, and for the Water Delivery Guarantee, Water Availability Guarantee, and Water Treatment Guarantee at Sections 12, 13, and 14, respectively, of this Agreement. Total general and excess liability coverage limits shall be no less than $15,000,000 per occurrence.

(b) "All Risk" Property Insurance (including coverage for Builders' Risk, with additional coverage for loss or damage by water, earthquake, flood, collapse, and subsidence) with a total insured value equal to replacement cost of the AWT Facilities during the term of this Agreement

(c) Cyber Liability Insurance with $2,000,000 coverage limits for first and third party limits.

(d) (1) Public Entity Pollution Liability (claims made and reported) with coverage limits in the amounts of $25,000,000 policy aggregate and $2,000,000 per pollution condition with a $75,000 per pollution condition retention; (2) Pollution & Remediation Legal Liability with coverage limits in the amounts of $1,000,000 each pollution condition and $5,000,000 aggregate liability limits including a self-insured retention not to exceed $25,000 each pollution condition; and (3) TankAdvantage Pollution Liability with coverage limits in the amounts of $1,000,000 each claim and $2,000,000 aggregate.

(e) Workers' Compensation/Employers' Liability. Workers' Compensation and Employer's Liability insurance and excess insurance policy(s) shall be written on a policy form providing workers' compensation statutory benefits as required by California law. Employers' liability limits shall be no less than one million dollars ($1,000,000) per accident or disease.

ii. The District will provide coverage as follows:

(a) General Liability Coverage: $10,000,000 per Occurrence
Personal injury and Property Damage Coverage

(b) Automobile Liability Coverage: $10,000,000 per Occurrence
Personal Injury and Property Damage Coverage

(c) Workers' Compensation Coverage

A. Statutory Workers Compensation Coverage;

B. Employers' Liability Coverage: $5,000,000 each Occurrence

(d) Public Officials' and Employees Errors and Omissions: $10,000,000 per Occurrence

(e) Property Coverage: $1,000,000,000 (pooled limit)
Includes Fire, Theft and Flood Coverage with property replacement values

(f) Public Entity Pollution Liability with coverage limits in the amounts of $10,000,000 per occurrence with a not-to-exceed $75,000 per-pollution-condition retention; and (2) Pollution & Remediation Legal Liability with coverage limits in the amounts of $10,000,000 per occurrence including a self-insured retention not to exceed $25,000 each pollution condition.

Attachment 1

Pure Water Monterey
Proposed Insurance Requirements for Construction and Design Professional Contracts

Contractors and design professionals (as that term is used in California Civil Code §2782.8) shall procure and maintain for the duration of the contract, and for twelve (12) years thereafter, insurance against claims for injuries to persons or damages to property which may arise from or in connection with the performance of the work hereunder by the contractor or design professional, his/her agents, representatives, employees, or subcontractors.[1]

MINIMUM SCOPE AND LIMIT OF INSURANCE

Coverage shall be at least as broad as:

1. **Commercial General Liability (CGL):** Insurance Services Office Form CG 00 01 covering CGL on an "occurrence" basis, including products and completed operations, property damage, bodily injury and personal & advertising injury with limits no less than $5,000,000 per occurrence. If a general aggregate limit applies, either the general aggregate limit shall apply separately to this project/location or the general aggregate limit shall be twice the required occurrence limit.

2. **Automobile Liability:** Insurance Services Office Form Number CA 0001 covering Code 1 (any auto), with limits no less than $5,000,000 per accident for bodily injury and property damage.

3. **Workers' Compensation** insurance as required by the State of California, with Statutory Limits, and Employers' Liability insurance with a limit of no less than $1,000,000 per accident for bodily injury or disease.

4. **Builder's Risk (Course of Construction)** insurance utilizing an "All Risk" (Special Perils) coverage form, with limits equal to the completed value of the project and no coinsurance penalty provisions.

5. **Surety Bonds** as described below.

[1] The coverages herein are understood to be representative only and the Agency and District retain the right to modify the insurance and indemnity requirements based upon the scope of services for any engagement.

6. **Professional Liability** (for all design professionals and contractors for design/build projects), with limits no less than $2,000,000 per occurrence or claim, and $4,000,000 policy aggregate.

7. **Contractors' Pollution Legal Liability and Errors and Omissions** (if project involves environmental hazards) with limits no less than $2,000,000 per occurrence or claim, and $4,000,000 policy aggregate.

If the contractor or design professional maintains higher limits than the minimums shown above, the Entity[2] requires and shall be entitled to coverage for the higher limits maintained by the contractor or design professional. Any available insurance proceeds in excess of the specified minimum limits of insurance and coverage shall be available to the Entity.

Deductibles and Self-Insured Retentions

Any deductibles or self-insured retentions must be declared to and approved by the Entity. At the option of the Entity, either: the contractor shall cause the insurer to reduce or eliminate such deductibles or self-insured retentions as respects the Entity, its officers, officials, employees, and volunteers; or the contractor or design professional shall provide a financial guarantee satisfactory to the Entity guaranteeing payment of losses and related investigations, claim administration, and defense expenses.

The insurance policies are to contain, or be endorsed to contain, the following provisions[3]:

1. The Entity, its officers, officials, employees, and volunteers are to be covered as additional insureds on the CGL policy with respect to liability arising out of with respect to liability arising out of work or operations performed by or on behalf of the Contractor including materials, parts, or equipment furnished in connection with such work or operations and automobiles owned, leased, hired, or borrowed by or on behalf of the Contractor. General liability coverage can be provided in the form of an endorsement to the Contractor's insurance (at least as broad as ISO Form CG 20 10 10 93, CG 00 01 11 85 or both CG 20 10 10 01 and CG 20 37 10 01 forms if later revisions used).

2. For any claims related to this project, the Contractor's insurance coverage shall be primary insurance as respects the Entity, its officers, officials, employees, and volunteers. Any insurance or self-insurance maintained by the Entity, its officers, officials, employees, or volunteers shall be excess of the Contractor's insurance and shall not contribute with it.

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2 The term "Entity" as used herein means the Agency or the District.

3 The term "Contractor" as used herein also means Design Professional in context of an agreement for services by a design professional as that term is used in CA CC 2782.8.

3. Each insurance policy required by this clause shall provide at least thirty (30) days' written notification of cancellation, material reduction in coverage or reduction in available limits.

Builder's Risk (Course of Construction) Insurance
Contractor may submit evidence of Builder's Risk insurance in the form of Course of Construction coverage. Such coverage shall name the Entity as a loss payee as their interest may appear.

If the project does not involve new or major reconstruction, at the option of the Entity, an Installation Floater may be acceptable. For such projects, a Property Installation Floater shall be obtained that provides for the improvement, remodel, modification, alteration, conversion or adjustment to existing buildings, structures, processes, machinery and equipment. The Property Installation Floater shall provide property damage coverage for any building, structure, machinery or equipment damaged, impaired, broken, or destroyed during the performance of the Work, including during transit, installation, and testing at the Entity's site.

Claims Made Policies
If any coverage required is written on a claims-made coverage form:

1. The retroactive date must be shown, and this date must be before the execution date of the contract or the beginning of contract work.

2. Insurance must be maintained and evidence of insurance must be provided for at least twelve (12) years after completion of contract work.

3. If coverage is canceled or non-renewed, and not replaced with another claims-made policy form with a retroactive date prior to the contract effective, or start of work date, the Contractor must purchase extended reporting period coverage for a minimum of five (5) years after completion of contract work.

4. A copy of the claims reporting requirements must be submitted to the Entity for review.

5. If the services involve lead-based paint or asbestos identification/remediation, the Contractors Pollution Liability policy shall not contain lead-based paint or asbestos exclusions. If the services involve mold identification/remediation, the Contractors Pollution Liability policy shall not contain a mold exclusion, and the definition of Pollution shall include microbial matter, including mold.

Acceptability of Insurers
Insurance is to be placed with insurers authorized to do business in California with a current A.M. Best rating of no less than A: VII, unless otherwise acceptable to the Entity.

Waiver of Subrogation

Contractor hereby agrees to waive rights of subrogation which any insurer of Contractor may acquire from Contractor by virtue of the payment of any loss. Contractor agrees to obtain any endorsement that may be necessary to affect this waiver of subrogation. The Workers' Compensation policy shall be endorsed with a waiver of subrogation in favor of the Entity for all work performed by the Contractor, its employees, agents and subcontractors.

Verification of Coverage

Contractor shall furnish the Entity with original certificates and amendatory endorsements, or copies of the applicable insurance language, effecting coverage required by this contract. All certificates and endorsements are to be received and approved by the Entity before work commences. However, failure to obtain the required documents prior to the work beginning shall not waive the Contractor's obligation to provide them. The Entity reserves the right to require complete, certified copies of all required insurance policies, including endorsements, required by these specifications, at any time.

Subcontractors

Contractor shall require and verify that all subcontractors maintain insurance meeting all the requirements stated herein, and Contractor shall ensure that Entity is an additional insured on insurance required from subcontractors. For CGL coverage subcontractors shall provide coverage with a format least as broad as CG 20 38 04 13.

Surety Bonds

Contractor shall provide the following Surety Bonds:

1. Bid bond
2. Performance bond
3. Payment bond
4. Maintenance bond

The Payment Bond and the Performance Bond shall be in a sum equal to the contract price. If the Performance Bond provides for a one-year warranty a separate Maintenance Bond is not necessary. If the warranty period specified in the contract is for longer than one year a Maintenance Bond equal to 10% of the contract price is required. Bonds shall be duly executed by a responsible corporate surety, authorized to issue such bonds in the State of California and secured through an authorized agent with an office in California.

Special Risks or Circumstances

Entity reserves the right to modify these requirements, including limits, based on the nature of the risk, prior experience, insurer, coverage, or other circumstances.

Hold Harmless - Contractor

To the fullest extent permitted by law, Contractor shall hold harmless, immediately defend, and indemnify Entity and its officers, officials, employees, and volunteers from and against all claims, damages, losses, and expenses including attorney fees arising out of the performance of the work described herein, caused in whole or in part by any negligent act or omission of the Contractor, any subcontractor, anyone directly or indirectly employed by any of them, or anyone for whose acts any of them may be liable, except to the extent caused by the active negligence, sole negligence, or willful misconduct of the Entity.

Hold Harmless – Design Professional

To the fullest extent permitted by law, Design Professional shall hold harmless, immediately defend, and indemnify Entity and its officers, officials, employees, and volunteers from and against all claims, damages, losses, and expenses including attorney fees that arise out of, pertain to, or relate to the negligence, recklessness, or willful misconduct of the Design Professional, or its employees, agents or subcontractors, except to the extent caused by the active negligence, sole negligence, or willful misconduct of the Entity.

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Attachment I

SWRCCB General Application

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GENERAL INFORMATION PACKAGE

I. TYPE OF ASSISTANCE REQUESTED

Amount of Assistance Requested: $

Proposed Security: ☑ Wastewater revenues and fund ☐ Water revenues and fund ☐ Other:

Project Type(s): ☑ Wastewater ☑ Water Recycling ☐ Estuary ☐ Nonpoint Source

II. APPLICANT INFORMATION

Applicant Name: Monterey One Water

Street Address: 5 Harris Ct, Bldg D	City: Monterey	State: CA	Zip+4 Code: 93940-5756

Applicant Type: ✓ Public Indian Tribe Nonprofit Other: Specify

County: Monterey	Charter City/County: ☑ Yes ☐ No

Mailing Address: 5 Harris Ct, Bldg D	City: Monterey	State: CA	Zip+4 Code: 93940-5756

Congressional District(s): 20

State Senate District(s): 12, 17

State Assembly District(s): 29,30

Data Universal Numbering System (DUNS) No.: 102772860	Federal Tax ID No.: 942424202

Regional Water Board where the project will take place: ☐ 1 (North Coast) ☐ 2 (San Francisco Bay) ☑ 3 (Central Coast) ☐ 4 (Los Angeles) ☐ 5 (Central Valley) ☐ 6 (Lahontan) ☐ 7 (Colorado River) ☐ 8 (Santa Ana) ☐ 9 (San Diego)

Authorized Representative Name, Title: Paul A. Sciuto, General Manager

Phone No.: (831) 645-4600	Email Address: paul@my1water.org

Contact Person Name: Mike McCullough

Phone No.: (831) 645-4618	Email Address: mikem@my1water.org

Local Counsel Name: George Thatcher

Phone No.: (831) 373-8733	Email Address: attys@wellingtonlaw.com

III. PROJECT INFORMATION AND PROPOSED SCHEDULES

Project Description: *(Enter a brief description of the project)*

M1W will expand the Advanced Water Purification Facility, recharge (injection) facilities, upgrade conveyance portions of the conveyance pipeline and Pond Storage and Return to accommodate 7.0 Million Gallons a Day.

Project Title: Pure Water Monterey Expansion

Project Location Street Address: 14811 Del Monte Blvd	City: Marina	State: CA	Zip+4 Code: 93933-3308

NPDES Permit or WDR Order No. (if applicable): CA 0048551

Current Year Estimated Population Served: 105,000

State Use Only	
CWSRF Project #	
Project Manager	
Date Received	

		Estimated or Actual Date
Estimated Project Schedule:	Complete Construction Application	
	1) General Information Package	4/6/2018
	2) Technical Package	11/6/2018
	3) Environmental Package	2/12/2019
	4) Financial Security Package	3/13/2019
	Complete Project Plans and Specifications	6/15/2019
	Advertise Bids	6/29/2019
	Issue Notice to Proceed	10/12/2019
	Complete Construction	3/3/2021

Consultation with Other Agencies
Please list other Federal and State agencies that have been involved in this project (e.g. planning, CEQA/NEPA consultation, funding, etc.), their contact information if known, and estimated dates for resolution of any issues.

California Public Utilities Commission (CPUC)

Partnering Agencies
Please list all other agencies that have an interest in this project. Provide contact information if known.

Monterey Peninsula Water Management District - Dave Stoldt - 831-658-5651

Potential CWSRF Flags Worksheet – Although not required, it is recommended that you complete and attach the Potential CWSRF Flags Worksheet to the General Information Package.

IV. ESTIMATED PROJECT CAPITAL COSTS AND FUNDING SUMMARY

Cost Classification	Total Project Costs	Other Funding	Requested Financing
A. Facilities Planning *(a)*	$ 2,442,000	$	$ 2,442,000
B. Facilities Design *(a)*	$ 3,173,333	$	$ 3,173,333
C. Construction Management *(a)*	$ 1,586,500	$	$ 1,586,500
D. Value Engineering *(a)*	$ 1,586,500	$	$ 1,586,500
E. Administration *(a)*	$	$	$
F. Facilities Construction Total	$ 31,732,666	$	$ 31,732,666
G. Contingency	$ 3,000,000	$	$ 3,000,000
H. Pre-Purchase Material/Equipment	$	$	$
I. Land and Right-of-Way	$ 100,000	$	$ 100,000
J. Other Costs	$ 173,000	$	$ 173,000
Explain: Legal			
K. Total Project Costs	$ 43,793,999	$	$ 43,793,999

(a) Soft costs may be provided for planning, design, value engineering, construction management, and administration costs.

Portion of the Total Project Costs that will serve existing facilities and/or existing communities $ 43,793,999

Portion of the Total Project Costs that will serve new development $ 0

V. TECHNICAL SPONSORSHIP

If the Division were to set up a technical sponsorship program, would you be interested in providing in-kind technical assistance to another CWSRF applicant in exchange for special financing? Note that checking "Yes" in no way obligates you to participate in this potential program or guarantees that this incentive will be available or offered.

☑ Yes ☐ No

If Yes, please indicate the areas where you would be willing to provide assistance:

- ☑ Assistance in completing a funding application
- ☑ Assistance in writing a facilities plan/project report
- ☑ Assistance in developing a Capital Improvement Plan
- ☑ Assistance in conducting a water or energy audit
- ☑ Assistance in building Operations & Maintenance capacity
- ☐ Other: Specify ______

VI. SUSTAINABILITY

A project that supports or incorporates one or more of the following sustainability goals receives one priority point for each area addressed.

Label the requested documents as Attachment G1, G2, G3, etc.

	The project supports infill development or results in the reuse or redevelopment of land in an area presently served by transit, streets, water, sewer and other essential services. **G1 – Provide a map highlighting the infill or redevelopment areas.**
	The applicant maintains a Capital Improvement Plan, an Asset Management Plan, or has performed a full-cost pricing analysis, or the project incorporates climate change adaption. **G2 – Provide copies or links to these plan or analysis.**
	The project protects environmental or agricultural resources such as farm, range and forest lends; wetlands and wildlife habitats; recreational lands such as parks, trails, and greenbelts; or landscapes with locally unique features or areas identified by the state as deserving special protection. **G3 – Provide a map highlighting the areas that will be protected.**
	The project is cited in one or more regional environmental management plans. **G4 – Provide copies or links to these plans.**
✓	The project incorporates wastewater or storm water/urban runoff recycling, water conservation, energy conservation, low impact development, or reduced use of other vital resources. **G5 – Explain the reason for the energy savings and the expected energy savings.**
	The project uses low-impact treatment for lower lifecycle operating costs through reduced energy, chemical, or other inputs. **G6 – Explain the reason(s) for the reduced operating costs.**

CERTIFICATION AND SIGNATURE OF AUTHORIZED REPRESENTATIVE

To the best of my knowledge and belief, I certify that I am authorized to submit this application; the information provided in this application is true and correct; the documentation has been duly authorized by the governing body of the applicant; and the entity possesses the legal authority to apply for the financing and enter into a financing agreement with the State Water Resources Control Board and to finance and construct the proposed facilities.

Name of Authorized Representative: Paul A. Sciuto Title: General Manager

Signature of Authorized Representative: Paul A. Sciuto Date: 4/6/18

HOW DID YOU HEAR ABOUT THE CWSRF PROGRAM?

☐ California Financing Coordinating Committee (CFCC) Funding Fair ☐ Colleague ☐ State Water Board Letter

☐ Conference/Trade Show/Workshop (Specify): ______ ☑ Employer/Employee

☐ Consultant ☐ Internet ☐ Publication ☐ Other (Specify): ______

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Attachment J

Pure Water Monterey Injection Well Field - Phase 3 Draft Civil Work Plan

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PURE WATER MONTEREY

INJECTION WELL FIELD

PHASE 3

DRAFT CIVIL WORK PLAN

Pure Water Monterey
A Groundwater Replenishment Program

Prepared by

Schaaf & Wheeler
CONSULTING CIVIL ENGINEERS
3 QUAIL RUN CIRCLE, SUITE 101
SALINAS, CA 93907

April 2018

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Table i. Acronyms Used in this Report

Acronym	Description
AFY, ac-ft/yr	Acre-feet/year
cfs	Cubic foot per second
CY	Cubic yard
gpd	Gallons per day
LF	Linear Feet
mgd	Million gallons per day
ASR	Aquifer Storage and Recovery
BLM	U.S. Bureau of Land Management
BMP	Best management practice
CAW, CalAm	California American Water Company
CCR	California Code of Regulations
CCRWQCB	Central Coast Regional Water Quality Control Board
DDW	SWRCB Division of Drinking Water
CEQA	California Environmental Quality Act
CMU	Concrete masonry unit
CWC	California Water Code
DWR	California Department of Water Resources
ESCA	Environmental Services Cooperative Agreement
FORA	Fort Ord Reuse Authority
GWR	Groundwater Replenishment
M1W	Monterey One Water (formerly MRWPCA)
MCWRA	Monterey County Water Resources Agency
MPWMD	Monterey Peninsula Water Management District
MRSWMP	Monterey Regional Stormwater Management Program
MRWPCA	Monterey Regional Water Pollution Control Agency (now M1W)
PWM	Pure Water Monterey
RTP	Regional Treatment Plant
RW	Recycled Water
SB	California Senate Bill
SIWTF	Salinas Industrial Wastewater Treatment Facility
SRDF	Salinas River Diversion Facility
SVRP	Salinas Valley Reclamation Plant
SVGB	Salinas Valley Groundwater Basin
SWRCB	California State Water Resources Control Board
USACE	U.S. Army Corps of Engineers
USBR	U.S. Bureau of Reclamation
USGS	U.S. Geologic Survey
UXO	Unexploded Ordnance

Table ii. Units of Measure Used in this Report

Unit	Equals
1 acre-foot	= 43,560 cubic feet = 325,851 gallons
1 cubic foot	= 7.48 gallons
1 cfs	= 448.8 gallons per minute = 724 acre-feet/year
1 MGD	= 1,000,000 gallons/day = 1,120 acre-feet / year
1 mg/L	= 1 ppm = 1 / 10^6
1 µg/L	= 1 ppb =1 / 10^9

Section 1 - Introduction

The purpose of this report is to summarize the civil construction activities for the Pure Water Monterey Injection Well Field, Phase 3, located in Seaside, CA.

Monterey One Water (M1W, formerly MRWPCA), in partnership with Monterey Peninsula Water Management District (MPWMD), is proceeding with design and construction of injection facilities as part of the Pure Water Monterey Groundwater Replenishment Project (Project). As part of this process, M1W has developed a well drilling and testing program to be implemented in three phases. Phase 1, completed in 2017, was the drilling of one deep injection well and a monitoring well cluster (with shallow and deep monitoring wells). Phase 2, to be constructed in 2018-2019, involves the drilling of a second deep injection well, a vadose zone injection well, and three additional monitoring well clusters. Phase 3 will add two deep injection wells, up to two vadose zone wells, a booster pump station and three monitoring well clusters. All of the wells are located in the Seaside Groundwater Basin (Seaside Basin) and are shown on Figure A1. Phases 2 and 3 also include construction of underground pipelines and conduits and surface improvements at the injection well sites.

The Work will be conducted on former Fort Ord land, now under the control of the Fort Ord Reuse Authority (FORA). Project wells will be located on two parcels that are part of the Seaside Munitions Response Site. Environmental cleanup activities are being conducted at this site under the Environmental Services Cooperative Agreement (ESCA) between FORA and the U.S. Army. Once these activities are complete, the land will be conveyed to the City of Seaside (City). ESCA parcels associated with the Project are outlined on Figure A1 (APN 031-211-001-00 and 031-151-062-000). Project wells will be drilled along a narrow strip of land (about 150 feet wide) designated for construction of wells, pipelines, and other injection appurtenances; the Injection Facility areas are highlighted on Figure A1.

In order to conduct the Phase 1 and Phase 2 work, M1W acquired a Right of Entry (ROE) permit from FORA and various approvals from the City of Seaside (City). The ROE must be extended for Phase 3, and an additional grading permit will be required from the City. This Work Plan describes the planned Phase 3 activities to support these requirements.

1.1 Project Background and Well Field Facilities

The Project involves advanced water treatment of industrial, agricultural, and municipal wastewater effluent and stormwater at a new Advanced Water Treatment Facility (AWTF) in Marina, California about six miles north of the Seaside Groundwater Basin (Seaside Basin). This purified recycled water (product water) will be conveyed to the Seaside Basin for recharge into basin aquifers for subsequent recovery from existing and proposed potable water extraction wells.

The approved Pure Water Monterey Project will recharge an average of 3,500 acre-feet a year (AFY) to increase water supply from the Seaside Basin. The Project incorporates a drought reserve component that allows an additional 200 AFY of water to be stored in the Seaside Basin during wet and normal years up to a maximum cumulative storage of 1,000 AF. During drought cycles, delivery to recharge wells will be decreased by a similar amount to allow increased water deliveries to agricultural areas outside of the Seaside Basin. The Phase 3 Project will increase the project yield by an average 2,250 AFY, requiring new injection and extraction wells. This memorandum describes the work plan for the injection well facilities only. A separate technical memorandum describes the extraction well facilities.

Recharge will occur in both of the Seaside Basin aquifers that are used for water supply including the relatively shallow Paso Robles Aquifer and the deeper Santa Margarita Aquifer. Recharge will be accomplished using two different injection well types: deep injection wells, which will inject product water directly into the Santa Margarita Aquifer, and vadose zone wells, which will be used to inject product water into the unsaturated zone for percolation to the underlying Paso Robles Aquifer. Consistent with the allocation of production in the basin, about 90 percent of the product water will be used to recharge the Santa Margarita Aquifer and about 10 percent will recharge the Paso Robles Aquifer. In order to accommodate maximum instantaneous delivery of product water at these percentages, wells are required to have a total maximum injection capacity of about 2,600 gallons per minute (gpm) for deep injection wells and 150 gpm for vadose zone wells. Recharge wells will be connected to a product water supply pipeline. Well designs and drilling methods are discussed in detail in the Pure Water Monterey Well Drilling and Testing, Phase 3 Field Programs Workplan (Field Program Workplan), prepared by Todd Groundwater.

The Injection Facilities will be constructed in a narrow strip of land along the southeastern parcel boundaries adjacent to land owned by the U.S. Bureau of Land Management (BLM). The Injection Facilities area is approximately 200 feet wide and 3,000 feet long. The southwestern edge is approximately 500 feet east of General Jim Moore Boulevard, near the intersection with San Pablo Avenue. From that point, the area curves northeastward and upslope approximately 3,000 feet along two parcel boundaries, generally following existing unimproved roads of former Fort Ord lands. The northeastern edge of the site is approximately 2,200 feet east of General Jim Moore Boulevard and 1,200 feet south of Eucalyptus Road.

In accordance with Title 22 of the California Code of Regulations requirements, monitoring wells will be installed adjacent to the injection wells (within the well lot). Additional monitoring wells will be installed between each injection point and the closest downgradient drinking water supply well. Monitoring wells must be capable of monitoring each aquifer receiving injection. Therefore, monitoring wells are being drilled in pairs with one well screened in the upper Paso Robles Aquifer and the other screened in the Santa Margarita Aquifer.

The preliminary design of the Injection Facilities included a total of eight recharge wells – four deep injection wells and four vadose zone wells, located within four well lots. The Project also included eight monitoring well clusters and a percolation basin for discharge of water back-flushed from injection wells for maintenance (backflush basin). All eight recharge wells were evaluated in the recent Project Environmental Impact Report (EIR) and included in the Engineering Report prepared for the Title 22 permit application. Well sites are designated numerically, with Well Site 1 being the furthest east, and Well Site 4 being the furthest west (see Figure A2). Wells are numbered in the order in which they are drilled.

1.2 Field Program Overview

The goal of the Field Program is to construct Project injection wells for recharge of product water into the Seaside Basin. Objectives of the Field Program include:

- Evaluate local aquifer conditions, to include groundwater levels and quality
- Estimate specific injection capacity of both well types
- Establish monitoring wells for the Project groundwater monitoring network

Wells are being installed in phases to allow for adjustments to the final design of wells and other injection facilities. Phase 1 installed wells within Well Site 2, and Phase 2 work will install wells within Wells Sites 2 and 3, and at two additional monitoring sites. Phase 3 will install monitoring and deep injection wells within well Sites 1 and 4, a vadose zone well at Well Site 3, and at a third monitoring well site. Based on the testing performance of VZW-1 during Phase 2, three vadose zone wells may be needed. If a third vadose zone well is required, it will be installed at Well Site 4. This work plan includes that well. The Phase 3 work is summarized in Table 1-1, below.

Table 1-1: Work Elements by Phase and Location

Phase	Area	Activities
3	Existing Dirt Roads	Grading (if needed) Install underground piping by open trench Install all-weather surface
3	Well Site 1	Clear, grub & strip 150' x 300' work area Grade 100' x 100' lot Drill wells DIW-4, MW-4S and MW-4D Spread well cuttings on-site Test and develop Well DIW-4 Install underground piping by open trench Install well site equipment
3	Well Site 3	Drill well VZW-2 Spread well cuttings on site Install well site equipment
3	Well Site 4	Clear, grub & strip 150' x 150' work area Grade 100' x 100' lot Drill wells DIW-3, MW-3S and MW-3D Drill well VZW-3 (if needed) Spread well cuttings on-site Test and develop Well DIW-3 Install underground piping by open trench Install well site equipment
3	Booster Pump Station	Clear, grub & strip 120' x 100' work area Grade 40' x 100' lot Install underground piping by open trench Construct pump station and install equipment
3	Percolation Basin	Scarify (if needed) Surface lay temporary piping to Well Sites 1 and 4
3	Monitoring Well 3A	Clear and grade a 250' x 20' access driveway Clear and grade a 100' x 100' work area Drill wells MW-3AS and MW-3AD Spread well cuttings on-site Install well site equipment

1.3 Right-Of-Entry (ROE) Requirements

Because of the history of military activities on the former Fort Ord lands, the FORA ROE requirements focus on ground disturbing activities and monitoring for unexploded ordnance (UXO). The ROE application will be reviewed and coordinated with the FORA UXO contractors and the California Department of Toxic Substances Control (DTSC). Ground disturbing activities will be subject to UXO Awareness training, monitoring, and construction support by FORA contractors. Specific ROE application requirements include: location and description of ground disturbing and other work activities; calculations of the amount of soil to be disturbed; development of a soils management plan; and the schedule (dates) over which activities will occur.

The City of Seaside has established operating procedures for any projects involving soil disturbance or groundwater wells within the former Fort Ord lands (Chapter 15.34, Seaside Municipal Code, also referred to as the Ordnance Ordinance). The procedures are applicable to projects that disturb greater than 10 cubic yards (CY) of soil on certain parcels identified as having munitions or explosives of concern, including the two parcels involved in the injection well field. Further restrictions are involved for proposed well installations or groundwater recharge projects on parcels having a groundwater covenant. Although these parcels do not have a groundwater covenant (DTSC LUC Tracking No. SOIL 6), the parcels are subject to certain soil restrictions as categorized below:

1. No sensitive uses
2. No soil disturbance or violation of ordinance without a management plan
3. Notification of MEC is required
4. Access rights are required.

In addition to the requirements for soil management, other City permits and approvals are necessary for implementation of the Project. The process for securing those approvals is being conducted concurrently with the request for an ROE.

1.4 Summary of Ground Disturbing Activities

Ground disturbing activities associated with Phase 3 are summarized below and described in detail in other sections of the Work Plan. In general, these activities include:

- grading existing access roads, which may include scarifying and compacting;
- clearing and grading of two large work areas (150 feet by 300 feet), which includes leveling of a permanent well pad (100 feet by 100 feet) within each work area, for well drilling and installation of multiple wells;
- clearing and grading of one smaller work area (100 feet by 100 feet) for drilling and installation of one monitoring well cluster;
- clearing and grading of one new 20-foot wide monitoring well access road (total of approximately 130 linear feet);
- clearing and grading the booster pump station site (120 feet by 100 feet) adjacent to the electrical equipment site;

- movement and staging of tanks, drill rigs, vehicles, and heavy equipment on the work areas;
- drilling, logging, and construction of up to seven wells, including three monitoring well clusters with two boreholes each (total of 10 drilled boreholes);
- anchoring of noise abatement walls, lighting, and/or other features within each work area, as needed;
- land application of soil and cuttings from 10 drilled boreholes;
- discharge of water from well development and aquifer testing activities in the percolation pond constructed during Phase 2 by running temporary piping down existing unimproved roads;
- scarifying of the bottom of the percolation pond to improve infiltration rates;
- constructing approximately 1,000 LF of product water pipeline by open trench methods;
- constructing approximately 1,000 LF of product water pipeline by open trench methods;
- constructing approximately 1,000 LF of joint trench (power and controls) by open trench methods; and
- constructing surface improvements within disturbed areas.

1.4.1 Location of Ground Disturbing Activities

All ground disturbing activities will occur within delineated work areas in portions of two ESCA parcels as shown on Figure A1 and listed below:

- APN 031-151-062-000
- APN 031-211-001-000

The location of the proposed Phase 3 wells, pipeline alignments and parcel boundaries are shown on Figure A1. Detailed descriptions of the work areas and soil calculations associated with each are presented in Section 2 (Phase 3 activities) of this Work Plan.

1.4.2 Site Access

Construction vehicles and equipment (including drilling rigs) will access the work areas using existing unimproved roads on the FORA property. Workers will enter the property from Eucalyptus Road, turning south onto an existing unimproved dirt road approximately 1,100 feet east of the intersection of General Jim Moore Blvd and Eucalyptus Road (see arrows on Figure A1). The dirt road, referred to in some of the Fort Ord documents as Austin Road, is accessed through an existing FORA locked gate near Eucalyptus Road. This road connects to other existing unimproved roads that provide access to work areas designated for Project wells. Austin

Road is an essential fire access road and will not be blocked during any part of the field programs.

Phase 2 will add a driveway entrance on General Jim Moore Blvd near San Pablo Drive. This entrance will be used for Operations and Maintenance staff only. Construction traffic will enter from Eucalyptus Road.

A road along the parcel southern boundary will be used for Phase 3 activities. Although parking along this road is envisioned during the field programs, the road will maintain at least a single traffic lane at all times.

The proposed Phase 3 monitoring well (MW-3A) will be located near General Jim Moore Blvd, and may potentially be accessed from the percolation basin site or from the utility corridor.

Work areas are shown in more detail on maps presented in subsequent sections of this Work Plan. In general, well pad and construction staging areas will be graded around the proposed wells prior to field activities. Two work areas, each with dimensions of 150 feet by 300 feet, will be graded around the areas proposed for permanent well pads for the drilling and installation of the injection wells. One new access road (approximately 130 linear feet) and one smaller work area (dimensions of about 100 feet by 100 feet) will also be graded to support construction of a monitoring well cluster that will be drilled away from the permanent well pads.

1.4.3 Soil Disturbance Calculations

Grading associated with the Phase 3 activities will consist of clearing vegetation and re-distributing surficial soils to flatten a work area. In general, soils will be redistributed across a work area or, in the case of well cuttings, stockpiled within the work areas. Cut and fill will be balanced for each area to ensure that soils remain on-site. Only small quantities of soil (from the drilled boreholes) will be removed from the site to allow laboratory analyses for purposes of well design (maximum estimated total of less than 2 ft^3).

A 50-foot band along the southern boundary of the Injection Facilities area (labeled as Blue Line Road on Figure A1) has been identified by FORA as a utility corridor. This corridor is associated with different remediation standards than those for the remaining portion of the Injection Facilities area. As such, there are restrictions regarding soil movement and management across this zone. In particular, soils from the utility corridor cannot be moved into remaining areas, which have a higher cleanup standard. Soils outside of the utility corridor can be moved into the corridor, but then cannot be returned to outside areas. The utility corridor encompasses a portion of the land north of the existing access road. Care will be taken to manage soils within these two zones separately. The utility corridor will be clearly delineated during all construction activities. Surveyors will provide specific information to allow staking or other demarcation of this boundary in order to properly manage soils.

Estimated amounts of soil to be disturbed during the Proposed Field Programs are summarized in Table 1-2. The basis and assumptions for these calculations are discussed for each item in Sections 2 (Phase 3 activities) of this Work Plan.

Table 1-2: Estimated Soil Disturbance by Phase

Phase	Proposed Project Well/Feature	Site Grading	Road Grading	Borehole Cuttings	Total	Total
		(ft^3)	(ft^3)	(ft^3)	(ft^3)	(CY)
3	Well Site 1	67,500			67,500	2,500
3	Access Roads		20,000		20,000	741
3	MW-4D & 4S			800	800	30
3	DIW-4			6,000	6,000	222
3	Well Site 3				0	0
3	VZW-2			3,000	3,000	111
3	Well Site 4	45,000			45,000	1,667
3	Access Roads		0		0	0
3	MW-3D & 3S			800	800	30
3	DIW-3			6,000	6,000	222
3	VZW-3 (if needed)			3,000	3,000	111
3	MW-3A	15,000	2,500	800	18,300	678
3	Booster Pump Station	18,000			18,000	667
3	Scarify Percolation Basin	12,600			12,600	467
3	24" Water Main	60,000			60,000	2,222
3	16" Backwash Pipeline	27,000			27,000	1,000
3	Power/Control Conduits	46,200			46,200	1,711
	Total:				**334,200**	**12,378**

As shown in Table 1-2, the proposed wells disturb soil within designated work areas, along new access roads, and with depth in each borehole. The development and testing program for DIW-3 and DIW-4 will require temporary discharge of relatively large volumes of groundwater. In order to accommodate these volumes, discharge is proposed to be conveyed with temporary piping to the percolation basin constructed in Phase 2 (see Figure A1). As explained in subsequent sections, the bottom of the depression will be scraped (scarified) in order to improve infiltration rates of the discharged water. This activity may disturb up to 12,600 ft^3 of soil as shown in Table 1-2. Scarifying the basin may be required more than once during Phase 3.

Finally, there may be additional activities within the designated work areas that require local staking and anchoring to deeper depths than previously graded. An example of these activities includes anchoring of noise abatement walls (if needed).

1.4.4 Soils Management Plan

The Project's soils management plan incorporates restrictions from both FORA and the City and provides guidelines for onsite compliance. For clearing and grading of the work areas, a separate grading permit will also be required. This plan supplements the grading plan required for that permit. Components of the soils management plan are provided below:

- Incorporate UXO Awareness Training and Monitoring into field activities as required by FORA; also incorporate requirements will into the Health and Safety Plan.
- Adhere to any requirements of the FORA UXO contractor for construction support.
- Delineate the 50-foot utility corridor using a licensed surveyor.
- Maintain separate soil management zones for soils within (Zone 1) and outside (Zone 2) of the 50-foot utility corridor.
- Balance cut and fill on the work areas such that no soil is deposited outside the work area or removed from the site.
- Conduct grading in accordance with all requirements in the grading permit.
- Designate a specific section of the ground surface within each work area where soils and cuttings will be stockpiled; ensure that the cuttings areas are in the same soils management zone as the boreholes.
- Use best management practices to avoid erosion or over-wetting of the stockpiled cuttings and soils.
- Prevent comingling of cuttings from boreholes in different soils management zones; however, comingling of cuttings from various boreholes within the same management zone (e.g., Zone 2) is allowed.
- Grade the cuttings stockpile at appropriate times to level the area and distribute the cuttings across the work area.
- Document all cuttings that are removed from the site for laboratory analyses as needed; transport soil samples to laboratory under a chain-of-custody protocol.
- Incorporate the soils management plan into all contracts for drilling and construction associated with the Field Programs.

1.4.5 Water Management Plan

Control of water within the disturbed areas and during well drilling and testing will include the following items:

- Water applied for dust control or compaction will be managed to prevent run-off.

- If constructing in the wet season, erosion control barriers will be installed along disturbed portions of the utility corridor to prevent the migration of sediments into the residential (higher clean-up) area.
- Drilling fluids (mud) will be contained within portable tanks where solids (soil cuttings) will settle out. Drilling mud will not be discharged directly onto the ground.
- At the completion of the well drilling, the drilling fluids will be moved to the next well or hauled away for disposal off-site. A temporary seepage pit may be used to dewater the drilling fluids and reduce the volume of material to be hauled.
- Well testing and development water will be routed through settling tanks as needed and then discharged to a local percolation basin (northeast of the intersection of General Jim Moore Blvd and San Pablo Ave) for recharge into the groundwater basin. This will require temporary piping laid alongside the existing dirt road from the well to the percolation basin. The maximum daily discharge would be approximately 385,000 cubic feet (assuming 24-hours of aquifer test pumping at 2,000 gpm).

1.5 Schedule

Phase 3 activities involve the installation of up to seven wells (including three well clusters). The amount of time required to complete the program depends on the number of rigs being used concurrently, the sequencing of events, and other factors. Assuming some overlap of activities, the Phase 3 Field Program is estimated to take approximately nine to twelve months to complete.

On-going maintenance activities will commence at the completion of facility construction and commissioning, and continue indefinitely into the future. Operation and maintenance of the Phase 1 and 2 sites will be ongoing during the Phase 3 construction period.

In Table 1-3, below, the duration of soil disturbing activities is estimated to facilitate the FORA/ESCA site support planning. Descriptions of these activities are provided in Section 2 of this Work Plan. Well drilling durations are for the top 30-ft of soil disturbance, and not the time required for drilling, log and completing the well to the full depth. Phase 3 may have work occurring concurrently on multiple sites.

Table 1-3: Estimated Durations of Soil Disturbing Activities, by Phase

Phase	Area	Activities	Duration (work days)
3	Existing Dirt Roads	Grading (if needed)	1
3	Existing Dirt Roads	Install 1000 LF of water main	5
3	Existing Dirt Roads	Install 1000 LF of conduits (power/controls)	5
3	Existing Dirt Roads	Install 1000 LF of backflush water pipeline	5
3	Existing Dirt Roads	Install all-weather surface	NA
3	Well Site 1	Clear, grub & strip 150' x 300' work area	0.5
3	Well Site 1	Grade 100' x 100' lot	0.5
3	Well Site 1	Drill well MW-4D (top 30-ft)	1
3	Well Site 1	Drill well MW-4S (top 30-ft)	1
3	Well Site 1	Drill well DIW-4 (set conductor casing to 30-ft)	2
3	Well Site 1	Test and develop Well DIW-4	NA
3	Well Site 1	Install on-site underground piping	4
3	Well Site 1	Excavate foundations	2
3	Well Site 1	Set fence posts	1
3	Well Site 3	Drill well VZW-2 (set conductor casing to 30-ft)	2
3	Well Site 3	Spread well cuttings on-site	NA
3	Well Site 4	Clear, grub & strip 150' x 300' work area	0.5
3	Well Site 4	Grade 100' x 100' lot	0.5
3	Well Site 4	Drill well MW-3D (top 30-ft)	1
3	Well Site 4	Drill well MW-3S (top 30-ft)	1
3	Well Site 4	Drill well DIW-3 (set conductor casing to 30-ft)	2
3	Well Site 4	Test and develop Well DIW-3	NA
3	Well Site 4 (if needed)	Drill well VZW-3 (set conductor casing to 30-ft)	2
3	Well Site 4	Spread well cuttings on-site	NA
3	Well Site 4	Install on-site underground piping	4
3	Well Site 4	Excavate foundations	2
3	Well Site 4	Set fence posts	1
3	Booster Pump Station Site	Clear, grub & strip 120' x 100' work area	0.5
3	Booster Pump Station Site	Grade 40' x 100' lot	0.5
3	Booster Pump Station Site	Install on-site underground piping	4
3	Booster Pump Station Site	Excavate foundations	2
3	Booster Pump Station Site	Set fence posts	1
3	Booster Pump Station Site	Construct pump station	NA
3	New Percolation Basin	Scarify (if needed)	0.5
3	New Percolation Basin	Surface lay temporary piping to Well Site 1	NA
3	New Percolation Basin	Surface lay temporary piping to Well Site 4	NA
3	Monitoring Well 3A	Grade a 250' access driveway	0.5
3	Monitoring Well 3A	Clear and grade a 100' x 100' work area	0.5
3	Monitoring Well 3A	Drill well MW-3AD (top 30-ft)	1
3	Monitoring Well 3A	Drill well MW-3AS (top 30-ft)	1
3	Monitoring Well 3A	Spread well cuttings on-site	NA
3	Monitoring Well 3A	Install well cap and grout seal	NA
		Total Days Requiring On-Site Monitoring:	**55.5**

Section 2 - Phase 3 Activities

Phase 3 involves the drilling and installation of three monitoring well clusters (MW-3, MW-4 and MW-3A), two deep injection wells (DIW-3 and DIW-4), and up to two vadose zone injection wells (VZW-2 and VZW-3). It includes site grading for Well Sites 1 and 4, monitoring wells site 3A, and underground pipeline construction extending the water mains and conduits from Well Site 2 to Well Site 1. Finally, it includes the construction of surface improvements at Well Sites 1 and 4, and providing an all-weather surface on the access road. The sequencing of Phase 3 field activities will be determined based upon the well testing results during construction. The specific activities in Phase 3 are:

- Mobilize grading/earth-moving equipment to regrade the access roads (if needed) and to clear and grade Well Site 4 (150-ft x 300-ft work area, 100-ft x 100-ft finished lot). Equipment may include road grader, dozer, backhoe/track-hoe and roller compactor. Well Site 4 is adjacent to areas graded during Phase 2, so portions of the construction area may not require additional grading.
- Move the grading/earth-moving equipment to Monitoring Well 3A and clear/grade the access driveway and work area (100-ft x 100-ft work area, 10-ft x 10-ft finished lot).
- Move the grading/earth-moving equipment to Well Site 1 and clear/grade the 150-ft x 300-ft work area and 100-ft x 100-ft finished lot.
- Move the grading/earth-moving equipment to the Booster Pump Station site and clear/grade the 120-ft x 100-ft work area and 40-ft x 100-ft finished lot.
- Move the grading equipment to the percolation basin site, and scarify the bottom as needed prior to and following well development testing.
- Mobilize a direct or reverse rotary rig to Well Site 4; drill, log, develop, and install monitoring well cluster MW-3 in close proximity to the DIW-3 proposed location.
- Move the drilling rig to Well Site 1; drill, log, develop, and install monitoring well cluster MW-4 in close proximity to the DIW-4 proposed location.
- Move the drilling rig to the Monitoring Well 3A site; drill, log, develop, and install monitoring well cluster MW-3A.
- Mobilize a reverse rotary rig to Well Site 4; drill, log, and install DIW-3.
- Mobilize an auger rig to Well Site 3; drill, log and install VZW-2.
- If needed, move the auger rig to Well Site 4; drill, log and install VZW-3.
- Move the reverse rotary rig to Well Site 1; drill, log, and install DIW-4.

- Develop DIW-3 with mechanical and pumping techniques. Discharge development water to the percolation basin.
- Develop DIW-4 with mechanical and pumping techniques. Discharge development water to the percolation basin.
- Demobilize rigs offsite, build well completion pads, clean site.
- Construct approximately 1,000-LF of production water pipeline under the existing access roads by open trench methods. Pipeline will connect to the pipeline constructed in Phase 2, and extend it from Well Site 2 to Well Site 1.
- Construct approximately 1,000-LF of conduit trench for power and control cables under the existing access roads by open trench methods. Conduit trench will run parallel to the product water pipeline.
- Construct approximately 1,000-LF of backwash water pipeline under the existing access roads by open trench methods. Pipeline will connect to the pipeline constructed in Phase 2, and extend it from Well Site 2 to Well Site 1.
- Construct on-site improvements at Well Site 1, which will include underground pipelines and conduits, above grade equipment pedestals and supports, a deep injection well pump, an electrical equipment pad, site surfacing and a perimeter fence.
- Construct on-site improvements at Well Site 4, which will include underground pipelines and conduits, above grade equipment pedestals and supports, a deep injection well pump, an electrical equipment pad, site surfacing and a perimeter fence.
- Construct on-site improvements at the Booster Pump Station, which will include underground pipelines and conduits, the pump station building and equipment, site surfacing and extending the electrical site perimeter fence to include the pump station.

The Phase 3 Field Program will require a water supply for drilling fluids, equipment cleaning, dust control, and other uses. For this Project, M1W may provide water from the production water pipeline, or they may require the contractor to obtain access to a local fire hydrant and import water by truck.

Depending on contractor costs and other factors, multiple rigs may be used for the Phase 3 Field Program. Rigs are expected to be drilling concurrently on different well sites.

Proposed Phase 3 field activities and wells as previously summarized in Table 1-1 are described in more detail below. The amounts of soil that will be disturbed for Phase 3 work areas and wells (Table 1-2) are also described in the following sections.

2.1 Field Program Planning

Planning for the Phase 3 Field Program involves a series of activities including selection of field contractors, permitting, and determining the sequence of events. Contractors have not yet been identified and will be selected according to M1W protocol during or after the ROE process. All drilling will be conducted by California licensed drillers that have received pre-approval for insurance requirements from the City of Seaside. All site work will be conducted by a California licensed General Contractor. Event sequencing will be finalized with contractor input to provide an efficient, cost-effective field program.

Additional planning steps include identifying underground utilities (in coordination with FORA), securing well permits, and developing the final field program including health and safety measures. Some of these steps are described in more detail below.

2.1.1 Underground Utilities

The potential presence of underground lines or other potential hazards in the area will be evaluated in coordination with FORA and their UXO contractors. The Underground Service Alert (USA) system will also be contacted as typical for drilling projects.

2.1.2 Well Permits and Approvals

Permits required for the Phase 3 Field Program include a FORA ROE, approvals and permits from the City of Seaside, drilling permits from Monterey County and DWR, and approval of land application of water from well development and aquifer testing from the Regional Water Quality Control Board (RWQCB).

2.1.2.1 City of Seaside

According to the Ordnance Ordinance, the City of Seaside requires a Soils Management Plan for activities on the parcels associated with the Phase 3 Field Program. This plan is included in this Work Plan. Additional approvals will also be required from the City including a Conditional Use Permit, Encroachment Permit, Construction Permits, and land easements.

2.1.2.2 California Regional Water Quality Control Board (RWQCB)

Approval for land application of groundwater from well development and aquifer testing will be required from the RWQCB. This permit may be under a General Order for Waste Discharge Requirements (WDR) such as the WDRs for Discharges to Land with a Low Threat to Water Quality (DWQ 2003-0003).

2.1.2.3 Drilling Permits

Drilling permit requirements are outlined in the Field Program Workplan.

2.1.3 Health and Safety Program

All field personnel, including contractors and suppliers, will attend and comply with the UXO Awareness Training Program led by FORA ESCA contractors. Field personnel will follow site-specific rules and guidelines provided by the FORA ESCA contractors providing construction support and field monitoring.

Todd Groundwater will prepare a Site-Specific Health and Safety Plan (H&SP) for the Well Drilling Field Programs prior to mobilization in the field, as discussed in the Field Program Workplan. The well drilling and general contractor will also be required to develop a Site-Specific H&SP for the Project. Both the Todd Groundwater H&SP and the contractor H&SP will reference the other and require adherence to both plans.

2.2 Well Site 1 Civil Work

Deep injection well DIW-4 and monitoring well cluster MW-4 will be constructed at Well Site 1 as part of the Phase 3 work, as well as the Well Site surface improvements As shown on Figure A2, the well site is located about 2,000-feet east of General Jim Moore Blvd.

2.2.1 Work Area Preparation and Equipment Staging

A work area will be cleared for the Phase 3 wells to accommodate all construction activities associated with well drilling, installation, development, and testing. The area must be sufficiently large to allow turning and staging of drilling rigs, drill pipe layout, and large equipment such as tanks, air compressor, and a tool house in various configurations for the proposed Phase 3 wells. Proposed dimensions for the work area are 150 feet deep by 300 feet wide (see Figure A2). A permanent well pad approximately 100 feet by 100 feet will be defined within this work area and will need to accommodate multiple boreholes. Site layouts for the well drilling are provided in the Field Program Workplan.

The existing unimproved access road will be evaluated at the time of construction for its ability to support the drilling rigs and support trucks. If needed, it will be regraded to remove ruts. Affected segments will be Austen Road (1,825 LF), which connects the utility corridor to Eucalyptus Road, and Blue Line Road within the utility corridor (1,000 LF from Well Site 1 to Well Site 2). The road from Well Site 2 to Well Site 4 will be improved during Phase 2. Regrading may include scarifying and compacting the top 12-inches of road surface.

2.2.2 Soils Management

The amount of soil disturbed for the site grading is estimated at 2,500 CY. This includes general clearing and grading over a work area of 150 feet by 300 feet. Within that work area, a well pad will be leveled consisting of 100 ft^2. The soil will be re-distributed over the work area during grading such that cut and fill are balanced. In general, soil will be moved parallel to the road from the higher side to the lower side to create a level work area. Staking or other field delineation measures will be used to define soil management zones.

The cuttings volume from drilling MW-4 and DIW-4 is estimated at 252 CY. Cuttings will be stockpiled within the work area, and then graded level over an approximately 100-ft by 200-ft area as part of the site clean-up at demobilization. Alternatively, the cuttings may be used at Well Site 4 as site fill. All wells are to be located on the residential clean-up side of the utility corridor boundary, so the cuttings may be stock-piled and spread in either area.

Grading and compacting the existing access roads will not relocate soils from one area to another. The only point where this may occur is at the intersection of the north-south road with the utility corridor. In that area, grading will be restricted to run north-to-south only.

Similarly, re-scarifying the percolation basin will not relocate soils. The disturbance is estimated at 467 CY, which is based on scarifying an area 120-ft long by 70-ft wide to a depth of 1.5-ft.

2.2.3 Aquifer Testing

Aquifer tests will be conducted in DIW-4 following development, as described in the Field Program Workplan. Groundwater pumped during aquifer testing will be discharged to the ground at the percolation basin west of the site (see Figure A1). Temporary piping will be used to convey groundwater to the basin for infiltration into the subsurface in accordance with a general order from the RWQCB. The pipeline will be surface laid in the utility corridor adjacent to the existing dirt road. At the end of the testing, the temporary pipeline will be disassembled and removed.

2.2.4 Site Improvements – Underground Construction

Underground pipelines and conduits will be installed on-site to connect the new facilities to the pipelines and conduits installed in the utility corridor. Construction will be by open-trench method, to depths up to 72-inches (6-feet) below finished grade. Trench construction will be by wheeled backhoe or tracked excavator. Soil disturbance may be up to 450 CY (assumes 200-LF at maximum 6-ft deep with 1V:1H side slopes). Compaction will be by small roller or hand tampers.

The soil materials on Fort Ord are generally poorly-graded sands, which are suitable for use as pipe bedding and structural backfill. No fill material will be imported. Trench spoils will be stockpiled on-site, and then returned to the trench as bedding and backfill. Excess trench spoils will be spread on-site within the appropriate management zone.

Underground construction within the Well Site will be sequenced by the general contractor to coordinate with the well drilling schedule, the pipeline construction in the utility corridor and the construction of surface improvements.

2.2.5 Site Improvements – Above Grade Construction

Surface improvements at the Well Site will include a concrete well pedestal at DIW-4, a deep well pump and electric motor at DIW-4, surface piping and valves to DIW-4, an electrical controls pad, a chain-link perimeter fence and all-weather surfacing of the driveway areas. The site layout will be similar to Well Site 3 (see Figure A3).

The equipment pedestal construction may require excavation up to 3-feet below finished grade. Existing soils will be scarified and recompacted to 95% relative dry density, using rollers or hand-tamping equipment. These areas will have been previously disturbed as part of the site grading prior to well drilling.

Fence construction will require setting fence posts to a depth of up to 4-feet below finished grade using an earth auger for excavation and backfilling with concrete. Surface paving will require compacting previously-disturbed areas using a roller compactor, placing up to 8-inches of compacted aggregate base.

2.3 Well Site 4 Civil Work

Deep injection well DIW-3, monitoring well cluster MW-3, if needed, vadose zone well VZW-3 and will be constructed at Well Site 4 as part of the Phase 3 work, as well as the Well Site surface improvements.

2.3.1 Work Area Preparation and Equipment Staging

A work area will be cleared for the Phase 3 wells to accommodate all construction activities associated with well drilling, installation, development, and testing. Proposed dimensions for the work area are 150 feet deep by 300 feet wide (see Figure A2). A permanent well pad approximately 100 feet by 100 feet will be defined within this work area and will need to accommodate multiple boreholes. Site layouts for the well drilling are provided in the Field Program Workplan

The access road in front of Well Site 4 will be graded during Phase 2. No additional earthwork within the roadway is anticipated.

2.3.2 Soils Management

The amount of soil disturbed for the site grading is estimated at 1,670 CY. This includes general clearing and grading over a work area of 150 feet by 300 feet. Portions of that area will be graded during Phase 2, and are not included in this total. Within that work area, a well pad will be leveled consisting of 100 ft^2. The soil will be re-distributed over the work area during grading such that cut and fill are balanced. In general, soil will be moved parallel to the road from the higher side to the lower side to create a level work area. Staking or other field delineation measures will be used to define soil management zones.

The cuttings volume from drilling MW-3, DIW-3 and VZW-3 is estimated at 363 CY. Cuttings will be stockpiled within the work area, and then graded level over an approximately 100-ft by 200-ft area prior to constructing surface improvements. Alternatively, the cuttings may be spread within the larger drainage depression area, if so directed by the City. All wells are to be located on the residential clean-up side of the utility corridor boundary, so the cuttings may be stock-piled and spread in either area.

2.3.3 Aquifer Testing

Aquifer tests will be conducted in DIW-3 following development, as described in the Field Program Workplan. Groundwater pumped during aquifer testing will be discharged to the ground at the percolation pond adjacent to the site (see Figure A1). Temporary piping will be used to convey groundwater to the depression for infiltration into the subsurface in accordance with a general order from the RWQCB. The pipeline will be surface laid. At the end of the testing, the temporary pipeline will be disassembled and removed.

Injection testing of VZW-3 may be conducted using water pumped on-site from DIW-3. Some water may be discharged within the work area during pump start-up and shut-down, but larger quantities will be discharged to the new percolation basin.

2.3.4 Site Improvements – Underground Construction

Underground pipelines and conduits will be installed on-site to connect the new facilities to the pipelines and conduits installed in the utility corridor. Construction will be by open-trench method, to depths up to 72-inches (6-feet) below finished grade. Trench construction will be by wheeled backhoe or tracked excavator. Soil disturbance may be up to 450 CY (assumes 200-LF at maximum 6-ft deep with 1V:1H side slopes). Compaction will be by small roller or hand tampers.

The soil materials on Fort Ord are generally poorly-graded sands, which are suitable for use as pipe bedding and structural backfill. No fill material will be imported. Trench spoils will be stockpiled on-site, and then returned to the trench as bedding and backfill. Excess trench spoils will be spread on-site within the appropriate management zone.

Underground construction within the Well Site will be sequenced by the general contractor to coordinate with the well drilling schedule, the pipeline construction in the utility corridor and the construction of surface improvements.

2.3.5 Site Improvements – Above Grade Construction

Surface improvements at the Well Site will include a concrete well pedestal at DIW-3 and VZW-3, a deep well pump and electric motor at DIW-3, surface piping and valves to DIW-3 and VZW-3, an electrical controls pedestal, a chain-link perimeter fence and all-weather surfacing of the driveway areas. The site layout will be similar to Well Site 2 (see Figure A4).

The equipment pedestal construction may require excavation up to 3-feet below finished grade. Existing soils will be scarified and recompacted to 95% relative dry density, using rollers or hand-tamping equipment. These areas will have been previously disturbed as part of the site grading prior to well drilling.

Fence construction will require setting fence posts to a depth of up to 4-feet below finished grade using an earth auger for excavation and backfilling with concrete. Surface paving will require compacting previously-disturbed areas using a roller compactor, and placing up to 8-inches of compacted aggregate base.

2.4 Well Site 3 Civil Work

Vadose zone well VZW-2 will be constructed at Well Site 3 as part of the Phase 3 work, with related surface improvements.

2.4.1 Work Area Preparation and Equipment Staging

Well site 3 will be cleared and graded as part of the Phase 2 work. Site preparation will involve removing a portion of the site fence to allow rig access. Proposed dimensions for the work area are 100 feet deep by 100 feet wide (see Figure A2). Site layouts for the well drilling are provided in the Field Program Workplan

The access road in front of Well Site 3 will be graded during Phase 2. No additional earthwork within the roadway is anticipated.

2.4.2 Soils Management

Site grading will not be required at Well Site 3. The cuttings volume from drilling VZW-2 is estimated at 111 CY. Cuttings will be stockpiled within the work area, and then graded level over an approximately 100-ft by 100-ft area prior to constructing surface improvements. Alternatively, the cuttings may be spread within the larger drainage depression area, if so directed by the City. The well is located on the residential clean-up side of the utility corridor boundary, so the cuttings may be stock-piled and spread in either area.

2.4.3 Aquifer Testing

Injection testing of VZW-2 may be conducted using water pumped on-site from DIW-2. Some water may be discharged within the work area during pump start-up and shut-down, but larger quantities will be discharged to the new percolation basin.

2.4.4 Site Improvements – Underground Construction

Underground pipelines and conduits will be installed on-site to connect the new facilities to the pipelines and conduits installed in the utility corridor. Construction will be by open-trench method, to depths up to 72-inches (6-feet) below finished grade. Trench construction will be by wheeled backhoe or tracked excavator. Soil disturbance may be up to 66 CY (assumes 50-LF at maximum 6-ft deep with 1V:1H side slopes). Compaction will be by small roller or hand tampers.

The soil materials on Fort Ord are generally poorly-graded sands, which are suitable for use as pipe bedding and structural backfill. No fill material will be imported. Trench spoils will be stockpiled on-site, and then returned to the trench as bedding and backfill. Excess trench spoils will be spread on-site within the appropriate management zone.

Underground construction within the Well Site will be sequenced by the general contractor to coordinate with the well drilling schedule, the pipeline construction in the utility corridor and the construction of surface improvements.

2.4.5 Site Improvements – Above Grade Construction

Surface improvements at the Well Site will include a concrete well pedestal at VZW-2, surface piping and valves to VZW-2, and replacing the removed portion of the chain-link perimeter fence. The site layout is shown on Figure A3.

The equipment pedestal construction may require excavation up to 3-feet below finished grade. Existing soils will be scarified and recompacted to 95% relative dry density, using rollers or hand-tamping equipment. Fence construction will require setting fence posts to a depth of up to 4-feet below finished grade using an earth auger for excavation and backfilling with concrete. These areas will have been previously disturbed as part of the site grading prior to well drilling.

2.5 Booster Pump Station Site Civil Work

The booster pump station will be located adjacent to the electrical site, which is being constructed as part of Phase 2.

2.5.1 Work Area Preparation and Equipment Staging

A portion of the booster pump station site will be cleared and graded as part of the Phase 2 work. Site preparation will involve grading additional area and relocating a portion of the site fence. Proposed dimensions for the work area are 120 feet deep by 100 feet wide (see Figure A2). The combined electrical and pump station site will be 100-ft wide by 100-ft deep.

The access road in front of the booster pump station will be graded during Phase 2. Trenching in the roadway to connect the booster pump station to the product water pipeline will be required.

2.5.2 Soils Management

The amount of soil disturbed during site grading is estimated at 667 CY. This includes the general clearing and grading over a work area of 120-feet by 100-feet. It is expected that the trench spoils from on-site piping will balance the grading fill requirement.

2.5.3 Site Improvements – Underground Construction

Underground pipelines and conduits will be installed on-site to connect the new facilities to the pipelines and conduits installed in the utility corridor. Construction will be by open-trench method, to depths up to 72-inches (6-feet) below finished grade. Trench construction will be by wheeled backhoe or tracked excavator. Soil disturbance may be up to 225 CY (assumes 100-LF at maximum 6-ft deep with 1V:1H side slopes). Compaction will be by small roller or hand tampers.

The soil materials on Fort Ord are generally poorly-graded sands, which are suitable for use as pipe bedding and structural backfill. No fill material will be imported. Trench spoils will be stockpiled on-site, and then returned to the trench as bedding and backfill. Excess trench spoils will be spread on-site within the appropriate management zone.

Underground construction within the Well Site will be sequenced by the general contractor to coordinate with the construction of surface improvements.

2.5.4 Site Improvements – Above Grade Construction

Surface improvements at the Booster Pump Station will include a pump station building (16-ft by 30-ft) and extending the electrical site fencing to enclose the pump station as well.

The building foundation construction may require excavation up to 3-feet below finished grade. Existing soils will be scarified and recompacted to 95% relative dry density, using rollers or hand-tamping equipment. Fence construction will require setting fence posts to a depth of up to 4-feet below finished grade using an earth auger for excavation and backfilling with concrete. These areas will have been previously disturbed as part of the site grading.

2.6 Monitoring Well 3A Civil Work

Monitoring Well 3A will be located north of Well Site 4.

2.6.1 Work Area Preparation and Equipment Staging

An access driveway and work area will be cleared for the site to accommodate rig access for well drilling and casing installation. The area must be sufficiently large to allow turning and staging of drilling rigs, drill pipe layout, and large equipment such as tanks, air compressor, and a tool house. Proposed dimensions for the work area are 100 feet deep by 100 feet wide. A permanent well pad approximately 5 feet by 20 feet will be defined within this work area. The cluster will include a deep and vadose zone monitoring well. Site layouts for the well drilling are provided in the Field Program Workplan.

A 20-ft wide driveway will be cleared and graded to connect each monitoring well site to the existing access road. The length of the driveway is approximately 250-LF for MW-3A.

2.6.2 Soils Management

The amount of soil disturbed for the site grading at MW-3A is estimated at 678 CY. This includes general clearing and grading over a work area of 100 feet by 100 feet, grading a 20-ft by 250 LF driveway, and the well cuttings. The soil will be re-distributed over the work area during grading such that cut and fill are balanced.

2.7 Utility Corridor Construction

2.7.1 Underground Construction

Underground pipelines and conduits will be installed under the existing access road within the utility corridor, extending from Well Site 2 to Well Site 1. These will include a 16-inch diameter product water main, a 16-inch diameter backflush water pipeline and a conduit trench for power and controls. The power and controls conduits may require pull box vaults along the alignment (within the utility corridor). The pipeline and conduits installed during Phase 2 included stubs into Well Site 4, so no additional work will be required in the road for that site.

Construction will be by open-trench method, to depths up to 72-inches (6-feet) below finished grade. Trench construction will be by wheeled backhoe or tracked excavator. Soil disturbance is shown in Table 2-1 (assumes 1V:1H side slopes). If a trench box or temporary shoring is used, the actual disturbed soil volume will be lower. Compaction will be by small roller or hand tampers. Water trucks will spread water for dust control and compaction. Assuming installation rates of 300-LF per day, the open trench construction in the access road should take 15 construction days, or approximately three weeks.

Table 2-1: Utility Corridor Pipelines and Conduits

	L	W	D	Vol
Segment	**ft**	**in**	**in**	**CY**
Water Main, 16" Pipe, Assume 42" Cover Well 2 to Well 1	1,000	112	72	2,074
Conduits, Assume 18" Wide, 54" Deep Well 2 to Well 1	1,000	72	54	1,000
Backwash Pipeline, 16" Pipe, 42" cover Well 2 to Well 1	1,000	104	64	1,712

2.7.2 Soils Management

The soil materials on Fort Ord are generally poorly-graded sands, which are suitable for use as pipe bedding and structural backfill. Therefore, no fill material will be imported. Trench spoils will be stockpiled within the utility corridor along the side of the trench, and returned to the trench as bedding and backfill. Construction will be managed to maintain a traffic lane capable of passing a fire truck during the work. Excess trench spoils will be spread within the utility corridor.

2.7.3 Roadway Construction

Following completion of the underground construction, the existing access road along the BLM-border will be graded, compacted given an all-weather surface. Fine grading will be performed using a wheeled grader. Surface paving will require compacting previously-disturbed areas using a roller compactor, and placing up to 8-inches of compacted aggregate base. Paving equipment will include dump trucks with spreader boxes and roller compactors.

Pipe culverts will be installed under the driveway entrances to Well Sites 1 and 4 if needed to maintain the flow line of the roadside drainage ditch.

Section 3 - On-Going Maintenance Activities

Once constructed, the injection well field will require on-going access and maintenance, as described below.

3.1 Site Access

System operators will require daily site access to inspect and adjust equipment. These site visits will involve vehicle traffic on the access roads and within the completed well sites. We anticipate Agency staff having a keyed access gate (or separately locked shared gate) allowing them to access the wellfield site without FORA/ESCA support. Monitoring well sites may be accessed weekly or monthly to download data-loggers or to collect water samples. No ground disturbing activity will be required.

The system operators will undergo the MEC training as part of the system start-up, and new staff will be scheduled for training as needed.

3.2 Well Back-flushing and Percolation Basin Maintenance

The injection wells will periodically be back-flushed, and the water will be discharged to the new percolation basin through underground pipelines. The expected frequency is once per week per deep injection well. This will be an automated process and system operators may or may not be present to monitor it.

The percolation basin will periodically require scarifying to maintain the required minimum percolation rate. A system operator will visit and inspect the basin on a weekly or monthly basis. The frequency of maintenance scarifying will be based on the site condition, but is not expected to occur more than once per year. This being a previously disturbed site, we anticipate that it will require notifying the City and FORA or its successor agency about the work, but on-site monitoring will not be required.

If erosion damage ever occurs on the outer slope of the percolation basin, the operational staff may regrade the slope to prevent further damage. This being a previously disturbed site, we anticipate that it will require notifying FORA or its successor agency about the work, and determine at that time if on-site monitoring will be required.

3.3 Monitoring Well Monitoring and Sampling

The monitoring well clusters will be equipped with level transducers, data loggers and submersible pumps in the deep wells, which will require periodic access to replace batteries and download the data. This equipment will be accessed through the monitoring well locking cover, and will not be ground disturbing. Access will be required on a weekly basis.

Water sampling at the monitoring wells will be required on a less frequent basis (monthly or quarterly). Sampling will require access with a service vehicle, connecting a portable generator to the installed pump (at sites 1A, 2A and 3A), pumping out a volume of water equal to the standing water in the well casing and gravel pack, collecting a water sample and finally removing the generator and relocking the access cover. The water pumped from the well will be discharged to the ground at rates between 5 gpm and 15 gpm, in a manner that does not cause an erosion channel.

3.4 Well Maintenance and Equipment Replacement

The mechanical and electrical equipment within the well sites (pumps, valves, panels, fences, etc.) will require periodic maintenance and replacement. The majority of this work will not be ground disturbing, and should not require notification. Mechanical equipment should last ten to fifteen years before requiring major repair or replacement.

Some valves within the well site may be buried and require excavation to make replacements. Valves should last a minimum of 20-years. If a buried valve requires replacement, it will be located in a previously disturbed site. We anticipate that it will require notifying FORA or its successor agency about the work, but on-site monitoring will not be required.

The injection wells may require periodic rehabilitation to maintain the injection capacity. Activities such as well camera inspection and screen cleaning will require removing the well pump and motor and then lowering equipment into the well casing. All of the activity will be above grade within the fenced well lot and not be soil disturbing. If the well requires redevelopment pumping, the water will be discharged to the new back-flush percolation basin. This will be planned in advance of any redevelopment pumping and coordinated with the City of Seaside and FORA or its successor agency.

3.5 Access Road Repair

The access road will receive an improved gravel surface as part of the Phase 2 work. The gravel surface will require periodic grading and compacting. The frequency of maintenance will depend on the level of use and annual rainfall. When this occurs, we anticipate that it will require notifying the City and FORA or its successor agency about the work, but on-site monitoring will not be required.

3.6 Pipeline Repair

The pipelines conveying water to and from the injection wells may require repair or replacement in the future. Modern pipeline materials are expected to last 50 to 75 years. Emergency repairs of a leaking pipeline will be made as needed. These will, by definition, occur in previously disturbed areas. Construction of replacement pipelines will occur within the same easement, but in parallel alignments. Pipeline replacement will be a formal capital improvement project for the M1W, and they will coordinate construction supervision through the City of Seaside and FORA or its successor agency as part of the project.

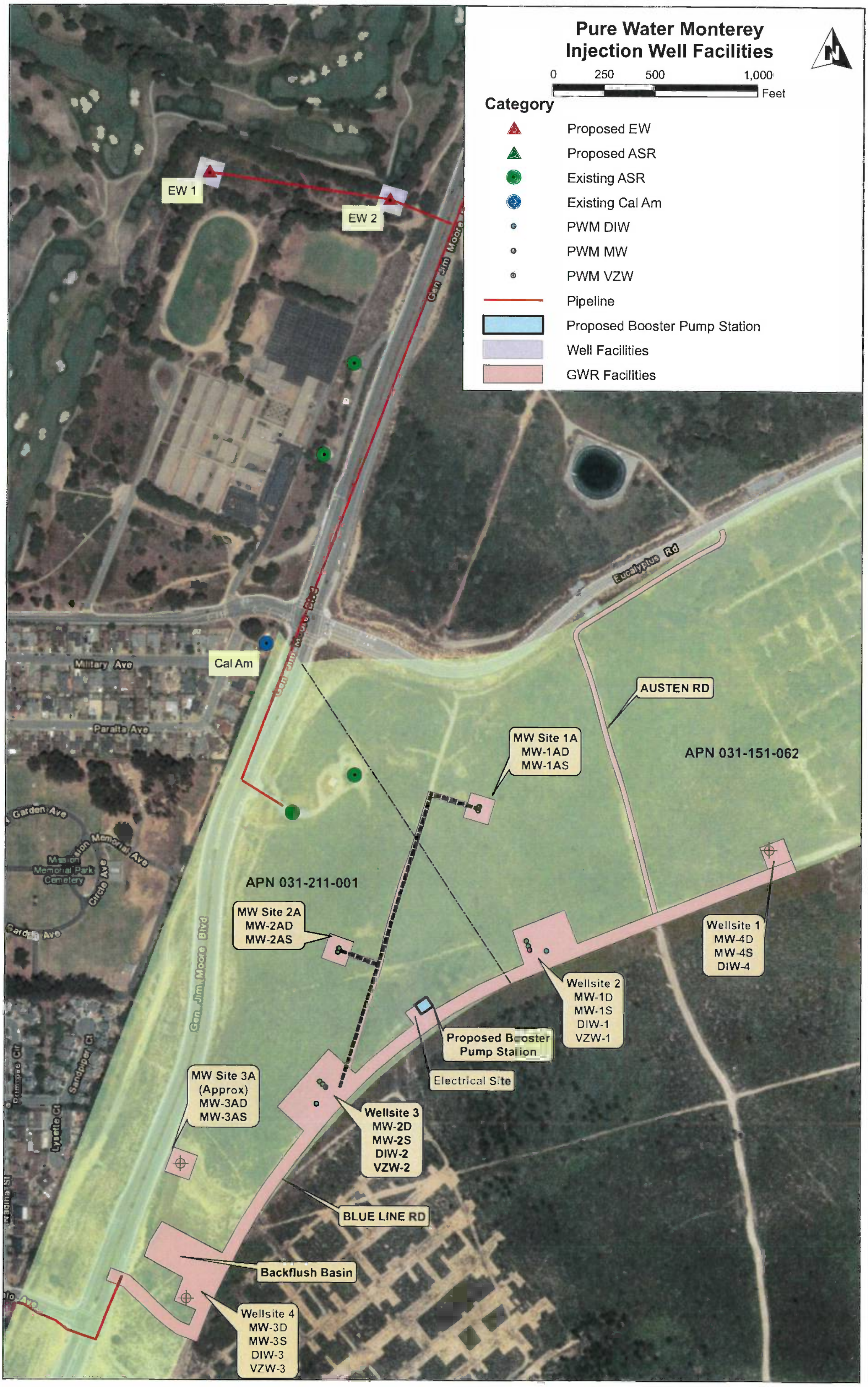
3.7 Future Wells

Replacement wells may be constructed within Well Sites 1 through 4. Drilling and completion of new wells and abandonment of existing wells will be a formal capital improvement project for the M1W. When new wells are required, the M1W will coordinate construction supervision through the City of Seaside and FORA or its successor agency.

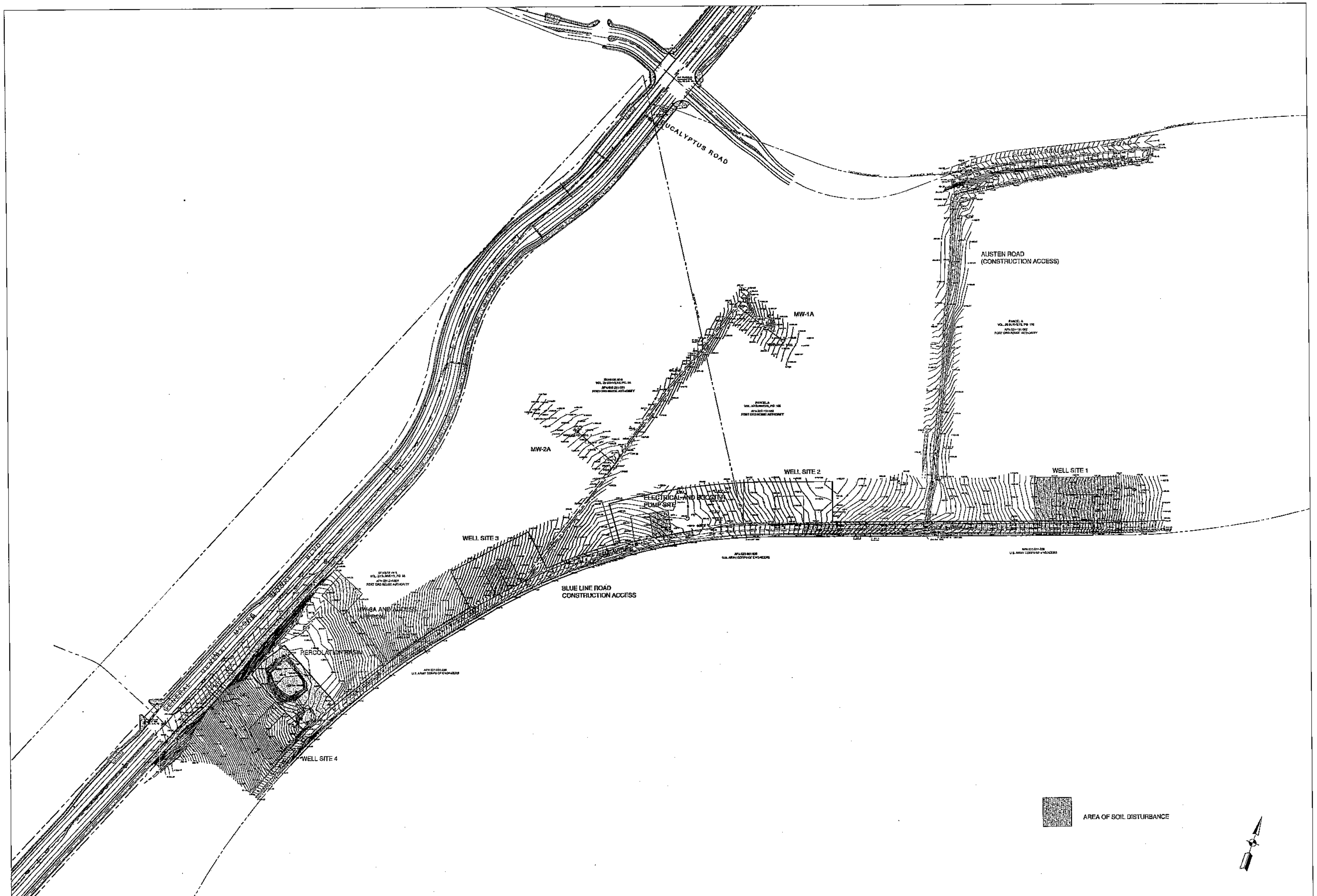
When the surrounding land is redeveloped, it may be necessary to relocate one or more monitoring wells to support the land use plan. Drilling of new monitoring wells and abandonment of existing monitoring wells may be an M1W capital project, or may be included in the land developer's overall site work. In either case, M1W will coordinate construction supervision for the well drilling and abandonment through the City of Seaside and FORA or its successor agency.

Appendix A: Figures

Figure A1: Proposed Pure Water Monterey Injection Well Facilities
Figure A2: Areas of Soil Disturbance
Figure A3: Well Site 3 Site Plan
Figure A4: Well Site 2 Site Plan



Pure Water Monterey
Injection Well Facilities
0
250
500
1,000
Feet
Category
Proposed EW
Proposed ASR
Existing ASR
Existing Cal Am
PWM DIW
PWM MW
PWM VZW
Pipeline
Proposed Booster Pump Station
Well Facilities
GWR Facilities
EW 1
EW 2
Gen Jim Moore Blvd
Eucalyptus Rd
Military Ave
Cal Am
Paralta Ave
AUSTEN RD
MW Site 1A
MW-1AD
MW-1AS
APN 031-151-062
Garden Ave
Mission Memorial Ave
Mission Memorial Park Cemetery
Circle Ave
APN 031-211-001
MW Site 2A
MW-2AD
MW-2AS
Wellsite 1
MW-4D
MW-4S
DIW-4
Wellsite 2
MW-1D
MW-1S
DIW-1
VZW-1
Proposed Booster Pump Station
Electrical Site
MW Site 3A
(Approx)
MW-3AD
MW-3AS
Wellsite 3
MW-2D
MW-2S
DIW-2
VZW-2
BLUE LINE RD
Backflush Basin
Wellsite 4
MW-3D
MW-3S
DIW-3
VZW-3



NOTE:
1. SHADED AREAS ARE APPROXIMATE MAXIMUM AREA OF SOIL DISTURBANCE.
2. ACCESS ROAD GRADING ASSUMED TO BE 20-FT WIDE.

NO.	REVISION DESCRIPTION	DATE	APPR

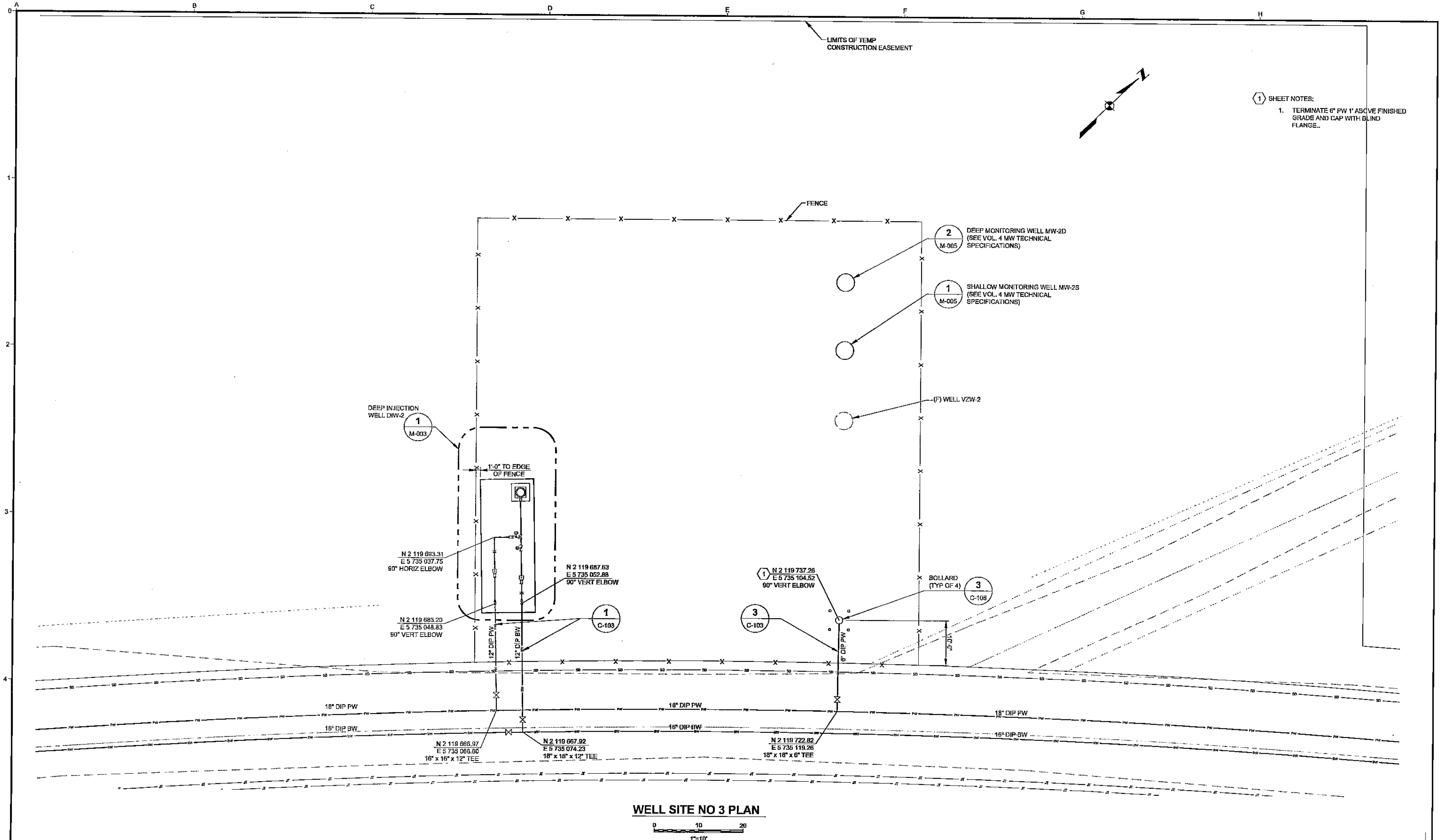
MONTEREY REGIONAL WATER POLLUTION CONTROL AGENCY
MONTEREY, CA
PURE WATER MONTEREY
GROUNDWATER REPLENISHMENT PROJECT

Schaaf & Wheeler
CONSULTING CIVIL ENGINEERS
3 Quail Run Circle, Suite 101
Salinas, CA 93907-2348
(831) 883-4848

INJECTION WELL FIELD, PHASE 3
AREAS OF SOIL DISTURBANCE FIGURE

DATE:	4/17/2018
SCALE:	As Noted
DESIGN:	AAS
DRAWN:	AAS
CHECK:	AAS

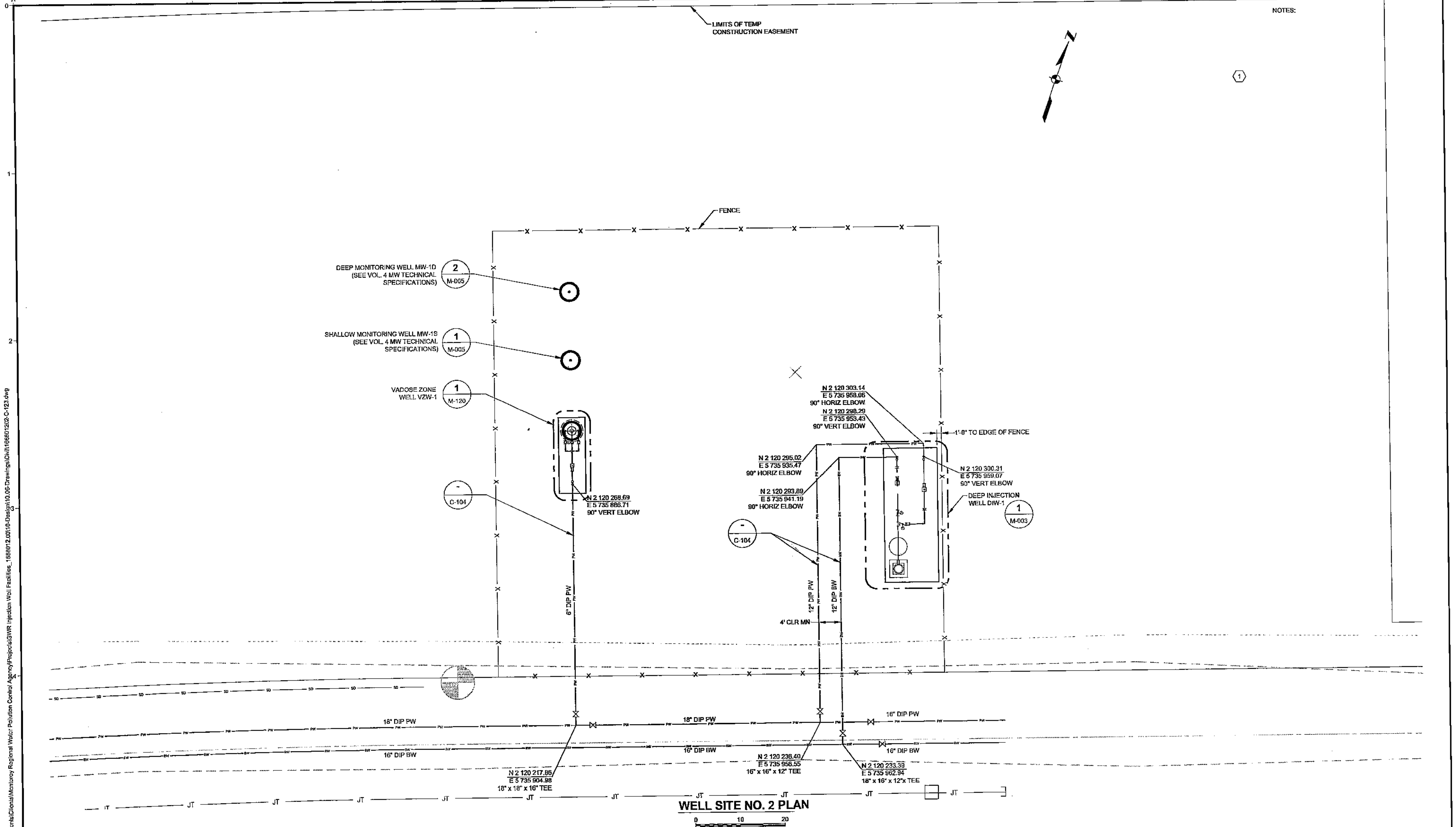
Figure A2



WELL SITE NO 3 PLAN

0 10 20
1"=10'

USE OF DOCUMENTS	NO.	REVISION	DATE	BY	SCALES		DESIGNED			
THIS DOCUMENT, INCLUDING THE INCORPORATED DESIGNS, IS AN INSTRUMENT OF SERVICE FOR THIS PROJECT AND SHALL NOT BE USED FOR ANY OTHER PROJECT WITHOUT THE WRITTEN AUTHORIZATION OF KENNEDY/JENKS CONSULTANTS.					0 — 1" 0 — 25mm IF THIS BAR IS NOT DIMENSION SHOWN, ADJUST SCALES ACCORDINGLY.	No. C54215 Exp. 12/31/18 CIVIL STATE OF CALIFORNIA 12/1/17	DESIGNED RRH DRAWN BBH CHECKED	MONTEREY REGIONAL WATER POLLUTION CONTROL AGENCY MONTEREY, CA PURE WATER MONTEREY GROUNDWATER REPLENISHMENT PROJECT Kennedy/Jenks Consultants 200 Fourth Street, Suite 210, Santa Rosa, CA 95401-8534	INJECTION WELL FACILITIES PHASE 2 WELL SITE NO. 3 YARD PIPING PLAN	FILE NAME 166801202-C-133.dwg JOB NO. 1668012*02 DATE DECEMBER 2017 SHEET C-133



WELL SITE NO. 2 PLAN

0 10 20
1"=10'

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REGISTERED PROFESSIONAL ENGINEER No. C54315 Exp. 12/31/18 CIVIL STATE OF CALIFORNIA
12/1/17

DESIGNED RRH
DRAWN DWM
CHECKED -

MRWPCA

MONTEREY REGIONAL WATER POLLUTION CONTROL AGENCY
MONTEREY, CA
PURE WATER MONTEREY
GROUNDWATER REPLENISHMENT PROJECT

Kennedy/Jenks Consultants
200 Fourth Street, Suite 210, Santa Rosa, CA 95401-8534

INJECTION WELL FACILITIES
PHASE 2

WELL SITE NO. 2 YARD PIPING PLAN

FILE NAME 1658012*02-C-123.dwg
JOB NO. 1658012*02
DATE DECEMBER 2017
SHEET C-123

Appendix B: References

Arcadis, Inc. / Weston Solutions, Inc., On-Call Construction Support Plan, Pure Water Monterey Groundwater Replenishment Project, Former Fort Ord, April 2017

Central Coast Regional Water Quality Control Board

Water Quality Control Plan for the Central Coast Basin, 2011 Update

California Department of Water Resources, Division of Safety of Dams, Statutes and Regulations Pertaining to Supervision of Dams and Reservoirs

Federal Emergency Management Agency, Flood Insurance Study, Monterey County, CA and Incorporated Areas, FSI No. 06053CV001A, April 2009

Fort Ord Reuse Authority

Fort Ord Reuse Authority/ESCA Remediation Program, Right of Entry Procedure and Requirements

FORA ESCA Remediation Program, Residential Protocol Implementation Technical Report, Seaside Munitions Response Area, Former Fort Ord, Monterey County, California, prepared by ARCADIS, DEC 2015

FORA ESCA Remediation Program, Final Technical Information Paper, Phase II Seaside Munitions Response Area, Roadway Alignment and Utility Corridor (Pollution Report and Removal Action Activity Report) Former Fort Ord, Monterey County, California, September 26, 2008

Fort Ord Reuse Authority and Monterey Regional Water Pollution Control Agency, Agreement No. RA-041812, dated April 20, 2012

Construction Plans for General Jim Moore Blvd, Phases IV & V (Water and Recycled Water in Coe Ave to Del Rey Oaks), prepared by Creegan + D'Angelo, 2006

City of Seaside

Municipal Code Section 15.34, Digging and Excavation on the Former Fort Ord

Standard Operating Procedure for Code Section 15.34

Monterey Regional Water Pollution Control Agency:

Mitigation, Monitoring and Reporting Program for the Pure Water Monterey Groundwater Replenishment Project: Staff-Recommended Alternative, adopted October 8, 2015

Technical Memorandum, Groundwater Replenishment Project, Well Back-Flush Water Pumping, Conveyance and Storage Facilities, prepared by E2 Consulting Engineers, August 2014

Pacific Gas & Electric Company, S5453, Exhibit B, Joint Trench Configurations and Occupancy Guide, 9/27/2006

Schaaf & Wheeler, Pure Water Monterey Injection Well Field, Civil Work Plan, November 2016

State Water Resources Control Board

Water Quality Order No. 2003 – 0003 – DWQ, Statewide General Waste Discharge Requirements (WDRs) for Discharges to Land with a Low Threat to Water Quality (General WDRs)

Water Quality Order No 2014-0194-DWQ, General Order No. CAG140001, Statewide NPDES Permit for Drinking Water System Discharges to Waters of the United States

Todd Groundwater

Pure Water Monterey Well Drilling and Testing, Phase 1 and Phase 2 Workplan, June 2016

Pure Water Monterey Well Drilling and Testing, Phase 3 Workplan, February 2018

U.S. Army Corps of Engineers, Installation-Wide Multi-Species Habitat Management Plan for Former Fort Ord, CA, April 1997

Attachment K

Economic Analysis of Pure Water Monterey Expansion

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MONTEREY PENINSULA WATER MANAGEMENT DISTRICT

MEMORANDUM

To: Paul Sciuto, Monterey One Water
From: Dave Stoldt, Monterey Peninsula Water Management District
Date: April 27, 2018
Subject: Economic Analysis of Pure Water Monterey Expansion

We have received the Report titled "Economic Analysis of Pure Water Monterey Expansion" prepared by NBS, the consultant hired by the Monterey Peninsula Water Management District (District) on behalf of Monterey One Water and the District. The analysis was to examine the expansion as an interim measure to relieve the Monterey Peninsula of the moratorium on new service connections and lift the State-imposed Cease and Desist Order (CDO) in the event the proposed 6.4 MGD desalination facility is delayed several years or more.

The purpose of this memorandum is to summarize the District's view of the results presented in Tables S-1 and S-2, and Figures S-1, S-2, S-3, and S4 of the report. These tables and figures represent the net present value (NPV), as well as the total revenues required from ratepayers, for the 30-year life-cycle beginning 2021.[1] It is also instructive to examine Table CF-1 in Appendix B of the report to see individual annual revenue requirements for the combined projects vis a vis the 6.4 MGD desalination project online by 2021.

In general, the following global conclusions can be reached.

- In all cases, the net present value of the 30-year revenue requirement is lower for Pure Water Monterey expansion combined with any of the reduced size and delayed desalination plants.

- In all but one case, the total revenue requirement over the 30-year period is favorable for Pure Water Monterey expansion combined with any of the reduced size and delayed desalination plants. In that one scenario, expansion combined with a 4.8 MGD plant delayed 5 years, ratepayers would pay $11 million additional over a 30-year period in order to relieve the moratorium and lift the CDO 5 years early.

- The combined annual revenue requirement (Table CF-1), once the desalination plant does come on line, is shown to be higher than it would have been with only the 6.4 MGD desalination project online by 2021. This augers toward attempting to further reduce the construction cost of the desalination alternative, when and if it is ready to proceed.

[1] Revenue requirements for either project beyond the 30-year period are truncated and not included.

- It should be noted that waiting on the eventual construction of a 6.4 MGD plant without a Pure Water Monterey expansion, would result in escalation of both capital and O&M costs of the project, leading to $3-5 million per year in additional annual revenue requirement over the base case shown in Table CF-1.

We recognize that scenarios that include a 1.6 MGD desalination plant, or a delay of 25 years to 2036 are unlikely. However, there does appear to be a benefit to ratepayers to expand Pure Water Monterey today, in conjunction with a delay of 5 or 15 years in the start of a "right-sized" desalination plant.

Thank you for the opportunity to provide my high-level review of the NBS report.

Sincerely,

David J. Stoldt

David J. Stoldt
General Manager
Monterey Peninsula Water Management District

32605 Temecula Parkway, Suite 100
Temecula, CA 92592
Toll free: 800.676.7516 (P) 951.296.1997
(F) 951.296.1998

nbsgov.com

TECHNICAL MEMORANDUM

TO:	DAVID STOLDT, GENERAL MANAGER, MONTEREY PENISULA WATER MANAGEMENT DISTRICT
	PAUL SCIUTO, GENERAL MANAGER, MONTEREY ONE WATER
FROM:	GREG CLUMPNER, DIRECTOR, NBS
RE:	ECONOMIC ANALYSIS OF PURE WATER MONTEREY EXPANSION
DATE:	APRIL 27, 2018

INTRODUCTION

This memo summarizes the scope of work for the economic analysis that Monterey Peninsula Water Management District (the District) hired NBS to prepare. This work was conducted jointly with input and direction from the District (Dave Stoldt) and relied on various project assumptions, financial analyses, and loan sizings as well as previous testimony submitted by various parties for California Public Utilities Commission (CPUC) hearings.

The overall intent of this analysis is to determine the annual revenue requirements over a 30-year life cycle, as well as the total cashflows and net present values of those cashflows, for an expansion of Monterey One Water's (M1W) Pure Water Monterey Groundwater Replenishment (GWR) Project combined with various smaller and/or delayed versions of Cal-Am's proposed Desalination (Desal) project described below.

The following sections discuss the general background, assumptions, methodology, study alternatives, and results of this analysis. Source documents and detailed tables for various components of the study are presented in Appendices A through E.

GENERAL BACKGROUND

An expansion of M1W's Pure Water Monterey Ground Water Replenishment (GWR) project, in conjunction with a smaller and delayed version of the Cal-Am Desal project, is being evaluated for consideration by the CPUC. Delay in the Desal project may occur if the project becomes litigated in the courts for several years. With such a delay, the expansion of GWR might also allow the decision to add the next increment of water supply to be delayed. The reason for GWR expansion would be to allow the moratorium on new connections to be eased and the Cease and Desist Order (CDO) lifted while the Desal litigation is being resolved in the courts.

In order to assess the economic and financial impacts of the combinations of GWR expansion and Desal projects, as may be required by the CPUC, an analysis of the projected capital and O&M costs for the GWR and each version of the Desal project, at various assumed construction dates in the future is required. Desal costs were derived from Cal-Am's *Monterey Peninsula Water Supply Project (MPWSP)* model, which estimates capital and O&M cost and net revenue requirements and annual costs for the Desal Project. Adjustments to capital and O&M costs for reduced-size Desal projects were provided by the District (Stoldt) after running the MPWSP model based on assumptions from testimony to the CPUC and a cost review by Hazen and Sawyer. Capital and O&M costs for the GWR expansion were provided by M1W and were developed both in-house (Bob Holden) and by M1W's design consultant Kennedy Jenks.

The results of NBS' economic analysis are intended to address three questions: (1) how much higher or lower revenue requirements are for combinations of the GWR and reduced Desal projects, (2) the economic value of waiting for the next increment of water supply, and (3) what it might cost to remove the moratorium on new connections and the Cease and Desist Order Cal-Am is currently under through a combination of GWR/Desal projects.

This analysis is intended to rely on the most accurate cost projections available and, therefore, provide the best assessment of economic consequences for alternatives to Cal-Am's current plans to construct a 6.4 MGD Desal project commencing immediately upon issuance of a Certificate of Public Convenience and Necessity (CPCN) by the CPUC.

GENERAL ASSUMPTIONS

The general assumptions used in this analysis are:

- Timing of construction of project alternatives – Initial GWR expansion construction is 2021 with delayed Desal construction date alternatives of 2026, 2036 and 2046.
- Planning period for net present valuation estimates – 30 years.
- Annual construction inflation – 2.32%, which is the weighted average inflation assuming O&M costs of power (42%), CPUC Labor (Escalation and Non-Escalation) of 58%.
- Replacement cycles:
  - Wells = 30 years.
  - Electrical Equipment = 30 years
  - Pumps, motors and ozonators = 20 years.
  - Instrumentation equipment = 15 years.
- GWR expansion O&M costs – included M1W's overhead rate of 16.9%.
- Issuance of bonds to fund GWR and/or replacement construction – per District estimates 4% interest rate, 30-year repayment period, issuance costs of 1% were used.
- Outfall lease payments for Cal-Am's use of the M1W's Ocean Outfall – based on current M1W negotiations with Cal-Am.
- Discount rate used to calculate net present values – based on California Department of Water Resources estimates for project analysis a 6% discount rate was used.

METHODOLOGY

Financial vs. Economic Analysis

For the purposes of this study, it is useful to summarize the differences between a financial and an economic analysis:

- ***Financial Analysis*** is typically used to evaluate expected annual cashflows for the purposes of budgeting and to determine if revenues will be sufficient to cover project costs. Therefore, financial analyses include projected inflation, grants, and market-based loan assumptions. The intent is to project actual costs and revenues in the year they occur.

- ***Economic Analysis*** is typically used to compare project alternatives and to identify the relative values in present dollar terms and provide an apples-to-apples comparison of competing alternatives. Therefore, economic analyses typically do not include inflation, although inflation can be included if necessary. Discount rates typically represent opportunity costs; a "real" discount rate (without inflation) is used if inflation is not included and a nominal discount rate (including inflation) is used if inflation was included. The latter was used in this analysis, since projected costs included inflation.

This study and report include both financial and economic analyses, as represented by 30-year cashflows, which include inflation, and the net present value (NPV) estimates of those cashflows. Therefore, the results provide a comparison of project alternatives on both a financial and economic basis.

Cost Estimates

Cost estimates for both capital and O&M costs were prepared through various means, as described below:

- **GWR Expansion Costs** – M1W prepared capital and O&M cost estimates for the 2,250 acre-feet per year (AFY) GWR expansion (i.e., from 3,500 AFY to 5,750 AFY). Costs that have been included in the 3,500 AFY project are inappropriate for inclusion in the expansion and, therefore, were not allocated to the expansion project. M1W overhead rates (16.9%) were included in O&M costs but not in capital costs.
- **Desal Project Costs** – Cal-Am's MPWSP model provided the capital and O&M costs for the base case of a 6.4 million gallons per day (MGD) Desal project. Reduced Desal alternatives of 4.8 MGD, 3.2 MGD and 1.6 MGD were developed as follows:
  - For the Base Case, which assumes a 6.4 MGD desalination plant is built on schedule with operations beginning in 2021, the Cal-Am model titled "*MPWSP Model -V 2.1.xlsm*" was used to produce the scenario "*6.4 MGD – Tier 2*" shown in Attachment 1 to the "*Rebuttal Testimony of Jeffrey T. Linam*" dated October 13, 2017. The line "*Total Cashflows From Customers*" in the "*NPV*" worksheet, beginning in 2021 and ending in 2051 represents the fixed and variable costs of the project over that 30-year period. However, those cashflows do not include replacement costs during the period or cost to utilize capacity in the M1W outfall – both of which need to be layered on top of the "*Total Cashflows From Customers*" from the MPWSP model.
  - To develop proxy life-cycle cashflows for alternate sizes of the Cal-Am desalination facilities – 4.8 MGD, 3.2 MGD, and 1.6 MGD – the following assumptions were made, based first on the "*Direct Testimony of Ian Crooks Errata Version*" dated September 27, 2017: (1) eliminating one seawater reverse osmosis (RO) skid and one brackish water RO train saves $1.84 million; (2) eliminating one slant well saves $3.5 million; and (3) we assume the combination of the two for each 1.6 MGD reduction in facility size.
  - Three additional Alternative Scenarios "B" were examined to see what a reduced project scope might look like. It was noted that in a March 9, 2016 Technical Memorandum by the consulting firm Hazen and Sawyer transmitted to M1W that savings from a reduction in pipe diameters and certain other project components were possible for a 6.4 MGD plant. At that time, Hazen and Sawyer estimated overall project costs at approximately 83% of the Cal-Am estimates contained in their model Version 8.4 in March 2016. Hence, here we also examined the same scenarios above – 4.8 MGD, 3.2 MGD, and 1.6 MGD – but with all capital costs in the model's "*Capital 6.4 MGD*" worksheet at 83%.
  - The Crooks testimony also identified savings in energy and chemicals costs resulting from a reduction in size. For each 1.6 MGD reduction, $750,750 of savings in energy

and $230,000 of savings in chemicals would occur. We assume the combination of the two for each 1.6 MGD reduction in facility size.

- The Cal-Am model identifies future replacement costs, but does not incorporate them into the projected cash flow. It assumes the intake wells have a 20-year life and are replaced in December 2014, and the chemical facilities have a 15-year life and are replaced in 2036 and 2051. Because the Alternative Scenarios have fewer intake wells, their replacement cost must be adjusted. This is done by reducing well replacement costs in the "Capital Summary" worksheet by $3.5 million for each successive reduction of 1.6 MGD and computing a new future value. The chemical facilities remain the same for each scenario. The "B" alternatives also incorporate an 83% factor. The resulting future replacement costs and timelines were then input to the District's investor-owned utility screening model to create a future cashflow that incorporates depreciation, rate of return, and taxes.
- Costs for the lease of outfall capacity were provided by M1W (Holden) and escalated by NBS.
- Since project alternatives included delayed Desal project construction, it was necessary to escalate capital and O&M costs to match assumed start dates. A consistent inflation rate of 2.32% was used for all escalations.

Projected Cashflows and Net Revenue Requirements

Projected cashflows and annual net revenue requirements were developed as follows:

- **GWR Expansion Costs** – Based on M1W's (Bob Holden) capital and O&M costs, annual costs were summarized over the 30-year period; initial capital costs assumed bond financing; future replacement costs assumed 2.32% inflation and financing through issuance of bonds.
- **Desal Project Costs** – MPWMD (Stoldt) modified Cal-Am's MPWSP model to estimate cashflows and net revenue requirements for Desal alternatives (i.e., for each project size and construction date). This included replacement project financings (i.e., debt service schedules).

STUDY ALTERNATIVES

Table 1 summarizes the study alternatives and illustrates the assumed construction dates for the base case Desal project (6.4 MGD), 2,250 AFY GWR expansion, and Desal alternatives.

GWR Expansion – The Pure Monterey Project Expansion (GWR) includes capital costs of approximately $52.7 million for the 2021 construction date, plus assumed replacement costs of $72,600 in 2036 (for 15-year replacement costs) and $773,000 in 2041 (for 20-year replacement costs). Capital assets requiring replacement on a 30-year basis were excluded because they fall outside the 30-year period of analysis (i.e., 2021-2050).

Desal Alternatives – Cal-Am's MPWSP model provided the capital and O&M costs for the base case (6.4 MGD) Desal project, and this model was adjusted in order to provide similar annual cashflows for each Desal alternative. These cashflows are annual net revenue required from customers. Replacement costs were added to these annual cashflows in the form of amortized payments, beginning the year after the assumed replacement cost occurred – which was necessary because Cal-Am's model did not incorporate replacement costs.

Table 1

Study Alternatives								
Summary of Combined Cal-Am Desal and PWM/GWR Project Scenarios								
Scenarios	Base Case - 6.4 MGD	PWM Expansion	4.8 MGD Desal	3.2 MGD Desal	1.6 MGD Desal	4.8 MGD Desal Alt. B	3.2 MGD Desal Alt. B	1.6 MGD Desal Alt. B
Base Case	2021							
Scenario 1		2021	2026					
Scenario 2		2021		2026				
Scenario 3		2021			2026			
Scenario 4		2021	2036					
Scenario 5		2021		2036				
Scenario 6		2021			2036			
Scenario 7		2021	2046					
Scenario 8		2021		2046				
Scenario 9		2021			2046			
Scenario 10		2021				2026		
Scenario 11		2021					2026	
Scenario 12		2021						2026
Scenario 13		2021				2036		
Scenario 14		2021					2036	
Scenario 15		2021						2036
Scenario 16		2021				2046		
Scenario 17		2021					2046	
Scenario 18		2021						2046

The capital and O&M costs for the GWR Expansion and each of the Desal alternatives were converted into annual cashflows, including inflation, which were then converted to net present values. Using this same approach for each project alternative allows a comparison of all alternatives (i.e., combinations of GWR expansion and Desal sizings) on the same cashflow and net present value basis.

STUDY RESULTS

As noted above, the intent of this analysis is to provide a comparison of both the annual cashflows and the net present values of those cashflows for each alternative. The following tables and graphs summarize the results.

Tables S-1 and S-2 summarize the net present values and total annual cashflows for the base case and each alternative. Figures S-1 and S-2 present the net present values and total annual cashflows, respectively, for alternatives one through 18.

Figures S-3 and S-4 present the same information except the alternatives have been ranked from lowest to highest. These last two figures show that the Desal alternatives with the most delayed timing have the lowest net present values and total annual cashflows. Also, the smaller Desal projects within each construction period (e.g., 2046, 2036, and 2046) have lower net present values and annual cashflows than those with larger production capacities.

Table S-1 Summary of NPV Analysis for Cal-Am Desal & PWM Expansion Project

(30-Year Analysis of Net Present Values and Total Annual Cashflows for Scenarios 1-9)

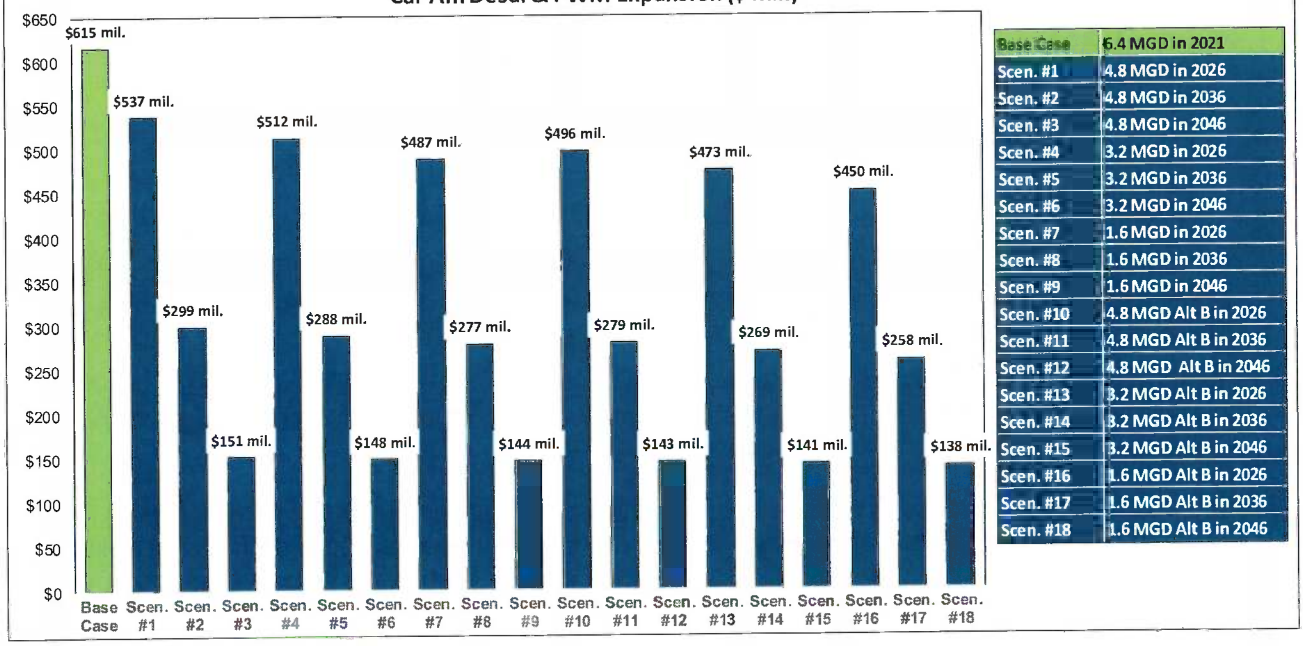
Results of 30-Year Analysis	Base Case 6.4 MGD On Schedule	Scen. #1	Scen. #2	Scen. #3	Scen. #4	Scen. #5	Scen. #6	Scen. #7	Scen. #8	Scen. #9
		(All Scenarios Include PWM Expansion Project of 2,250 AFY)								
		4.8 MGD in 2026	4.8 MGD in 2036	4.8 MGD in 2046	3.2 MGD in 2026	3.2 MGD in 2036	3.2 MGD in 2046	1.6 MGD in 2026	1.6 MGD in 2036	1.6 MGD in 2046
Net Present Value	$615.5 mil.	$536.5 mil.	$298.8 mil.	$150.8 mil.	$512.1 mil.	$288.0 mil.	$147.5 mil.	$487.4 mil.	$277.3 mil.	$144.5 mil.
Total Cashflow	$1,300 mil.	$1,311 mil.	$929 mil.	$498 mil.	$1,247 mil.	$891 mil.	$482 mil.	$1,180 mil.	$853 mil.	$468 mil.

Table S-2 Summary of NPV Analysis for Cal-Am Desal & PWM Expansion Project

(30-Year Analysis of Net Present Values and Total Annual Cashflows for Scenarios 10-18)

Results of 30-Year Analysis	Base Case 6.4 MGD On Schedule	Scen. #10	Scen. #11	Scen. #12	Scen. #13	Scen. #14	Scen. #15	Scen. #16	Scen. #17	Scen. #18
		(All Scenarios Include PWM Expansion Project of 2,250 AFY)								
		4.8 MGD Alt B in 2026	4.8 MGD Alt B in 2036	4.8 MGD Alt B in 2046	3.2 MGD Alt B in 2026	3.2 MGD Alt B in 2036	3.2 MGD Alt B in 2046	1.6 MGD Alt B in 2026	1.6 MGD Alt B in 2036	1.6 MGD Alt B in 2046
Net Present Value	$615.5 mil.	$496.0 mil.	$278.5 mil.	$143.3 mil.	$473.5 mil.	$268.7 mil.	$140.6 mil.	$450.1 mil.	$258.5 mil.	$137.7 mil.
Total Cashflow	$1,300 mil.	$1,217 mil.	$862 mil.	$463 mil.	$1,157 mil.	$827 mil.	$450 mil.	$1,094 mil.	$790 mil.	$436 mil.

Figure S-1 Comparison of NPV for Combinations of Cal-Am Desal & PWM Expansion ($ mil.)



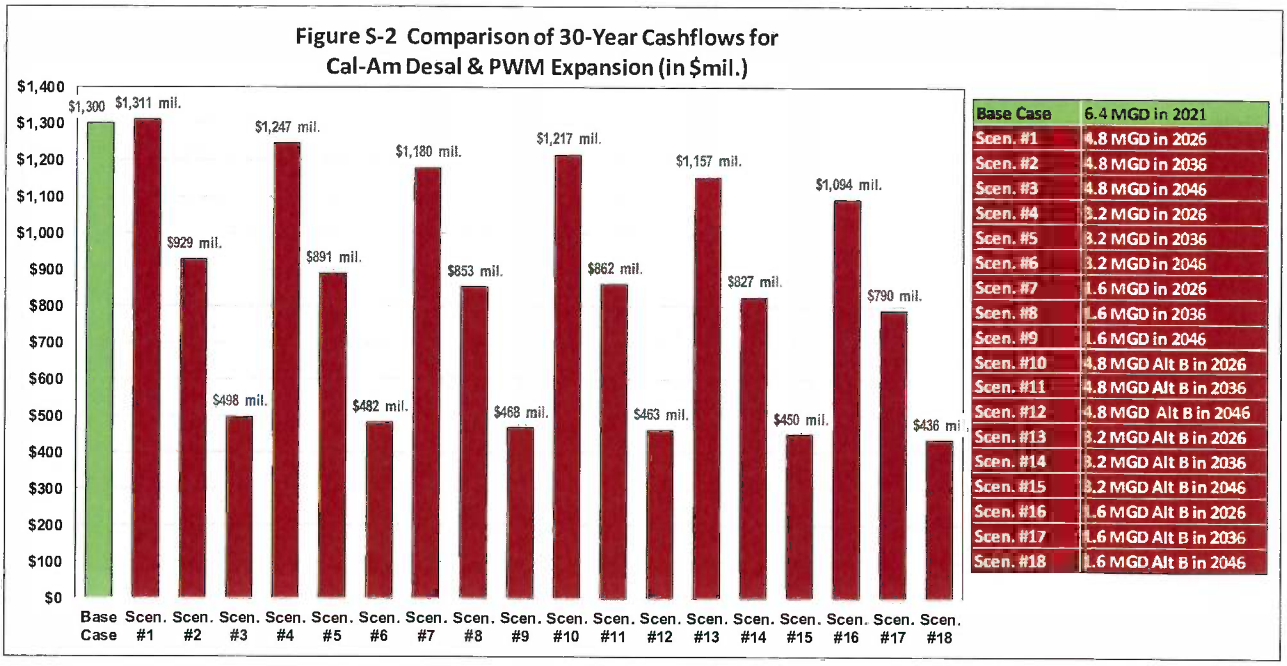


Figure S-2 Comparison of 30-Year Cashflows for
Cal-Am Desal & PWM Expansion (in $mil.)
$1,400
$1,300
$1,200
$1,100
$1,000
$900
$800
$700
$600
$500
$400
$300
$200
$100
$0
$1,300
$1,311 mil.
$929 mil.
$498 mil.
$1,247 mil.
$891 mil.
$482 mil.
$1,180 mil.
$853 mil.
$468 mil.
$1,217 mil.
$862 mil.
$463 mil.
$1,157 mil.
$827 mil.
$450 mil.
$1,094 mil.
$790 mil.
$436 mi
Base Case
Scen. #1
Scen. #2
Scen. #3
Scen. #4
Scen. #5
Scen. #6
Scen. #7
Scen. #8
Scen. #9
Scen. #10
Scen. #11
Scen. #12
Scen. #13
Scen. #14
Scen. #15
Scen. #16
Scen. #17
Scen. #18
Base Case 6.4 MGD in 2021
Scen. #1 4.8 MGD in 2026
Scen. #2 4.8 MGD in 2036
Scen. #3 4.8 MGD in 2046
Scen. #4 3.2 MGD in 2026
Scen. #5 3.2 MGD in 2036
Scen. #6 3.2 MGD in 2046
Scen. #7 1.6 MGD in 2026
Scen. #8 1.6 MGD in 2036
Scen. #9 1.6 MGD in 2046
Scen. #10 4.8 MGD Alt B in 2026
Scen. #11 4.8 MGD Alt B in 2036
Scen. #12 4.8 MGD Alt B in 2046
Scen. #13 3.2 MGD Alt B in 2026
Scen. #14 3.2 MGD Alt B in 2036
Scen. #15 3.2 MGD Alt B in 2046
Scen. #16 1.6 MGD Alt B in 2026
Scen. #17 1.6 MGD Alt B in 2036
Scen. #18 1.6 MGD Alt B in 2046

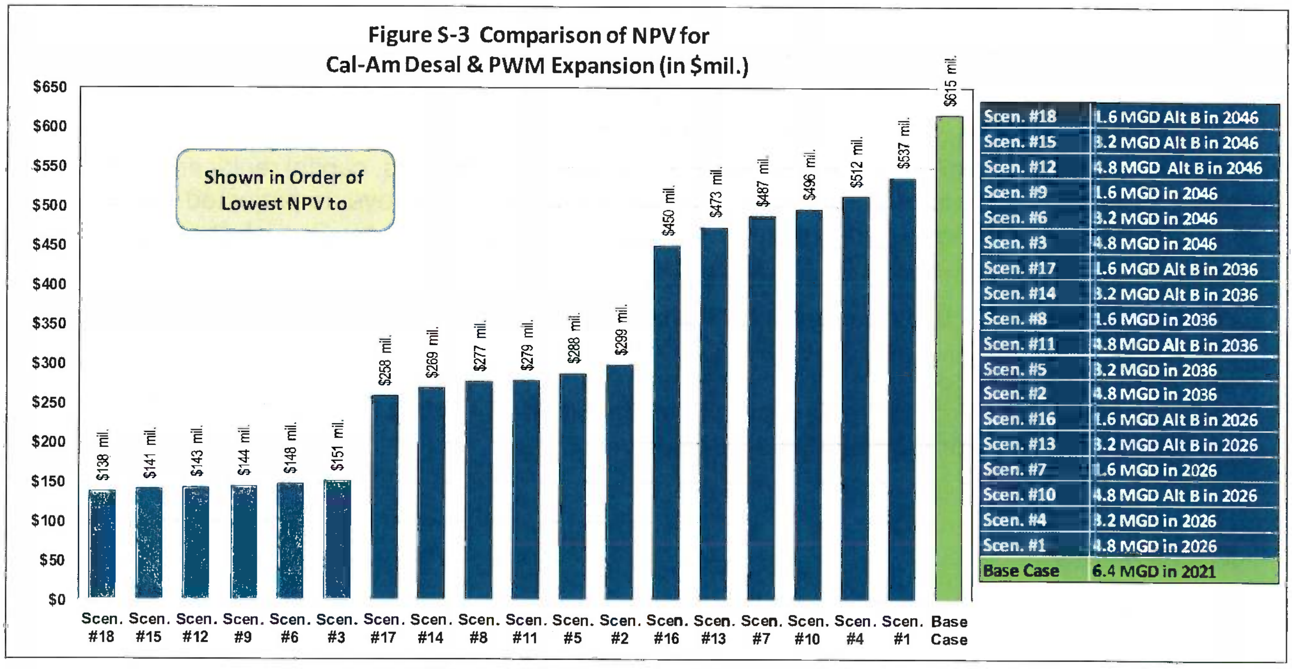
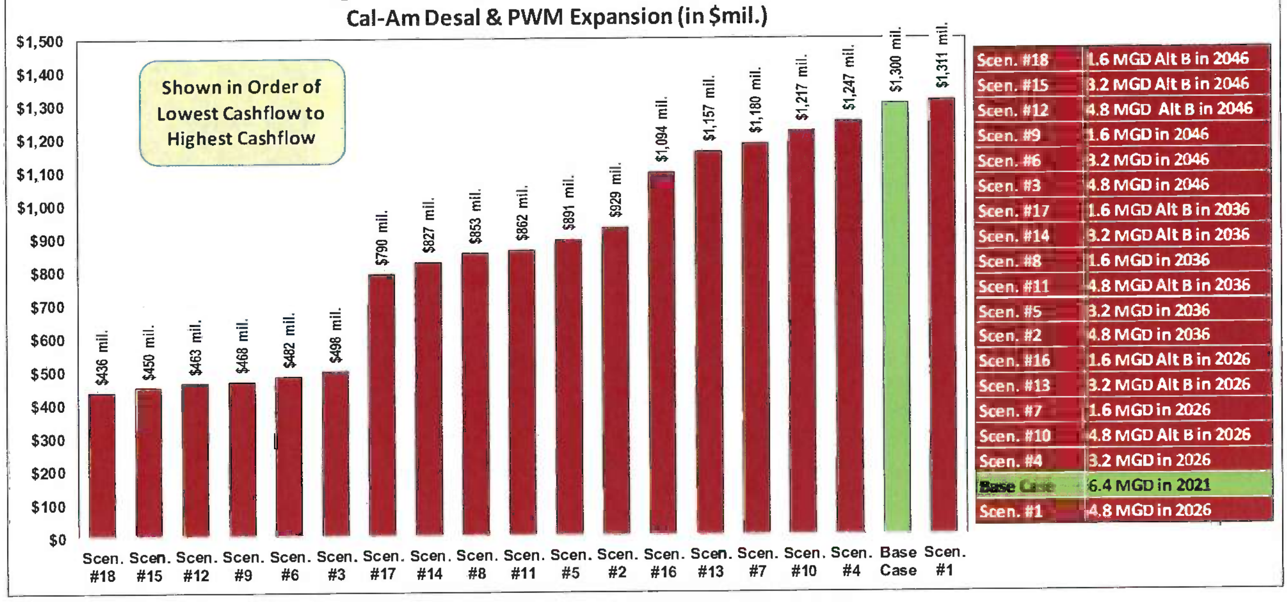


Figure S-3 Comparison of NPV for
Cal-Am Desal & PWM Expansion (in $mil.)
Shown in Order of
Lowest NPV to
$650
$600
$550
$500
$450
$400
$350
$300
$250
$200
$150
$100
$50
$0
$138 mil.
$141 mil.
$143 mil.
$144 mil.
$148 mil.
$151 mil.
$258 mil.
$269 mil.
$277 mil.
$279 mil.
$288 mil.
$299 mil.
$450 mil.
$473 mil.
$487 mil.
$496 mil.
$512 mil.
$537 mil.
$615 mil.
Scen. #18
Scen. #15
Scen. #12
Scen. #9
Scen. #6
Scen. #3
Scen. #17
Scen. #14
Scen. #8
Scen. #11
Scen. #5
Scen. #2
Scen. #16
Scen. #13
Scen. #7
Scen. #10
Scen. #4
Scen. #1
Base Case
Scen. #18 1.6 MGD Alt B in 2046
Scen. #15 3.2 MGD Alt B in 2046
Scen. #12 4.8 MGD Alt B in 2046
Scen. #9 1.6 MGD in 2046
Scen. #6 3.2 MGD in 2046
Scen. #3 4.8 MGD in 2046
Scen. #17 1.6 MGD Alt B in 2036
Scen. #14 3.2 MGD Alt B in 2036
Scen. #8 1.6 MGD in 2036
Scen. #11 4.8 MGD Alt B in 2036
Scen. #5 3.2 MGD in 2036
Scen. #2 4.8 MGD in 2036
Scen. #16 1.6 MGD Alt B in 2026
Scen. #13 3.2 MGD Alt B in 2026
Scen. #7 1.6 MGD in 2026
Scen. #10 4.8 MGD Alt B in 2026
Scen. #4 3.2 MGD in 2026
Scen. #1 4.8 MGD in 2026
Base Case 6.4 MGD in 2021

Figure S-4 Comparison of 30-Year Cashflow for Cal-Am Desal & PWM Expansion (in $mil.)



NBS' PRINCIPAL ASSUMPTIONS AND CONSIDERATIONS

In preparing this memo and the results included herein, NBS has relied on a number of principal assumptions and considerations with regard to financial, operational, and engineering matters, including the District's and M1W's estimates of capital and O&M costs, capital replacement plans, funding options, regulatory requirements, and other conditions and events projected to occur in the future. This information and these assumptions were provided by District staff and other sources we believe to be reliable, although NBS has not independently verified this data.

While we believe NBS' use of such information and assumptions is reasonable for the purpose of this analysis and memo, some assumptions will invariably not materialize as stated herein or may vary significantly due to unanticipated events and circumstances. Therefore, the actual results can be expected to vary from those projected to the extent that actual future conditions differ from those assumed by us or provided to us by others.

APPENDICES:

- Appendix A – Source Documents
- Appendix B – Summary of Net Present Value (NPV) and Annual Cashflows for Alternatives
- Appendix C – Summary and Details of Desal Cashflows by Alternative
- Appendix D – Summary of Annual Financing Costs for Replacements by Alternative, Traditional Utility Financing
- Appendix E – GWR Annual Costs and Initial Capital and O&M Costs

APPENDIX A - SOURCE DOCUMENTS

- Cal-Am Testimony of Ian Crooks 9-15-17
- Cal-Am Testimony of Chris Cook 9-15-17
- Cal-Am Testimony of Jeff Linam 10-13-17
- GWR Cost Comparison Model – 4-1-16
- Joint Testimony 5-18-16
- M1W Testimony of Paul Sciuto 9-29-17
- MPWMD testimony of Dave Stoldt 1-22-16
- MPWSP Model – V 2.1
- MPWSP Hazen Sawyer Cost Evaluation 3-9-2016
- MPWSP Hazen Sawyer Cost Review 3-9-2016
- GWR Expansion Capital and O&M Cost Estimates (Bob Holden)
- Summary of Annual Financing Costs for Desal Replacements by Alternative, Traditional Utility Financing – (Dave Stoldt)

APPENDIX B - SUMMARY OF NET PRESENT VALUE (NPV) AND ANNUAL CASHFLOWS FOR ALTERNATIVES

Appendix A Table NPV-1 Summary of Net Present Values of 30-Year Cashflows for Combined Desal and PWM Expansion Projects by Scenario ($mil.)

(Net Present Values of Combined 30-Year Cashflows for Desal and PWM Expansion Projects by Scenario)

Year		Base Case 6.4 MGD On Schedule	Scen. #1 4.8 MGD in 2026	Scen. #2 4.8 MGD in 2036	Scen. #3 4.8 MGD in 2046	Scen. #4 3.2 MGD in 2026	Scen. #5 3.2 MGD in 2036	Scen. #6 3.2 MGD in 2046	Scen. #7 1.6 MGD in 2026	Scen. #8 1.6 MGD in 2036	Scen. #9 1.6 MGD in 2046	Scen. #10 4.8 MGD Alt B in 2026	Scen. #11 4.8 MGD Alt B in 2036	Scen. #12 4.8 MGD Alt B in 2046	Scen. #13 3.2 MGD Alt B in 2026	Scen. #14 3.2 MGD Alt B in 2036	Scen. #15 3.2 MGD Alt B in 2046	Scen. #16 1.6 MGD Alt B in 2026	Scen. #17 1.6 MGD Alt B in 2036	Scen. #18 1.6 MGD Alt B in 2046
		$615.5 mil.	$536.5 mil.	$298.8 mil.	$150.8 mil.	$512.1 mil.	$288.0 mil.	$147.5 mil.	$487.4 mil.	$277.3 mil.	$144.5 mil.	$496.0 mil.	$278.5 mil.	$143.3 mil.	$473.5 mil.	$268.7 mil.	$140.6 mil.	$450.1 mil.	$258.5 mil.	$137.7 mil.
2021	1	$40.51	$5.23	$5.23	$5.23	$5.23	$5.23	$5.23	$5.23	$5.23	$5.23	$5.23	$5.23	$5.23	$5.23	$5.23	$5.23	$5.23	$5.23	$5.23
2022	2	$38.39	$4.98	$4.98	$4.98	$4.98	$4.98	$4.98	$4.98	$4.98	$4.98	$4.98	$4.98	$4.98	$4.98	$4.98	$4.98	$4.98	$4.98	$4.98
2023	3	$36.68	$4.75	$4.75	$4.75	$4.75	$4.75	$4.75	$4.75	$4.75	$4.75	$4.75	$4.75	$4.75	$4.75	$4.75	$4.75	$4.75	$4.75	$4.75
2024	4	$34.53	$4.52	$4.52	$4.52	$4.52	$4.52	$4.52	$4.52	$4.52	$4.52	$4.52	$4.52	$4.52	$4.52	$4.52	$4.52	$4.52	$4.52	$4.52
2025	5	$33.07	$4.31	$4.31	$4.31	$4.31	$4.31	$4.31	$4.31	$4.31	$4.31	$4.31	$4.31	$4.31	$4.31	$4.31	$4.31	$4.31	$4.31	$4.31
2026	6	$31.73	$36.08	$4.11	$4.11	$33.98	$4.11	$4.11	$32.67	$4.11	$4.11	$29.85	$4.11	$4.11	$28.62	$4.11	$4.11	$27.39	$4.11	$4.11
2027	7	$28.75	$34.77	$3.92	$3.92	$33.35	$3.92	$3.92	$31.87	$3.92	$3.92	$31.77	$3.92	$3.92	$30.42	$3.92	$3.92	$29.03	$3.92	$3.92
2028	8	$27.47	$33.23	$3.73	$3.73	$31.88	$3.73	$3.73	$30.49	$3.73	$3.73	$30.39	$3.73	$3.73	$29.12	$3.73	$3.73	$27.80	$3.73	$3.73
2029	9	$26.30	$31.32	$3.56	$3.56	$30.05	$3.56	$3.56	$28.73	$3.56	$3.56	$28.86	$3.56	$3.56	$27.66	$3.56	$3.56	$26.41	$3.56	$3.56
2030	10	$23.87	$30.00	$3.39	$3.39	$28.80	$3.39	$3.39	$27.48	$3.39	$3.39	$27.67	$3.39	$3.39	$26.47	$3.39	$3.39	$25.29	$3.39	$3.39
2031	11	$22.87	$28.72	$3.24	$3.24	$27.52	$3.24	$3.24	$26.28	$3.24	$3.24	$26.46	$3.24	$3.24	$25.33	$3.24	$3.24	$24.21	$3.24	$3.24
2032	12	$21.90	$26.07	$3.09	$3.09	$25.00	$3.09	$3.09	$23.83	$3.09	$3.09	$24.18	$3.09	$3.09	$23.11	$3.09	$3.09	$22.00	$3.09	$3.09
2033	13	$19.93	$24.97	$2.94	$2.94	$23.90	$2.94	$2.94	$22.79	$2.94	$2.94	$23.13	$2.94	$2.94	$22.12	$2.94	$2.94	$21.01	$2.94	$2.94
2034	14	$19.09	$23.91	$2.81	$2.81	$22.85	$2.81	$2.81	$21.80	$2.81	$2.81	$22.13	$2.81	$2.81	$21.17	$2.81	$2.81	$20.12	$2.81	$2.81
2035	15	$18.28	$21.76	$2.68	$2.68	$20.80	$2.68	$2.68	$19.76	$2.68	$2.68	$20.27	$2.68	$2.68	$19.32	$2.68	$2.68	$18.32	$2.68	$2.68
2036	16	$16.67	$20.86	$22.65	$2.58	$19.92	$21.33	$2.58	$18.93	$20.50	$2.58	$19.41	$18.75	$2.58	$18.51	$17.97	$2.58	$17.57	$17.19	$2.58
2037	17	$16.37	$19.98	$21.82	$2.46	$19.04	$20.92	$2.46	$18.11	$19.99	$2.46	$18.61	$19.94	$2.46	$17.72	$19.09	$2.46	$16.79	$18.21	$2.46
2038	18	$15.66	$18.22	$20.85	$2.35	$17.38	$20.01	$2.35	$16.45	$19.12	$2.35	$17.05	$19.08	$2.35	$16.21	$18.28	$2.35	$15.33	$17.44	$2.35
2039	19	$14.31	$17.46	$19.66	$2.24	$16.62	$18.86	$2.24	$15.75	$18.03	$2.24	$16.32	$18.12	$2.24	$15.52	$17.36	$2.24	$14.69	$16.57	$2.24
2040	20	$13.36	$16.69	$18.83	$2.14	$15.90	$18.08	$2.14	$15.07	$17.24	$2.14	$15.65	$17.38	$2.14	$14.86	$16.62	$2.14	$14.03	$15.87	$2.14
2041	21	$11.63	$15.32	$18.07	$2.08	$14.58	$17.32	$2.08	$13.76	$16.53	$2.08	$14.41	$16.66	$2.08	$13.67	$15.95	$2.08	$12.89	$15.24	$2.08
2042	22	$14.65	$15.02	$16.41	$1.99	$14.28	$15.74	$1.99	$13.47	$14.99	$1.99	$14.13	$15.23	$1.99	$13.42	$14.55	$1.99	$12.68	$13.85	$1.99
2043	23	$13.85	$14.34	$15.72	$1.90	$13.64	$15.05	$1.90	$12.88	$14.35	$1.90	$13.53	$14.57	$1.90	$12.83	$13.93	$1.90	$12.10	$13.23	$1.90
2044	24	$13.09	$13.16	$15.06	$1.81	$12.47	$14.39	$1.81	$11.75	$13.72	$1.81	$12.46	$13.94	$1.81	$11.80	$13.34	$1.81	$11.11	$12.67	$1.81
2045	25	$11.98	$12.29	$13.71	$1.73	$11.47	$13.10	$1.73	$10.79	$12.44	$1.73	$11.02	$12.77	$1.73	$10.39	$12.17	$1.73	$9.74	$11.54	$1.73
2046	26	$11.29	$10.83	$13.13	$15.75	$10.24	$12.53	$14.82	$9.59	$11.91	$14.24	$10.36	$12.22	$13.01	$9.77	$11.66	$12.46	$9.15	$11.06	$11.92
2047	27	$10.67	$13.04	$12.58	$15.18	$12.19	$11.99	$14.55	$11.29	$11.40	$13.89	$12.15	$11.72	$13.86	$11.34	$11.16	$13.26	$10.53	$10.57	$12.64
2048	28	$10.07	$12.33	$11.47	$14.51	$11.54	$10.94	$13.91	$10.69	$10.36	$13.29	$11.50	$10.74	$13.26	$10.75	$10.21	$12.70	$9.97	$9.65	$12.11
2049	29	$9.51	$11.66	$11.00	$13.68	$10.92	$10.47	$13.12	$10.11	$9.92	$12.53	$10.89	$10.28	$12.60	$10.19	$9.78	$12.06	$9.44	$9.25	$11.51
2050	30	$8.99	$10.71	$10.51	$13.10	$10.00	$10.01	$ 2.57	$9.24	$ .49	$11.99	$10.05	$9.86	$ 2.08	$9.36	$9.36	$ 1.55	$8.66	$8.84	$11.02
Total		$615.5	$536.5	$298.8	$150.8	$512.1	$288.0	$147.5	$487.4	$277.3	$144.5	$496.0	$278.5	$143.3	$473.5	$268.7	$140.6	$450.1	$258.5	$137.7

Appendix B *(cont.)*

Appendix B Table CF-1 Summary of 30-Year Cashflows for Combined Desal and PWM Expansion by Scenario ($mil.)

Year		Base Case 6.4 MGD On Schedule	*(Combined 30-Year Cashflows for Desal and PWM Expansion Projects by Scenario)* *Scen. #1* 4.8 MGD in 2026	*Scen. #2* 4.8 MGD in 2036	*Scen. #3* 4.8 MGD in 2046	*Scen. #4* 3.2 MGD in 2026	*Scen. #5* 3.2 MGD in 2036	*Scen. #6* 3.2 MGD in 2046	*Scen. #7* 1.6 MGD in 2026	*Scen. #8* 1.6 MGD in 2036	*Scen. #9* 1.6 MGD in 2046	*Scen. #10* 4.8 MGD Alt B in 2026	*Scen. #11* 4.8 MGD Alt B in 2036	*Scen. #12* 4.8 MGD Alt B in 2046	*Scen. #13* 3.2 MGD Alt B in 2026	*Scen. #14* 3.2 MGD Alt B in 2036	*Scen. #15* 3.2 MGD Alt B in 2046	*Scen. #16* 1.6 MGD Alt B in 2026	*Scen. #17* 1.6 MGD Alt B in 2036	*Scen. #18* 1.6 MGD Alt B in 2046
		$1,300 mil.	$1,311 mil.	$929 mil.	$498 mil.	$1,247 mil.	$891 mil.	$482 mil.	$1,180 mil.	$853 mil.	$468 mil.	$1,217 mil.	$862 mil.	$463 mil.	$1,157 mil.	$827 mil.	$450 mil.	$1,094 mil.	$790 mil.	$436 mil.
2021	1	$40.51	$5.23	$5.23	$5.23	$5.23	$5.23	$5.23	$5.23	$5.23	$5.23	$5.23	$5.23	$5.23	$5.23	$5.23	$5.23	$5.23	$5.23	$5.23
2022	2	$40.70	$5.28	$5.28	$5.28	$5.28	$5.28	$5.28	$5.28	$5.28	$5.28	$5.28	$5.28	$5.28	$5.28	$5.28	$5.28	$5.28	$5.28	$5.28
2023	3	$41.21	$5.33	$5.33	$5.33	$5.33	$5.33	$5.33	$5.33	$5.33	$5.33	$5.33	$5.33	$5.33	$5.33	$5.33	$5.33	$5.33	$5.33	$5.33
2024	4	$41.13	$5.39	$5.39	$5.39	$5.39	$5.39	$5.39	$5.39	$5.39	$5.39	$5.39	$5.39	$5.39	$5.39	$5.39	$5.39	$5.39	$5.39	$5.39
2025	5	$41.74	$5.44	$5.44	$5.44	$5.44	$5.44	$5.44	$5.44	$5.44	$5.44	$5.44	$5.44	$5.44	$5.44	$5.44	$5.44	$5.44	$5.44	$5.44
2026	6	$42.46	$48.28	$5.50	$5.50	$45.48	$5.50	$5.50	$43.72	$5.50	$5.50	$39.94	$5.50	$5.50	$38.30	$5.50	$5.50	$36.66	$5.50	$5.50
2027	7	$40.78	$49.33	$5.55	$5.55	$47.31	$5.55	$5.55	$45.21	$5.55	$5.55	$45.06	$5.55	$5.55	$43.16	$5.55	$5.55	$41.18	$5.55	$5.55
2028	8	$41.30	$49.96	$5.61	$5.61	$47.94	$5.61	$5.61	$45.84	$5.61	$5.61	$45.70	$5.61	$5.61	$43.79	$5.61	$5.61	$41.80	$5.61	$5.61
2029	9	$41.92	$49.93	$5.67	$5.67	$47.90	$5.67	$5.67	$45.80	$5.67	$5.67	$46.00	$5.67	$5.67	$44.09	$5.67	$5.67	$42.10	$5.67	$5.67
2030	10	$40.34	$50.68	$5.73	$5.73	$48.65	$5.73	$5.73	$46.43	$5.73	$5.73	$46.75	$5.73	$5.73	$44.72	$5.73	$5.73	$42.73	$5.73	$5.73
2031	11	$40.95	$51.43	$5.80	$5.80	$49.29	$5.80	$5.80	$47.06	$5.80	$5.80	$47.39	$5.80	$5.80	$45.36	$5.80	$5.80	$43.36	$5.80	$5.80
2032	12	$41.57	$49.49	$5.86	$5.86	$47.46	$5.86	$5.86	$45.23	$5.86	$5.86	$45.90	$5.86	$5.86	$43.87	$5.86	$5.86	$41.75	$5.86	$5.86
2033	13	$40.10	$50.25	$5.92	$5.92	$48.10	$5.92	$5.92	$45.87	$5.92	$5.92	$46.55	$5.92	$5.92	$44.51	$5.92	$5.92	$42.28	$5.92	$5.92
2034	14	$40.72	$51.01	$5.99	$5.99	$48.74	$5.99	$5.99	$46.51	$5.99	$5.99	$47.19	$5.99	$5.99	$45.16	$5.99	$5.99	$42.92	$5.99	$5.99
2035	15	$41.34	$49.19	$6.06	$6.06	$47.03	$6.06	$6.06	$44.68	$6.06	$6.06	$45.82	$6.06	$6.06	$43.67	$6.06	$6.06	$41.43	$6.06	$6.06
2036	16	$39.96	$50.00	$54.27	$6.18	$47.73	$51.12	$6.18	$45.37	$49.12	$6.18	$46.52	$44.93	$6.18	$44.37	$43.07	$6.18	$42.12	$41.20	$6.18
2037	17	$41.59	$50.76	$55.43	$6.25	$48.38	$53.16	$6.25	$46.01	$50.78	$6.25	$47.29	$50.66	$6.25	$45.01	$48.50	$6.25	$42.65	$46.25	$6.25
2038	18	$42.17	$49.06	$56.16	$6.32	$46.79	$53.88	$6.32	$44.30	$51.50	$6.32	$45.92	$51.38	$6.32	$43.65	$49.22	$6.32	$41.27	$46.97	$6.32
2039	19	$40.85	$49.83	$56.13	$6.40	$47.44	$53.84	$6.40	$44.95	$51.46	$6.40	$46.58	$51.73	$6.40	$44.30	$49.57	$6.40	$41.92	$47.31	$6.40
2040	20	$40.43	$50.49	$56.98	$6.47	$48.10	$54.69	$6.47	$45.60	$52.17	$6.47	$47.35	$52.58	$6.47	$44.96	$50.29	$6.47	$42.46	$48.02	$6.47
2041	21	$37.31	$49.15	$57.96	$6.68	$46.75	$55.54	$6.68	$44.13	$53.02	$6.68	$46.23	$53.43	$6.68	$43.83	$51.14	$6.68	$41.33	$48.87	$6.68
2042	22	$49.81	$51.05	$55.80	$6.76	$48.54	$53.50	$6.76	$45.81	$50.97	$6.76	$48.02	$51.77	$6.76	$45.62	$49.48	$6.76	$43.11	$47.08	$6.76
2043	23	$49.92	$51.67	$56.66	$6.84	$49.15	$54.23	$6.84	$46.41	$51.70	$6.84	$48.75	$52.51	$6.84	$46.24	$50.21	$6.84	$43.61	$47.67	$6.84
2044	24	$50.00	$50.27	$57.52	$6.92	$47.64	$54.97	$6.92	$44.89	$52.43	$6.92	$47.58	$53.25	$6.92	$45.06	$50.94	$6.92	$42.42	$48.40	$6.92
2045	25	$48.49	$49.77	$55.49	$7.01	$46.46	$53.06	$7.01	$43.71	$50.39	$7.01	$44.61	$51.72	$7.01	$42.08	$49.29	$7.01	$39.45	$46.74	$7.01
2046	26	$48.47	$46.47	$56.36	$67.59	$43.94	$53.80	$63.62	$41.18	$51.12	$61.11	$44.45	$52.46	$55.84	$41.92	$50.02	$53.50	$39.27	$47.47	$51.15
2047	27	$48.55	$59.33	$57.23	$69.05	$55.46	$54.54	$66.19	$51.36	$51.85	$63.20	$55.25	$53.33	$63.04	$51.58	$50.76	$60.33	$47.91	$48.08	$57.50
2048	28	$48.54	$59.48	$55.34	$69.96	$55.64	$52.77	$67.09	$51.57	$49.95	$64.10	$55.48	$51.81	$63.95	$51.83	$49.24	$61.24	$48.08	$46.55	$58.40
2049	29	$48.62	$59.59	$56.21	$69.92	$55.80	$53.51	$67.05	$51.66	$50.68	$64.05	$55.68	$52.56	$64.39	$52.07	$49.99	$61.67	$48.23	$47.29	$58.83
2050	30	$48.71	$58.03	$56.96	$71.00	$54.16	$54.26	$68.12	$50.06	$51.42	$64.95	$54.43	$53.44	$65.46	$50.74	$50.74	$62.58	$46.93	$47.90	$59.73
Total		$1,300.2	$1,311.2	$928.9	$497.7	$1,246.6	$891.2	$482.3	$1,180.0	$852.9	$467.6	$1,217.1	$861.9	$462.9	$1,156.6	$826.8	$449.5	$1,093.6	$790.2	$435.8

Appendix B *(cont.)*

Appendix B Table NPV-2 Cashflows and Net Present Value ($mil.)			
Year		Base Case 6.4 MGD On Schedule	Total NPV $615.5 mil.
2021	1	$40.51	$40.51
2022	2	$40.70	$38.39
2023	3	$41.21	$36.68
2024	4	$41.13	$34.53
2025	5	$41.74	$33.07
2026	6	$42.46	$31.73
2027	7	$40.78	$28.75
2028	8	$41.30	$27.47
2029	9	$41.92	$26.30
2030	10	$40.34	$23.87
2031	11	$40.95	$22.87
2032	12	$41.57	$21.90
2033	13	$40.10	$19.93
2034	14	$40.72	$19.09
2035	15	$41.34	$18.28
2036	16	$39.96	$16.67
2037	17	$41.59	$16.37
2038	18	$42.17	$15.66
2039	19	$40.85	$14.31
2040	20	$40.43	$13.36
2041	21	$37.31	$11.63
2042	22	$49.81	$14.65
2043	23	$49.92	$13.85
2044	24	$50.00	$13.09
2045	25	$48.49	$11.98
2046	26	$48.47	$11.29
2047	27	$48.55	$10.67
2048	28	$48.54	$10.07
2049	29	$48.62	$9.51
2050	30	$48.71	$8.99
Total		$1,300.17	$615.48

1. Summaries of cashflows, replacement capital costs (debt service), and Outfall lease payments from Tables ADC-2 through ADC-5.

Includes Customer Cashflows, Replacement Costs, and Outfall Lease Payments

Appendix B *(cont.)*

Appendix B Table NPV-3 Total Cashflows and Net Present Value ($mil.)
Scenario #1 - 4.8 MGD Desal in 2026

Year		Cal-Am Desal					Total - GWR Expansion	Combined Total	Total NPV
		Cashflows	Replacements Treatment	Replacements Wells	Outfall Lease	Total - Desal		$1,311 mil.	$536.5 mil.
2021	1	$0.00	$0.00	$0.00	$0.00	$0.00	$5.23	$5.23	$5.23
2022	2	$0.00	$0.00	$0.00	$0.00	$0.00	$5.28	$5.28	$4.98
2023	3	$0.00	$0.00	$0.00	$0.00	$0.00	$5.33	$5.33	$4.75
2024	4	$0.00	$0.00	$0.00	$0.00	$0.00	$5.39	$5.39	$4.52
2025	5	$0.00	$0.00	$0.00	$0.00	$0.00	$5.44	$5.44	$4.31
2026	6	$41.94	$0.00	$0.00	$0.84	$42.78	$5.50	$48.28	$36.08
2027	7	$43.07	$0.00	$0.00	$0.71	$43.77	$5.55	$49.33	$34.77
2028	8	$43.63	$0.00	$0.00	$0.72	$44.35	$5.61	$49.96	$33.23
2029	9	$43.51	$0.00	$0.00	$0.74	$44.25	$5.67	$49.93	$31.32
2030	10	$44.19	$0.00	$0.00	$0.76	$44.94	$5.73	$50.68	$30.00
2031	11	$44.86	$0.00	$0.00	$0.77	$45.63	$5.80	$51.43	$28.72
2032	12	$42.84	$0.00	$0.00	$0.79	$43.63	$5.86	$49.49	$26.07
2033	13	$43.51	$0.00	$0.00	$0.81	$44.32	$5.92	$50.25	$24.97
2034	14	$44.19	$0.00	$0.00	$0.83	$45.02	$5.99	$51.01	$23.91
2035	15	$42.28	$0.00	$0.00	$0.85	$43.13	$6.06	$49.19	$21.76
2036	16	$42.95	$0.00	$0.00	$0.87	$43.82	$6.18	$50.00	$20.86
2037	17	$43.63	$0.00	$0.00	$0.89	$44.51	$6.25	$50.76	$19.98
2038	18	$41.83	$0.00	$0.00	$0.91	$42.74	$6.32	$49.06	$18.22
2039	19	$42.51	$0.00	$0.00	$0.93	$43.43	$6.40	$49.83	$17.46
2040	20	$43.07	$0.00	$0.00	$0.95	$44.02	$6.47	$50.49	$16.69
2041	21	$41.50	$0.00	$0.00	$0.97	$42.47	$6.68	$49.15	$15.32
2042	22	$42.17	$1.13	$0.00	$0.99	$44.29	$6.76	$51.05	$15.02
2043	23	$42.73	$1.08	$0.00	$1.02	$44.83	$6.84	$51.67	$14.34
2044	24	$41.27	$1.03	$0.00	$1.04	$43.34	$6.92	$50.27	$13.16
2045	25	$40.71	$0.98	$0.00	$1.07	$42.76	$7.01	$49.77	$12.29
2046	26	$37.35	$0.93	$0.00	$1.09	$39.37	$7.10	$46.47	$10.83
2047	27	$36.00	$0.88	$14.15	$1.12	$52.15	$7.19	$59.33	$13.04
2048	28	$36.56	$0.83	$13.66	$1.14	$52.20	$7.28	$59.48	$12.33
2049	29	$37.12	$0.78	$13.15	$1.17	$52.22	$7.37	$59.59	$11.66
2050	30	$36.00	$0.73	$12.63	$1.20	$50.56	$7.47	$58.03	$10.71
Total		$1,039.41	$8.38	$53.59	$23.15	$1,124.54	$186.61	$1,311.15	$536.53

Appendix B *(cont.)*

Appendix B Table NPV-4 Total Cashflows and Net Present Value ($mil.)
Scenario #2 - 4.8 MGD Desal in 2036

Year		Cal-Am Desal					Total - GWR Expansion	Combined Total	Total NPV
			Replacements		Outfall	Total -			
		Cashflows	Treatment	Wells	Lease	Desal		$929 mil.	$298.8 mil.
2021	1	$0.00	$0.00	$0.00	$0.00	$0.00	$5.23	$5.23	$5.23
2022	2	$0.00	$0.00	$0.00	$0.00	$0.00	$5.28	$5.28	$4.98
2023	3	$0.00	$0.00	$0.00	$0.00	$0.00	$5.33	$5.33	$4.75
2024	4	$0.00	$0.00	$0.00	$0.00	$0.00	$5.39	$5.39	$4.52
2025	5	$0.00	$0.00	$0.00	$0.00	$0.00	$5.44	$5.44	$4.31
2026	6	$0.00	$0.00	$0.00	$0.00	$0.00	$5.50	$5.50	$4.11
2027	7	$0.00	$0.00	$0.00	$0.00	$0.00	$5.55	$5.55	$3.92
2028	8	$0.00	$0.00	$0.00	$0.00	$0.00	$5.61	$5.61	$3.73
2029	9	$0.00	$0.00	$0.00	$0.00	$0.00	$5.67	$5.67	$3.56
2030	10	$0.00	$0.00	$0.00	$0.00	$0.00	$5.73	$5.73	$3.39
2031	11	$0.00	$0.00	$0.00	$0.00	$0.00	$5.80	$5.80	$3.24
2032	12	$0.00	$0.00	$0.00	$0.00	$0.00	$5.86	$5.86	$3.09
2033	13	$0.00	$0.00	$0.00	$0.00	$0.00	$5.92	$5.92	$2.94
2034	14	$0.00	$0.00	$0.00	$0.00	$0.00	$5.99	$5.99	$2.81
2035	15	$0.00	$0.00	$0.00	$0.00	$0.00	$6.06	$6.06	$2.68
2036	16	$47.04	$0.00	$0.00	$1.05	$48.09	$6.18	$54.27	$22.65
2037	17	$48.30	$0.00	$0.00	$0.89	$49.19	$6.25	$55.43	$21.82
2038	18	$48.93	$0.00	$0.00	$0.91	$49.84	$6.32	$56.16	$20.85
2039	19	$48.80	$0.00	$0.00	$0.93	$49.73	$6.40	$56.13	$19.66
2040	20	$49.56	$0.00	$0.00	$0.95	$50.51	$6.47	$56.98	$18.83
2041	21	$50.31	$0.00	$0.00	$0.97	$51.28	$6.68	$57.96	$18.07
2042	22	$48.05	$0.00	$0.00	$0.99	$49.04	$6.76	$55.80	$16.41
2043	23	$48.80	$0.00	$0.00	$1.02	$49.82	$6.84	$56.66	$15.72
2044	24	$49.56	$0.00	$0.00	$1.04	$50.60	$6.92	$57.52	$15.06
2045	25	$47.42	$0.00	$0.00	$1.07	$48.48	$7.01	$55.49	$13.71
2046	26	$48.17	$0.00	$0.00	$1.09	$49.26	$7.10	$56.36	$13.13
2047	27	$48.93	$0.00	$0.00	$1.12	$50.04	$7.19	$57.23	$12.58
2048	28	$46.92	$0.00	$0.00	$1.14	$48.06	$7.28	$55.34	$11.47
2049	29	$47.67	$0.00	$0.00	$1.17	$48.84	$7.37	$56.21	$11.00
2050	30	$48.30	$0.00	$0.00	$1.20	$49.49	$7.47	$56.96	$10.51
Total		**$726.75**	**$0.00**	**$0.00**	**$15.53**	**$742.28**	**$186.61**	**$928.89**	**$298.75**

Appendix B *(cont.)*

Appendix B Table NPV-5 Total Cashflows and Net Present Value ($mil.) Scenario #3 - 4.8 MGD Desal in 2046									
Year		Cal-Am Desal					Total - GWR Expansion	Combined Total	Total NPV
			Replacements		Outfall	Total -			
		Cashflows	Treatment	Wells	Lease	Desal		$498 mil.	$150.8 mil.
2021	1	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.23**	$5.23	**$5.23**
2022	2	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.28**	$5.28	**$4.98**
2023	3	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.33**	$5.33	**$4.75**
2024	4	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.39**	$5.39	**$4.52**
2025	5	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.44**	$5.44	**$4.31**
2026	6	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.50**	$5.50	**$4.11**
2027	7	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.55**	$5.55	**$3.92**
2028	8	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.61**	$5.61	**$3.73**
2029	9	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.67**	$5.67	**$3.56**
2030	10	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.73**	$5.73	**$3.39**
2031	11	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.80**	$5.80	**$3.24**
2032	12	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.86**	$5.86	**$3.09**
2033	13	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.92**	$5.92	**$2.94**
2034	14	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.99**	$5.99	**$2.81**
2035	15	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$6.06**	$6.06	**$2.68**
2036	16	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$6.18**	$6.18	**$2.58**
2037	17	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$6.25**	$6.25	**$2.46**
2038	18	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$6.32**	$6.32	**$2.35**
2039	19	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$6.40**	$6.40	**$2.24**
2040	20	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$6.47**	$6.47	**$2.14**
2041	21	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$6.68**	$6.68	**$2.08**
2042	22	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$6.76**	$6.76	**$1.99**
2043	23	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$6.84**	$6.84	**$1.90**
2044	24	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$6.92**	$6.92	**$1.81**
2045	25	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$7.01**	$7.01	**$1.73**
2046	26	$59.17	$0.00	$0.00	$1.33	**$60.49**	**$7.10**	$67.59	**$15.75**
2047	27	$60.75	$0.00	$0.00	$1.12	**$61.87**	**$7.19**	$69.05	**$15.18**
2048	28	$61.54	$0.00	$0.00	$1.14	**$62.68**	**$7.28**	$69.96	**$14.51**
2049	29	$61.38	$0.00	$0.00	$1.17	**$62.55**	**$7.37**	$69.92	**$13.68**
2050	30	$62.33	$0.00	$0.00	$1.20	**$63.53**	**$7.47**	$71.00	**$13.10**
Total		$305.17	$0.00	$0.00	$5.95	$311.12	$186.61	$497.73	$150.76

Appendix B *(cont.)*

Appendix B Table NPV-6 Total Cashflows and Net Present Value ($mil.)
Scenario #4 - 3.2 MGD Desal in 2026

Year		Cal-Am Desal					Total - GWR	Combined Total	Total NPV
			Replacements		Outfall	Total -			
		Cashflows	Treatment	Wells	Lease	Desal	Expansion	$1,247 mil.	$512.1 mil.
2021	1	$0.00	$0.00	$0.00	$0.00	$0.00	$5.23	$5.23	$5.23
2022	2	$0.00	$0.00	$0.00	$0.00	$0.00	$5.28	$5.28	$4.98
2023	3	$0.00	$0.00	$0.00	$0.00	$0.00	$5.33	$5.33	$4.75
2024	4	$0.00	$0.00	$0.00	$0.00	$0.00	$5.39	$5.39	$4.52
2025	5	$0.00	$0.00	$0.00	$0.00	$0.00	$5.44	$5.44	$4.31
2026	6	$39.25	$0.00	$0.00	$0.73	$39.98	$5.50	$45.48	$33.98
2027	7	$41.16	$0.00	$0.00	$0.59	$41.75	$5.55	$47.31	$33.35
2028	8	$41.72	$0.00	$0.00	$0.61	$42.33	$5.61	$47.94	$31.88
2029	9	$41.61	$0.00	$0.00	$0.62	$42.23	$5.67	$47.90	$30.05
2030	10	$42.28	$0.00	$0.00	$0.64	$42.92	$5.73	$48.65	$28.80
2031	11	$42.84	$0.00	$0.00	$0.65	$43.49	$5.80	$49.29	$27.52
2032	12	$40.94	$0.00	$0.00	$0.67	$41.60	$5.86	$47.46	$25.00
2033	13	$41.50	$0.00	$0.00	$0.68	$42.18	$5.92	$48.10	$23.90
2034	14	$42.06	$0.00	$0.00	$0.70	$42.75	$5.99	$48.74	$22.85
2035	15	$40.26	$0.00	$0.00	$0.71	$40.97	$6.06	$47.03	$20.80
2036	16	$40.82	$0.00	$0.00	$0.73	$41.55	$6.18	$47.73	$19.92
2037	17	$41.38	$0.00	$0.00	$0.75	$42.13	$6.25	$48.38	$19.04
2038	18	$39.70	$0.00	$0.00	$0.76	$40.46	$6.32	$46.79	$17.38
2039	19	$40.26	$0.00	$0.00	$0.78	$41.04	$6.40	$47.44	$16.62
2040	20	$40.82	$0.00	$0.00	$0.80	$41.62	$6.47	$48.10	$15.90
2041	21	$39.25	$0.00	$0.00	$0.82	$40.07	$6.68	$46.75	$14.58
2042	22	$39.81	$1.13	$0.00	$0.84	$41.78	$6.76	$48.54	$14.28
2043	23	$40.37	$1.08	$0.00	$0.86	$42.31	$6.84	$49.15	$13.64
2044	24	$38.80	$1.03	$0.00	$0.88	$40.71	$6.92	$47.64	$12.47
2045	25	$37.57	$0.98	$0.00	$0.90	$39.45	$7.01	$46.46	$11.47
2046	26	$34.99	$0.93	$0.00	$0.92	$36.84	$7.10	$43.94	$10.24
2047	27	$33.53	$0.88	$12.92	$0.94	$48.27	$7.19	$55.46	$12.19
2048	28	$34.09	$0.83	$12.48	$0.96	$48.36	$7.28	$55.64	$11.54
2049	29	$34.65	$0.78	$12.01	$0.98	$48.43	$7.37	$55.80	$10.92
2050	30	$33.42	$0.73	$11.54	$1.01	$46.69	$7.47	$54.16	$10.00
Total		**$983.11**	**$8.38**	**$48.95**	**$19.50**	**$1,059.94**	**$186.61**	**$1,246.55**	**$512.12**

Appendix B *(cont.)*

Appendix B Table NPV-7 Total Cashflows and Net Present Value ($mil.) Scenario #5 - 3.2 MGD Desal in 2036									
Year		Cal-Am Desal					Total - GWR Expansion	Combined Total	Total NPV
			Replacements		Outfall	Total -			
		Cashflows	Treatment	Wells	Lease	Desal		$891 mil.	$288.0 mil.
2021	1	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.23**	$5.23	**$5.23**
2022	2	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.28**	$5.28	**$4.98**
2023	3	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.33**	$5.33	**$4.75**
2024	4	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.39**	$5.39	**$4.52**
2025	5	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.44**	$5.44	**$4.31**
2026	6	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.50**	$5.50	**$4.11**
2027	7	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.55**	$5.55	**$3.92**
2028	8	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.61**	$5.61	**$3.73**
2029	9	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.67**	$5.67	**$3.56**
2030	10	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.73**	$5.73	**$3.39**
2031	11	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.80**	$5.80	**$3.24**
2032	12	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.86**	$5.86	**$3.09**
2033	13	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.92**	$5.92	**$2.94**
2034	14	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.99**	$5.99	**$2.81**
2035	15	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$6.06**	$6.06	**$2.68**
2036	16	$44.02	$0.00	$0.00	$0.92	**$44.94**	**$6.18**	$51.12	**$21.33**
2037	17	$46.16	$0.00	$0.00	$0.75	**$46.91**	**$6.25**	$53.16	**$20.92**
2038	18	$46.79	$0.00	$0.00	$0.76	**$47.55**	**$6.32**	$53.88	**$20.01**
2039	19	$46.66	$0.00	$0.00	$0.78	**$47.45**	**$6.40**	$53.84	**$18.86**
2040	20	$47.42	$0.00	$0.00	$0.80	**$48.22**	**$6.47**	$54.69	**$18.08**
2041	21	$48.05	$0.00	$0.00	$0.82	**$48.87**	**$6.68**	$55.54	**$17.32**
2042	22	$45.91	$0.00	$0.00	$0.84	**$46.75**	**$6.76**	$53.50	**$15.74**
2043	23	$46.54	$0.00	$0.00	$0.86	**$47.39**	**$6.84**	$54.23	**$15.05**
2044	24	$47.17	$0.00	$0.00	$0.88	**$48.04**	**$6.92**	$54.97	**$14.39**
2045	25	$45.15	$0.00	$0.00	$0.90	**$46.05**	**$7.01**	$53.06	**$13.10**
2046	26	$45.78	$0.00	$0.00	$0.92	**$46.70**	**$7.10**	$53.80	**$12.53**
2047	27	$46.41	$0.00	$0.00	$0.94	**$47.35**	**$7.19**	$54.54	**$11.99**
2048	28	$44.53	$0.00	$0.00	$0.96	**$45.49**	**$7.28**	$52.77	**$10.94**
2049	29	$45.15	$0.00	$0.00	$0.98	**$46.14**	**$7.37**	$53.51	**$10.47**
2050	30	$45.78	$0.00	$0.00	$1.01	**$46.79**	**$7.47**	$54.26	**$10.01**
Total		**$691.53**	**$0.00**	**$0.00**	**$13.09**	**$704.62**	**$186.61**	**$891.24**	**$288.01**

Appendix B *(cont.)*

Appendix B Table NPV-8 Total Cashflows and Net Present Value ($mil.) Scenario #6 - 3.2 MGD Desal in 2046									
Year		Cal-Am Desal					Total - GWR Expansion	Combined Total	Total NPV
		Cashflows	Replacements		Outfall Lease	Total - Desal			
			Treatment	Wells				$482 mil.	$147.5 mil.
2021	1	$0.00	$0.00	$0.00	$0.00	$0.00	$5.23	$5.23	$5.23
2022	2	$0.00	$0.00	$0.00	$0.00	$0.00	$5.28	$5.28	$4.98
2023	3	$0.00	$0.00	$0.00	$0.00	$0.00	$5.33	$5.33	$4.75
2024	4	$0.00	$0.00	$0.00	$0.00	$0.00	$5.39	$5.39	$4.52
2025	5	$0.00	$0.00	$0.00	$0.00	$0.00	$5.44	$5.44	$4.31
2026	6	$0.00	$0.00	$0.00	$0.00	$0.00	$5.50	$5.50	$4.11
2027	7	$0.00	$0.00	$0.00	$0.00	$0.00	$5.55	$5.55	$3.92
2028	8	$0.00	$0.00	$0.00	$0.00	$0.00	$5.61	$5.61	$3.73
2029	9	$0.00	$0.00	$0.00	$0.00	$0.00	$5.67	$5.67	$3.56
2030	10	$0.00	$0.00	$0.00	$0.00	$0.00	$5.73	$5.73	$3.39
2031	11	$0.00	$0.00	$0.00	$0.00	$0.00	$5.80	$5.80	$3.24
2032	12	$0.00	$0.00	$0.00	$0.00	$0.00	$5.86	$5.86	$3.09
2033	13	$0.00	$0.00	$0.00	$0.00	$0.00	$5.92	$5.92	$2.94
2034	14	$0.00	$0.00	$0.00	$0.00	$0.00	$5.99	$5.99	$2.81
2035	15	$0.00	$0.00	$0.00	$0.00	$0.00	$6.06	$6.06	$2.68
2036	16	$0.00	$0.00	$0.00	$0.00	$0.00	$6.18	$6.18	$2.58
2037	17	$0.00	$0.00	$0.00	$0.00	$0.00	$6.25	$6.25	$2.46
2038	18	$0.00	$0.00	$0.00	$0.00	$0.00	$6.32	$6.32	$2.35
2039	19	$0.00	$0.00	$0.00	$0.00	$0.00	$6.40	$6.40	$2.24
2040	20	$0.00	$0.00	$0.00	$0.00	$0.00	$6.47	$6.47	$2.14
2041	21	$0.00	$0.00	$0.00	$0.00	$0.00	$6.68	$6.68	$2.08
2042	22	$0.00	$0.00	$0.00	$0.00	$0.00	$6.76	$6.76	$1.99
2043	23	$0.00	$0.00	$0.00	$0.00	$0.00	$6.84	$6.84	$1.90
2044	24	$0.00	$0.00	$0.00	$0.00	$0.00	$6.92	$6.92	$1.81
2045	25	$0.00	$0.00	$0.00	$0.00	$0.00	$7.01	$7.01	$1.73
2046	26	$55.37	$0.00	$0.00	$1.15	$56.52	$7.10	$63.62	$14.82
2047	27	$58.06	$0.00	$0.00	$0.94	$59.00	$7.19	$66.19	$14.55
2048	28	$58.85	$0.00	$0.00	$0.96	$59.81	$7.28	$67.09	$13.91
2049	29	$58.69	$0.00	$0.00	$0.98	$59.68	$7.37	$67.05	$13.12
2050	30	$59.64	$0.00	$0.00	$1.01	$60.65	$7.47	$68.12	$12.57
Total		$290.62	$0.00	$0.00	$5.04	$295.66	$186.61	$482.27	$147.51

Appendix B *(cont.)*

Appendix B Table NPV-9 Total Cashflows and Net Present Value ($mil.)
Scenario #7 - 1.6 MGD Desal in 2026

Year		Cal-Am Desal					Total - GWR Expansion	Combined Total	Total NPV
		Cashflows	Replacements: Treatment	Replacements: Wells	Outfall Lease	Total - Desal		$1,180 mil.	$487.4 mil.
2021	1	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.23**	$5.23	**$5.23**
2022	2	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.28**	$5.28	**$4.98**
2023	3	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.33**	$5.33	**$4.75**
2024	4	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.39**	$5.39	**$4.52**
2025	5	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.44**	$5.44	**$4.31**
2026	6	$37.68	$0.00	$0.00	$0.54	**$38.23**	**$5.50**	$43.72	**$32.67**
2027	7	$39.25	$0.00	$0.00	$0.41	**$39.66**	**$5.55**	$45.21	**$31.87**
2028	8	$39.81	$0.00	$0.00	$0.41	**$40.23**	**$5.61**	$45.84	**$30.49**
2029	9	$39.70	$0.00	$0.00	$0.42	**$40.13**	**$5.67**	$45.80	**$28.73**
2030	10	$40.26	$0.00	$0.00	$0.43	**$40.70**	**$5.73**	$46.43	**$27.48**
2031	11	$40.82	$0.00	$0.00	$0.44	**$41.27**	**$5.80**	$47.06	**$26.28**
2032	12	$38.92	$0.00	$0.00	$0.45	**$39.37**	**$5.86**	$45.23	**$23.83**
2033	13	$39.48	$0.00	$0.00	$0.47	**$39.94**	**$5.92**	$45.87	**$22.79**
2034	14	$40.04	$0.00	$0.00	$0.48	**$40.51**	**$5.99**	$46.51	**$21.80**
2035	15	$38.13	$0.00	$0.00	$0.49	**$38.62**	**$6.06**	$44.68	**$19.76**
2036	16	$38.69	$0.00	$0.00	$0.50	**$39.19**	**$6.18**	$45.37	**$18.93**
2037	17	$39.25	$0.00	$0.00	$0.51	**$39.76**	**$6.25**	$46.01	**$18.11**
2038	18	$37.46	$0.00	$0.00	$0.52	**$37.98**	**$6.32**	$44.30	**$16.45**
2039	19	$38.02	$0.00	$0.00	$0.53	**$38.55**	**$6.40**	$44.95	**$15.75**
2040	20	$38.58	$0.00	$0.00	$0.55	**$39.13**	**$6.47**	$45.60	**$15.07**
2041	21	$36.90	$0.00	$0.00	$0.56	**$37.46**	**$6.68**	$44.13	**$13.76**
2042	22	$37.35	$1.13	$0.00	$0.57	**$39.05**	**$6.76**	$45.81	**$13.47**
2043	23	$37.91	$1.08	$0.00	$0.59	**$39.57**	**$6.84**	$46.41	**$12.88**
2044	24	$36.34	$1.03	$0.00	$0.60	**$37.97**	**$6.92**	$44.89	**$11.75**
2045	25	$35.10	$0.98	$0.00	$0.61	**$36.70**	**$7.01**	$43.71	**$10.79**
2046	26	$32.52	$0.93	$0.00	$0.63	**$34.08**	**$7.10**	$41.18	**$9.59**
2047	27	$30.95	$0.88	$11.69	$0.64	**$44.17**	**$7.19**	$51.36	**$11.29**
2048	28	$31.51	$0.83	$11.29	$0.66	**$44.29**	**$7.28**	$51.57	**$10.69**
2049	29	$31.96	$0.78	$10.87	$0.67	**$44.28**	**$7.37**	$51.66	**$10.11**
2050	30	$30.73	$0.73	$10.44	$0.69	**$42.59**	**$7.47**	$50.06	**$9.24**
Total		**$927.38**	**$8.38**	**$44.30**	**$13.37**	**$993.42**	**$186.61**	**$1,180.04**	**$487.41**

Appendix B *(cont.)*

Appendix B Table NPV-10 Total Cashflows and Net Present Value ($mil.)
Scenario #8 - 1.6 MGD Desal in 2036

Year		Cal-Am Desal					Total -	Combined	Total NPV
			Replacements		Outfall	Total -	GWR	Total	
		Cashflows	Treatment	Wells	Lease	Desal	Expansion	$853 mil.	$277.3 mil.
2021	1	$0.00	$0.00	$0.00	$0.00	$0.00	$5.23	$5.23	$5.23
2022	2	$0.00	$0.00	$0.00	$0.00	$0.00	$5.28	$5.28	$4.98
2023	3	$0.00	$0.00	$0.00	$0.00	$0.00	$5.33	$5.33	$4.75
2024	4	$0.00	$0.00	$0.00	$0.00	$0.00	$5.39	$5.39	$4.52
2025	5	$0.00	$0.00	$0.00	$0.00	$0.00	$5.44	$5.44	$4.31
2026	6	$0.00	$0.00	$0.00	$0.00	$0.00	$5.50	$5.50	$4.11
2027	7	$0.00	$0.00	$0.00	$0.00	$0.00	$5.55	$5.55	$3.92
2028	8	$0.00	$0.00	$0.00	$0.00	$0.00	$5.61	$5.61	$3.73
2029	9	$0.00	$0.00	$0.00	$0.00	$0.00	$5.67	$5.67	$3.56
2030	10	$0.00	$0.00	$0.00	$0.00	$0.00	$5.73	$5.73	$3.39
2031	11	$0.00	$0.00	$0.00	$0.00	$0.00	$5.80	$5.80	$3.24
2032	12	$0.00	$0.00	$0.00	$0.00	$0.00	$5.86	$5.86	$3.09
2033	13	$0.00	$0.00	$0.00	$0.00	$0.00	$5.92	$5.92	$2.94
2034	14	$0.00	$0.00	$0.00	$0.00	$0.00	$5.99	$5.99	$2.81
2035	15	$0.00	$0.00	$0.00	$0.00	$0.00	$6.06	$6.06	$2.68
2036	16	$42.26	$0.00	$0.00	$0.69	$42.95	$6.18	$49.12	$20.50
2037	17	$44.02	$0.00	$0.00	$0.51	$44.53	$6.25	$50.78	$19.99
2038	18	$44.65	$0.00	$0.00	$0.52	$45.17	$6.32	$51.50	$19.12
2039	19	$44.53	$0.00	$0.00	$0.53	$45.06	$6.40	$51.46	$18.03
2040	20	$45.15	$0.00	$0.00	$0.55	$45.70	$6.47	$52.17	$17.24
2041	21	$45.78	$0.00	$0.00	$0.56	$46.34	$6.68	$53.02	$16.53
2042	22	$43.65	$0.00	$0.00	$0.57	$44.22	$6.76	$50.97	$14.99
2043	23	$44.27	$0.00	$0.00	$0.59	$44.86	$6.84	$51.70	$14.35
2044	24	$44.90	$0.00	$0.00	$0.60	$45.50	$6.92	$52.43	$13.72
2045	25	$42.76	$0.00	$0.00	$0.61	$43.38	$7.01	$50.39	$12.44
2046	26	$43.39	$0.00	$0.00	$0.63	$44.02	$7.10	$51.12	$11.91
2047	27	$44.02	$0.00	$0.00	$0.64	$44.66	$7.19	$51.85	$11.40
2048	28	$42.01	$0.00	$0.00	$0.66	$42.67	$7.28	$49.95	$10.36
2049	29	$42.64	$0.00	$0.00	$0.67	$43.31	$7.37	$50.68	$9.92
2050	30	$43.27	$0.00	$0.00	$0.69	$43.95	$7.47	$51.42	$9.49
Total		$657.32	$0.00	$0.00	$9.01	$666.32	$186.61	$852.94	$277.26

Appendix B *(cont.)*

Appendix B Table NPV-11 Total Cashflows and Net Present Value ($mil.) Scenario #9 - 1.6 MGD Desal in 2046									
Year		Cal-Am Desal					Total - GWR Expansion	Combined Total	Total NPV
		Cashflows	Replacements Treatment	Replacements Wells	Outfall Lease	Total - Desal		$468 mil.	$144.5 mil.
2021	1	$0.00	$0.00	$0.00	$0.00	$0.00	$5.23	$5.23	$5.23
2022	2	$0.00	$0.00	$0.00	$0.00	$0.00	$5.28	$5.28	$4.98
2023	3	$0.00	$0.00	$0.00	$0.00	$0.00	$5.33	$5.33	$4.75
2024	4	$0.00	$0.00	$0.00	$0.00	$0.00	$5.39	$5.39	$4.52
2025	5	$0.00	$0.00	$0.00	$0.00	$0.00	$5.44	$5.44	$4.31
2026	6	$0.00	$0.00	$0.00	$0.00	$0.00	$5.50	$5.50	$4.11
2027	7	$0.00	$0.00	$0.00	$0.00	$0.00	$5.55	$5.55	$3.92
2028	8	$0.00	$0.00	$0.00	$0.00	$0.00	$5.61	$5.61	$3.73
2029	9	$0.00	$0.00	$0.00	$0.00	$0.00	$5.67	$5.67	$3.56
2030	10	$0.00	$0.00	$0.00	$0.00	$0.00	$5.73	$5.73	$3.39
2031	11	$0.00	$0.00	$0.00	$0.00	$0.00	$5.80	$5.80	$3.24
2032	12	$0.00	$0.00	$0.00	$0.00	$0.00	$5.86	$5.86	$3.09
2033	13	$0.00	$0.00	$0.00	$0.00	$0.00	$5.92	$5.92	$2.94
2034	14	$0.00	$0.00	$0.00	$0.00	$0.00	$5.99	$5.99	$2.81
2035	15	$0.00	$0.00	$0.00	$0.00	$0.00	$6.06	$6.06	$2.68
2036	16	$0.00	$0.00	$0.00	$0.00	$0.00	$6.18	$6.18	$2.58
2037	17	$0.00	$0.00	$0.00	$0.00	$0.00	$6.25	$6.25	$2.46
2038	18	$0.00	$0.00	$0.00	$0.00	$0.00	$6.32	$6.32	$2.35
2039	19	$0.00	$0.00	$0.00	$0.00	$0.00	$6.40	$6.40	$2.24
2040	20	$0.00	$0.00	$0.00	$0.00	$0.00	$6.47	$6.47	$2.14
2041	21	$0.00	$0.00	$0.00	$0.00	$0.00	$6.68	$6.68	$2.08
2042	22	$0.00	$0.00	$0.00	$0.00	$0.00	$6.76	$6.76	$1.99
2043	23	$0.00	$0.00	$0.00	$0.00	$0.00	$6.84	$6.84	$1.90
2044	24	$0.00	$0.00	$0.00	$0.00	$0.00	$6.92	$6.92	$1.81
2045	25	$0.00	$0.00	$0.00	$0.00	$0.00	$7.01	$7.01	$1.73
2046	26	$53.16	$0.00	$0.00	$0.86	$54.02	$7.10	$61.11	$14.24
2047	27	$55.37	$0.00	$0.00	$0.64	$56.01	$7.19	$63.20	$13.89
2048	28	$56.16	$0.00	$0.00	$0.66	$56.82	$7.28	$64.10	$13.29
2049	29	$56.00	$0.00	$0.00	$0.67	$56.67	$7.37	$64.05	$12.53
2050	30	$56.79	$0.00	$0.00	$0.69	$57.48	$7.47	$64.95	$11.99
Total		$277.49	$0.00	$0.00	$3.52	$281.00	$186.61	$467.62	$144.48

Appendix B *(cont.)*

Appendix B Table NPV-12 Total Cashflows and Net Present Value ($mil.) Scenario #10 - 4.8 MGD Alt. B Desal in 2026									
Year		Cal-Am Desal					Total - GWR Expansion	Combined Total	Total NPV
		Cashflows	Replacements: Treatment	Replacements: Wells	Outfall Lease	Total - Desal		$1,217 mil.	$496.0 mil.
2021	1	$0.00	$0.00	$0.00	$0.00	$0.00	$5.23	$5.23	$5.23
2022	2	$0.00	$0.00	$0.00	$0.00	$0.00	$5.28	$5.28	$4.98
2023	3	$0.00	$0.00	$0.00	$0.00	$0.00	$5.33	$5.33	$4.75
2024	4	$0.00	$0.00	$0.00	$0.00	$0.00	$5.39	$5.39	$4.52
2025	5	$0.00	$0.00	$0.00	$0.00	$0.00	$5.44	$5.44	$4.31
2026	6	$33.53	$0.00	$0.00	$0.91	$34.44	$5.50	$39.94	$29.85
2027	7	$38.80	$0.00	$0.00	$0.71	$39.51	$5.55	$45.06	$31.77
2028	8	$39.36	$0.00	$0.00	$0.72	$40.09	$5.61	$45.70	$30.39
2029	9	$39.59	$0.00	$0.00	$0.74	$40.33	$5.67	$46.00	$28.86
2030	10	$40.26	$0.00	$0.00	$0.76	$41.02	$5.73	$46.75	$27.67
2031	11	$40.82	$0.00	$0.00	$0.77	$41.60	$5.80	$47.39	$26.46
2032	12	$39.25	$0.00	$0.00	$0.79	$40.04	$5.86	$45.90	$24.18
2033	13	$39.81	$0.00	$0.00	$0.81	$40.62	$5.92	$46.55	$23.13
2034	14	$40.37	$0.00	$0.00	$0.83	$41.20	$5.99	$47.19	$22.13
2035	15	$38.92	$0.00	$0.00	$0.85	$39.76	$6.06	$45.82	$20.27
2036	16	$39.48	$0.00	$0.00	$0.87	$40.34	$6.18	$46.52	$19.41
2037	17	$40.15	$0.00	$0.00	$0.89	$41.04	$6.25	$47.29	$18.61
2038	18	$38.69	$0.00	$0.00	$0.91	$39.60	$6.32	$45.92	$17.05
2039	19	$39.25	$0.00	$0.00	$0.93	$40.18	$6.40	$46.58	$16.32
2040	20	$39.93	$0.00	$0.00	$0.95	$40.88	$6.47	$47.35	$15.65
2041	21	$38.58	$0.00	$0.00	$0.97	$39.55	$6.68	$46.23	$14.41
2042	22	$39.14	$1.13	$0.00	$0.99	$41.27	$6.76	$48.02	$14.13
2043	23	$39.81	$1.08	$0.00	$1.02	$41.91	$6.84	$48.75	$13.53
2044	24	$38.58	$1.03	$0.00	$1.04	$40.65	$6.92	$47.58	$12.46
2045	25	$35.55	$0.98	$0.00	$1.07	$37.60	$7.01	$44.61	$11.02
2046	26	$35.33	$0.93	$0.00	$1.09	$37.35	$7.10	$44.45	$10.36
2047	27	$34.32	$0.88	$11.75	$1.12	$48.07	$7.19	$55.25	$12.15
2048	28	$34.88	$0.83	$11.35	$1.14	$48.20	$7.28	$55.48	$11.50
2049	29	$35.44	$0.78	$10.92	$1.17	$48.31	$7.37	$55.68	$10.89
2050	30	$34.54	$0.73	$10.49	$1.20	$46.96	$7.47	$54.43	$10.05
Total		$954.40	$8.38	$44.52	$23.22	$1,030.52	$186.61	$1,217.13	$496.04

Appendix B *(cont.)*

Appendix B Table NPV-13 Total Cashflows and Net Present Value ($mil.)
Scenario #11 - 4.8 MGD Alt. B Desal in 2036

Year		Cal-Am Desal					Total - GWR	Combined Total	Total NPV
			Replacements		Outfall	Total -			
		Cashflows	Treatment	Wells	Lease	Desal	Expansion	$862 mil.	$278.5 mil.
2021	1	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.23**	$5.23	**$5.23**
2022	2	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.28**	$5.28	**$4.98**
2023	3	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.33**	$5.33	**$4.75**
2024	4	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.39**	$5.39	**$4.52**
2025	5	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.44**	$5.44	**$4.31**
2026	6	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.50**	$5.50	**$4.11**
2027	7	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.55**	$5.55	**$3.92**
2028	8	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.61**	$5.61	**$3.73**
2029	9	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.67**	$5.67	**$3.56**
2030	10	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.73**	$5.73	**$3.39**
2031	11	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.80**	$5.80	**$3.24**
2032	12	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.86**	$5.86	**$3.09**
2033	13	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.92**	$5.92	**$2.94**
2034	14	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.99**	$5.99	**$2.81**
2035	15	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$6.06**	$6.06	**$2.68**
2036	16	$37.61	$0.00	$0.00	$1.14	**$38.75**	**$6.18**	$44.93	**$18.75**
2037	17	$43.52	$0.00	$0.00	$0.89	**$44.41**	**$6.25**	$50.66	**$19.94**
2038	18	$44.15	$0.00	$0.00	$0.91	**$45.06**	**$6.32**	$51.38	**$19.08**
2039	19	$44.40	$0.00	$0.00	$0.93	**$45.33**	**$6.40**	$51.73	**$18.12**
2040	20	$45.15	$0.00	$0.00	$0.95	**$46.10**	**$6.47**	$52.58	**$17.38**
2041	21	$45.78	$0.00	$0.00	$0.97	**$46.76**	**$6.68**	$53.43	**$16.66**
2042	22	$44.02	$0.00	$0.00	$0.99	**$45.02**	**$6.76**	$51.77	**$15.23**
2043	23	$44.65	$0.00	$0.00	$1.02	**$45.67**	**$6.84**	$52.51	**$14.57**
2044	24	$45.28	$0.00	$0.00	$1.04	**$46.32**	**$6.92**	$53.25	**$13.94**
2045	25	$43.65	$0.00	$0.00	$1.07	**$44.71**	**$7.01**	$51.72	**$12.77**
2046	26	$44.27	$0.00	$0.00	$1.09	**$45.36**	**$7.10**	$52.46	**$12.22**
2047	27	$45.03	$0.00	$0.00	$1.12	**$46.14**	**$7.19**	$53.33	**$11.72**
2048	28	$43.39	$0.00	$0.00	$1.14	**$44.54**	**$7.28**	$51.81	**$10.74**
2049	29	$44.02	$0.00	$0.00	$1.17	**$45.19**	**$7.37**	$52.56	**$10.28**
2050	30	$44.78	$0.00	$0.00	$1.20	**$45.97**	**$7.47**	$53.44	**$9.86**
Total		$659.71	$0.00	$0.00	$15.62	$675.33	$186.61	$861.94	$278.54

Appendix B *(cont.)*

Appendix B Table NPV-14 Total Cashflows and Net Present Value ($mil.) Scenario #12 - 4.8 MGD Alt. B Desal in 2046									
Year		Cal-Am Desal					Total - GWR Expansion	Combined Total	Total NPV
		Cashflows	Replacements		Outfall Lease	Total - Desal			
			Treatment	Wells				$463 mil.	$143.3 mil.
2021	1	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.23**	$5.23	**$5.23**
2022	2	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.28**	$5.28	**$4.98**
2023	3	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.33**	$5.33	**$4.75**
2024	4	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.39**	$5.39	**$4.52**
2025	5	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.44**	$5.44	**$4.31**
2026	6	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.50**	$5.50	**$4.11**
2027	7	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.55**	$5.55	**$3.92**
2028	8	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.61**	$5.61	**$3.73**
2029	9	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.67**	$5.67	**$3.56**
2030	10	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.73**	$5.73	**$3.39**
2031	11	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.80**	$5.80	**$3.24**
2032	12	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.86**	$5.86	**$3.09**
2033	13	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.92**	$5.92	**$2.94**
2034	14	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.99**	$5.99	**$2.81**
2035	15	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$6.06**	$6.06	**$2.68**
2036	16	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$6.18**	$6.18	**$2.58**
2037	17	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$6.25**	$6.25	**$2.46**
2038	18	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$6.32**	$6.32	**$2.35**
2039	19	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$6.40**	$6.40	**$2.24**
2040	20	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$6.47**	$6.47	**$2.14**
2041	21	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$6.68**	$6.68	**$2.08**
2042	22	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$6.76**	$6.76	**$1.99**
2043	23	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$6.84**	$6.84	**$1.90**
2044	24	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$6.92**	$6.92	**$1.81**
2045	25	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$7.01**	$7.01	**$1.73**
2046	26	$47.30	$0.00	$0.00	$1.44	**$48.74**	**$7.10**	$55.84	**$13.01**
2047	27	$54.74	$0.00	$0.00	$1.12	**$55.85**	**$7.19**	$63.04	**$13.86**
2048	28	$55.53	$0.00	$0.00	$1.14	**$56.67**	**$7.28**	$63.95	**$13.26**
2049	29	$55.85	$0.00	$0.00	$1.17	**$57.01**	**$7.37**	$64.39	**$12.60**
2050	30	$56.79	$0.00	$0.00	$1.20	**$57.99**	**$7.47**	$65.46	**$12.08**
Total		$270.21	$0.00	$0.00	$6.06	$276.27	$186.61	$462.88	$143.34

Appendix B *(cont.)*

Appendix B Table NPV-15 Total Cashflows and Net Present Value ($mil.) Scenario #13 - 3.2 MGD Alt. B Desal in 2026									
Year		Cal-Am Desal					Total - GWR Expansion	Combined Total	Total NPV
		Cashflows	Replacements: Treatment	Replacements: Wells	Outfall Lease	Total - Desal		$1,157 mil.	$473.5 mil.
2021	1	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.23**	$5.23	**$5.23**
2022	2	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.28**	$5.28	**$4.98**
2023	3	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.33**	$5.33	**$4.75**
2024	4	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.39**	$5.39	**$4.52**
2025	5	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.44**	$5.44	**$4.31**
2026	6	$32.08	$0.00	$0.00	$0.73	**$32.80**	**$5.50**	$38.30	**$28.62**
2027	7	$37.01	$0.00	$0.00	$0.59	**$37.60**	**$5.55**	$43.16	**$30.42**
2028	8	$37.57	$0.00	$0.00	$0.61	**$38.18**	**$5.61**	$43.79	**$29.12**
2029	9	$37.79	$0.00	$0.00	$0.62	**$38.42**	**$5.67**	$44.09	**$27.66**
2030	10	$38.36	$0.00	$0.00	$0.64	**$38.99**	**$5.73**	$44.72	**$26.47**
2031	11	$38.92	$0.00	$0.00	$0.65	**$39.57**	**$5.80**	$45.36	**$25.33**
2032	12	$37.35	$0.00	$0.00	$0.67	**$38.01**	**$5.86**	$43.87	**$23.11**
2033	13	$37.91	$0.00	$0.00	$0.68	**$38.59**	**$5.92**	$44.51	**$22.12**
2034	14	$38.47	$0.00	$0.00	$0.70	**$39.16**	**$5.99**	$45.16	**$21.17**
2035	15	$36.90	$0.00	$0.00	$0.71	**$37.61**	**$6.06**	$43.67	**$19.32**
2036	16	$37.46	$0.00	$0.00	$0.73	**$38.19**	**$6.18**	$44.37	**$18.51**
2037	17	$38.02	$0.00	$0.00	$0.75	**$38.77**	**$6.25**	$45.01	**$17.72**
2038	18	$36.56	$0.00	$0.00	$0.76	**$37.32**	**$6.32**	$43.65	**$16.21**
2039	19	$37.12	$0.00	$0.00	$0.78	**$37.90**	**$6.40**	$44.30	**$15.52**
2040	20	$37.68	$0.00	$0.00	$0.80	**$38.48**	**$6.47**	$44.96	**$14.86**
2041	21	$36.34	$0.00	$0.00	$0.82	**$37.15**	**$6.68**	$43.83	**$13.67**
2042	22	$36.90	$1.13	$0.00	$0.84	**$38.86**	**$6.76**	$45.62	**$13.42**
2043	23	$37.46	$1.08	$0.00	$0.86	**$39.40**	**$6.84**	$46.24	**$12.83**
2044	24	$36.22	$1.03	$0.00	$0.88	**$38.13**	**$6.92**	$45.06	**$11.80**
2045	25	$33.20	$0.98	$0.00	$0.90	**$35.07**	**$7.01**	$42.08	**$10.39**
2046	26	$32.97	$0.93	$0.00	$0.92	**$34.82**	**$7.10**	$41.92	**$9.77**
2047	27	$31.85	$0.88	$10.72	$0.94	**$44.39**	**$7.19**	$51.58	**$11.34**
2048	28	$32.41	$0.83	$10.35	$0.96	**$44.55**	**$7.28**	$51.83	**$10.75**
2049	29	$32.97	$0.78	$9.96	$0.98	**$44.69**	**$7.37**	$52.07	**$10.19**
2050	30	$31.96	$0.73	$9.57	$1.01	**$43.27**	**$7.47**	$50.74	**$9.36**
Total		$901.47	$8.38	$40.59	$19.50	$969.94	$186.61	$1,156.55	$473.48

Appendix B *(cont.)*

Appendix B Table NPV-16 Total Cashflows and Net Present Value ($mil.) Scenario #14 - 3.2 MGD Alt. B Desal in 2036									
Year		Cal-Am Desal					Total - GWR Expansion	Combined Total	Total NPV
		Cashflows	Replacements Treatment	Replacements Wells	Outfall Lease	Total - Desal		$827 mil.	$268.7 mil.
2021	1	$0.00	$0.00	$0.00	$0.00	$0.00	$5.23	$5.23	$5.23
2022	2	$0.00	$0.00	$0.00	$0.00	$0.00	$5.28	$5.28	$4.98
2023	3	$0.00	$0.00	$0.00	$0.00	$0.00	$5.33	$5.33	$4.75
2024	4	$0.00	$0.00	$0.00	$0.00	$0.00	$5.39	$5.39	$4.52
2025	5	$0.00	$0.00	$0.00	$0.00	$0.00	$5.44	$5.44	$4.31
2026	6	$0.00	$0.00	$0.00	$0.00	$0.00	$5.50	$5.50	$4.11
2027	7	$0.00	$0.00	$0.00	$0.00	$0.00	$5.55	$5.55	$3.92
2028	8	$0.00	$0.00	$0.00	$0.00	$0.00	$5.61	$5.61	$3.73
2029	9	$0.00	$0.00	$0.00	$0.00	$0.00	$5.67	$5.67	$3.56
2030	10	$0.00	$0.00	$0.00	$0.00	$0.00	$5.73	$5.73	$3.39
2031	11	$0.00	$0.00	$0.00	$0.00	$0.00	$5.80	$5.80	$3.24
2032	12	$0.00	$0.00	$0.00	$0.00	$0.00	$5.86	$5.86	$3.09
2033	13	$0.00	$0.00	$0.00	$0.00	$0.00	$5.92	$5.92	$2.94
2034	14	$0.00	$0.00	$0.00	$0.00	$0.00	$5.99	$5.99	$2.81
2035	15	$0.00	$0.00	$0.00	$0.00	$0.00	$6.06	$6.06	$2.68
2036	16	$35.97	$0.00	$0.00	$0.92	$36.89	$6.18	$43.07	$17.97
2037	17	$41.51	$0.00	$0.00	$0.75	$42.25	$6.25	$48.50	$19.09
2038	18	$42.14	$0.00	$0.00	$0.76	$42.90	$6.32	$49.22	$18.28
2039	19	$42.39	$0.00	$0.00	$0.78	$43.17	$6.40	$49.57	$17.36
2040	20	$43.02	$0.00	$0.00	$0.80	$43.82	$6.47	$50.29	$16.62
2041	21	$43.65	$0.00	$0.00	$0.82	$44.46	$6.68	$51.14	$15.95
2042	22	$41.88	$0.00	$0.00	$0.84	$42.72	$6.76	$49.48	$14.55
2043	23	$42.51	$0.00	$0.00	$0.86	$43.37	$6.84	$50.21	$13.93
2044	24	$43.14	$0.00	$0.00	$0.88	$44.02	$6.92	$50.94	$13.34
2045	25	$41.38	$0.00	$0.00	$0.90	$42.28	$7.01	$49.29	$12.17
2046	26	$42.01	$0.00	$0.00	$0.92	$42.93	$7.10	$50.02	$11.66
2047	27	$42.64	$0.00	$0.00	$0.94	$43.58	$7.19	$50.76	$11.16
2048	28	$41.00	$0.00	$0.00	$0.96	$41.96	$7.28	$49.24	$10.21
2049	29	$41.63	$0.00	$0.00	$0.98	$42.62	$7.37	$49.99	$9.78
2050	30	$42.26	$0.00	$0.00	$1.01	$43.27	$7.47	$50.74	$9.36
Total		$627.13	$0.00	$0.00	$13.09	$640.22	$186.61	$826.84	$268.70

Appendix B *(cont.)*

Appendix B Table NPV-17 Total Cashflows and Net Present Value ($mil.) Scenario #15 - 3.2 MGD Alt. B Desal in 2046									
Year		Cal-Am Desal					Total - GWR Expansion	Combined Total	Total NPV
			Replacements		Outfall	Total -			
		Cashflows	Treatment	Wells	Lease	Desal		$450 mil.	$140.6 mil.
2021	1	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.23**	$5.23	**$5.23**
2022	2	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.28**	$5.28	**$4.98**
2023	3	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.33**	$5.33	**$4.75**
2024	4	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.39**	$5.39	**$4.52**
2025	5	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.44**	$5.44	**$4.31**
2026	6	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.50**	$5.50	**$4.11**
2027	7	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.55**	$5.55	**$3.92**
2028	8	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.61**	$5.61	**$3.73**
2029	9	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.67**	$5.67	**$3.56**
2030	10	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.73**	$5.73	**$3.39**
2031	11	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.80**	$5.80	**$3.24**
2032	12	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.86**	$5.86	**$3.09**
2033	13	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.92**	$5.92	**$2.94**
2034	14	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.99**	$5.99	**$2.81**
2035	15	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$6.06**	$6.06	**$2.68**
2036	16	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$6.18**	$6.18	**$2.58**
2037	17	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$6.25**	$6.25	**$2.46**
2038	18	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$6.32**	$6.32	**$2.35**
2039	19	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$6.40**	$6.40	**$2.24**
2040	20	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$6.47**	$6.47	**$2.14**
2041	21	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$6.68**	$6.68	**$2.08**
2042	22	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$6.76**	$6.76	**$1.99**
2043	23	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$6.84**	$6.84	**$1.90**
2044	24	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$6.92**	$6.92	**$1.81**
2045	25	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$7.01**	$7.01	**$1.73**
2046	26	$45.25	$0.00	$0.00	$1.15	**$46.40**	**$7.10**	$53.50	**$12.46**
2047	27	$52.21	$0.00	$0.00	$0.94	**$53.15**	**$7.19**	$60.33	**$13.26**
2048	28	$53.00	$0.00	$0.00	$0.96	**$53.96**	**$7.28**	$61.24	**$12.70**
2049	29	$53.31	$0.00	$0.00	$0.98	**$54.30**	**$7.37**	$61.67	**$12.06**
2050	30	$54.10	$0.00	$0.00	$1.01	**$55.11**	**$7.47**	$62.58	**$11.55**
Total		$257.87	$0.00	$0.00	$5.04	$262.91	$186.61	$449.52	$140.58

Appendix B *(cont.)*

Appendix B Table NPV-18 Total Cashflows and Net Present Value ($mil.) Scenario #16 - 1.6 MGD Alt. B Desal in 2026									
Year		Cal-Am Desal					Total - GWR Expansion	Combined Total	Total NPV
		Cashflows	Replacements: Treatment	Replacements: Wells	Outfall Lease	Total - Desal		$1,094 mil.	$450.1 mil.
2021	1	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.23**	$5.23	**$5.23**
2022	2	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.28**	$5.28	**$4.98**
2023	3	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.33**	$5.33	**$4.75**
2024	4	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.39**	$5.39	**$4.52**
2025	5	$0.00	$0.00	$0.00	$0.00	**$0.00**	**$5.44**	$5.44	**$4.31**
2026	6	$30.62	$0.00	$0.00	$0.54	**$31.16**	**$5.50**	$36.66	**$27.39**
2027	7	$35.22	$0.00	$0.00	$0.41	**$35.62**	**$5.55**	$41.18	**$29.03**
2028	8	$35.78	$0.00	$0.00	$0.41	**$36.19**	**$5.61**	$41.80	**$27.80**
2029	9	$36.00	$0.00	$0.00	$0.42	**$36.42**	**$5.67**	$42.10	**$26.41**
2030	10	$36.56	$0.00	$0.00	$0.43	**$37.00**	**$5.73**	$42.73	**$25.29**
2031	11	$37.12	$0.00	$0.00	$0.44	**$37.57**	**$5.80**	$43.36	**$24.21**
2032	12	$35.44	$0.00	$0.00	$0.45	**$35.89**	**$5.86**	$41.75	**$22.00**
2033	13	$35.89	$0.00	$0.00	$0.47	**$36.35**	**$5.92**	$42.28	**$21.01**
2034	14	$36.45	$0.00	$0.00	$0.48	**$36.93**	**$5.99**	$42.92	**$20.12**
2035	15	$34.88	$0.00	$0.00	$0.49	**$35.37**	**$6.06**	$41.43	**$18.32**
2036	16	$35.44	$0.00	$0.00	$0.50	**$35.94**	**$6.18**	$42.12	**$17.57**
2037	17	$35.89	$0.00	$0.00	$0.51	**$36.40**	**$6.25**	$42.65	**$16.79**
2038	18	$34.43	$0.00	$0.00	$0.52	**$34.95**	**$6.32**	$41.27	**$15.33**
2039	19	$34.99	$0.00	$0.00	$0.53	**$35.52**	**$6.40**	$41.92	**$14.69**
2040	20	$35.44	$0.00	$0.00	$0.55	**$35.99**	**$6.47**	$42.46	**$14.03**
2041	21	$34.09	$0.00	$0.00	$0.56	**$34.65**	**$6.68**	$41.33	**$12.89**
2042	22	$34.65	$1.13	$0.00	$0.57	**$36.36**	**$6.76**	$43.11	**$12.68**
2043	23	$35.10	$1.08	$0.00	$0.59	**$36.77**	**$6.84**	$43.61	**$12.10**
2044	24	$33.87	$1.03	$0.00	$0.60	**$35.50**	**$6.92**	$42.42	**$11.11**
2045	25	$30.84	$0.98	$0.00	$0.61	**$32.44**	**$7.01**	$39.45	**$9.74**
2046	26	$30.62	$0.93	$0.00	$0.63	**$32.18**	**$7.10**	$39.27	**$9.15**
2047	27	$29.50	$0.88	$9.70	$0.64	**$40.72**	**$7.19**	$47.91	**$10.53**
2048	28	$29.94	$0.83	$9.37	$0.66	**$40.80**	**$7.28**	$48.08	**$9.97**
2049	29	$30.39	$0.78	$9.01	$0.67	**$40.86**	**$7.37**	$48.23	**$9.44**
2050	30	$29.38	$0.73	$8.66	$0.69	**$39.46**	**$7.47**	$46.93	**$8.66**
Total		$848.53	$8.38	$36.75	$13.37	$907.03	$186.61	$1,093.64	$450.06

Appendix B *(cont.)*

Appendix B Table NPV-19 Total Cashflows and Net Present Value ($mil.)
Scenario #17 - 1.6 MGD Alt. B Desal in 2036

Year		Cal-Am Desal					Total -	Combined	Total NPV
			Replacements		Outfall	Total -	GWR	Total	
		Cashflows	Treatment	Wells	Lease	Desal	Expansion	$790 mil.	$258.5 mil.
2021	1	$0.00	$0.00	$0.00	$0.00	$0.00	$5.23	$5.23	$5.23
2022	2	$0.00	$0.00	$0.00	$0.00	$0.00	$5.28	$5.28	$4.98
2023	3	$0.00	$0.00	$0.00	$0.00	$0.00	$5.33	$5.33	$4.75
2024	4	$0.00	$0.00	$0.00	$0.00	$0.00	$5.39	$5.39	$4.52
2025	5	$0.00	$0.00	$0.00	$0.00	$0.00	$5.44	$5.44	$4.31
2026	6	$0.00	$0.00	$0.00	$0.00	$0.00	$5.50	$5.50	$4.11
2027	7	$0.00	$0.00	$0.00	$0.00	$0.00	$5.55	$5.55	$3.92
2028	8	$0.00	$0.00	$0.00	$0.00	$0.00	$5.61	$5.61	$3.73
2029	9	$0.00	$0.00	$0.00	$0.00	$0.00	$5.67	$5.67	$3.56
2030	10	$0.00	$0.00	$0.00	$0.00	$0.00	$5.73	$5.73	$3.39
2031	11	$0.00	$0.00	$0.00	$0.00	$0.00	$5.80	$5.80	$3.24
2032	12	$0.00	$0.00	$0.00	$0.00	$0.00	$5.86	$5.86	$3.09
2033	13	$0.00	$0.00	$0.00	$0.00	$0.00	$5.92	$5.92	$2.94
2034	14	$0.00	$0.00	$0.00	$0.00	$0.00	$5.99	$5.99	$2.81
2035	15	$0.00	$0.00	$0.00	$0.00	$0.00	$6.06	$6.06	$2.68
2036	16	$34.34	$0.00	$0.00	$0.69	$35.02	$6.18	$41.20	$17.19
2037	17	$39.49	$0.00	$0.00	$0.51	$40.00	$6.25	$46.25	$18.21
2038	18	$40.12	$0.00	$0.00	$0.52	$40.64	$6.32	$46.97	$17.44
2039	19	$40.37	$0.00	$0.00	$0.53	$40.91	$6.40	$47.31	$16.57
2040	20	$41.00	$0.00	$0.00	$0.55	$41.55	$6.47	$48.02	$15.87
2041	21	$41.63	$0.00	$0.00	$0.56	$42.19	$6.68	$48.87	$15.24
2042	22	$39.75	$0.00	$0.00	$0.57	$40.32	$6.76	$47.08	$13.85
2043	23	$40.25	$0.00	$0.00	$0.59	$40.83	$6.84	$47.67	$13.23
2044	24	$40.88	$0.00	$0.00	$0.60	$41.48	$6.92	$48.40	$12.67
2045	25	$39.12	$0.00	$0.00	$0.61	$39.73	$7.01	$46.74	$11.54
2046	26	$39.75	$0.00	$0.00	$0.63	$40.37	$7.10	$47.47	$11.06
2047	27	$40.25	$0.00	$0.00	$0.64	$40.89	$7.19	$48.08	$10.57
2048	28	$38.61	$0.00	$0.00	$0.66	$39.27	$7.28	$46.55	$9.65
2049	29	$39.24	$0.00	$0.00	$0.67	$39.91	$7.37	$47.29	$9.25
2050	30	$39.75	$0.00	$0.00	$0.69	$40.43	$7.47	$47.90	$8.84
Total		$594.55	$0.00	$0.00	$9.01	$603.56	$186.61	$790.17	$258.45

Appendix B *(cont.)*

Appendix B Table NPV-20 Total Cashflows and Net Present Value ($mil.) Scenario #18 - 1.6 MGD Alt. B Desal in 2046									
Year		Cal-Am Desal					Total - GWR Expansion	Combined Total	Total NPV
		Cashflows	Replacements		Outfall Lease	Total - Desal			
			Treatment	Wells				$436 mil.	$137.7 mil.
2021	1	$0.00	$0.00	$0.00	$0.00	$0.00	$5.23	$5.23	$5.23
2022	2	$0.00	$0.00	$0.00	$0.00	$0.00	$5.28	$5.28	$4.98
2023	3	$0.00	$0.00	$0.00	$0.00	$0.00	$5.33	$5.33	$4.75
2024	4	$0.00	$0.00	$0.00	$0.00	$0.00	$5.39	$5.39	$4.52
2025	5	$0.00	$0.00	$0.00	$0.00	$0.00	$5.44	$5.44	$4.31
2026	6	$0.00	$0.00	$0.00	$0.00	$0.00	$5.50	$5.50	$4.11
2027	7	$0.00	$0.00	$0.00	$0.00	$0.00	$5.55	$5.55	$3.92
2028	8	$0.00	$0.00	$0.00	$0.00	$0.00	$5.61	$5.61	$3.73
2029	9	$0.00	$0.00	$0.00	$0.00	$0.00	$5.67	$5.67	$3.56
2030	10	$0.00	$0.00	$0.00	$0.00	$0.00	$5.73	$5.73	$3.39
2031	11	$0.00	$0.00	$0.00	$0.00	$0.00	$5.80	$5.80	$3.24
2032	12	$0.00	$0.00	$0.00	$0.00	$0.00	$5.86	$5.86	$3.09
2033	13	$0.00	$0.00	$0.00	$0.00	$0.00	$5.92	$5.92	$2.94
2034	14	$0.00	$0.00	$0.00	$0.00	$0.00	$5.99	$5.99	$2.81
2035	15	$0.00	$0.00	$0.00	$0.00	$0.00	$6.06	$6.06	$2.68
2036	16	$0.00	$0.00	$0.00	$0.00	$0.00	$6.18	$6.18	$2.58
2037	17	$0.00	$0.00	$0.00	$0.00	$0.00	$6.25	$6.25	$2.46
2038	18	$0.00	$0.00	$0.00	$0.00	$0.00	$6.32	$6.32	$2.35
2039	19	$0.00	$0.00	$0.00	$0.00	$0.00	$6.40	$6.40	$2.24
2040	20	$0.00	$0.00	$0.00	$0.00	$0.00	$6.47	$6.47	$2.14
2041	21	$0.00	$0.00	$0.00	$0.00	$0.00	$6.68	$6.68	$2.08
2042	22	$0.00	$0.00	$0.00	$0.00	$0.00	$6.76	$6.76	$1.99
2043	23	$0.00	$0.00	$0.00	$0.00	$0.00	$6.84	$6.84	$1.90
2044	24	$0.00	$0.00	$0.00	$0.00	$0.00	$6.92	$6.92	$1.81
2045	25	$0.00	$0.00	$0.00	$0.00	$0.00	$7.01	$7.01	$1.73
2046	26	$43.19	$0.00	$0.00	$0.86	$44.05	$7.10	$51.15	$11.92
2047	27	$49.68	$0.00	$0.00	$0.64	$50.32	$7.19	$57.50	$12.64
2048	28	$50.47	$0.00	$0.00	$0.66	$51.12	$7.28	$58.40	$12.11
2049	29	$50.78	$0.00	$0.00	$0.67	$51.45	$7.37	$58.83	$11.51
2050	30	$51.57	$0.00	$0.00	$0.69	$52.26	$7.47	$59.73	$11.02
Total		$245.69	$0.00	$0.00	$3.52	$249.20	$186.61	$435.82	$137.74

APPENDIX C – SUMMARY AND DETAILS OF DESAL CASHFLOWS BY ALTERNATIVE

Appendix C Table ADC-1 Cal-Am Desal Project - Total Cashflows from Customers[1] ($mil.)
(Includes Customer Cashflow, Replacement Cost, and Outfall Lease Payment)

Year		Base Case 6.4 MGD On Schedule	Scen. #1 4.8 MGD in 2026	Scen. #2 4.8 MGD in 2036	Scen. #3 4.8 MGD in 2046	Scen. #4 3.2 MGD in 2026	Scen. #5 3.2 MGD in 2036	Scen. #6 3.2 MGD in 2046	Scen. #7 1.6 MGD in 2026	Scen. #8 1.6 MGD in 2036	Scen. #9 1.6 MGD in 2046	Scen. #10 4.8 MGD Alt B in 2026	Scen. #11 4.8 MGD Alt B in 2036	Scen. #12 4.8 MGD Alt B in 2046	Scen. #13 3.2 MGD Alt B in 2026	Scen. #14 3.2 MGD Alt B in 2036	Scen. #15 3.2 MGD Alt B in 2046	Scen. #16 1.6 MGD Alt B in 2026	Scen. #17 1.6 MGD Alt B in 2036	Scen. #18 1.6 MGD Alt B in 2046
2021	1	$40.51	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2022	2	$40.70	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2023	3	$41.21	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2024	4	$41.13	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2025	5	$41.74	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2026	6	$42.46	$42.78	$0.00	$0.00	$39.98	$0.00	$0.00	$38.23	$0.00	$0.00	$34.44	$0.00	$0.00	$32.80	$0.00	$0.00	$31.16	$0.00	$0.00
2027	7	$40.78	$43.77	$0.00	$0.00	$41.75	$0.00	$0.00	$39.66	$0.00	$0.00	$39.51	$0.00	$0.00	$37.60	$0.00	$0.00	$35.62	$0.00	$0.00
2028	8	$41.30	$44.35	$0.00	$0.00	$42.33	$0.00	$0.00	$40.23	$0.00	$0.00	$40.09	$0.00	$0.00	$38.18	$0.00	$0.00	$36.19	$0.00	$0.00
2029	9	$41.92	$44.25	$0.00	$0.00	$42.23	$0.00	$0.00	$40.13	$0.00	$0.00	$40.33	$0.00	$0.00	$38.42	$0.00	$0.00	$36.42	$0.00	$0.00
2030	10	$40.34	$44.94	$0.00	$0.00	$42.92	$0.00	$0.00	$40.70	$0.00	$0.00	$41.02	$0.00	$0.00	$38.99	$0.00	$0.00	$37.00	$0.00	$0.00
2031	11	$40.95	$45.63	$0.00	$0.00	$43.49	$0.00	$0.00	$41.27	$0.00	$0.00	$41.60	$0.00	$0.00	$39.57	$0.00	$0.00	$37.57	$0.00	$0.00
2032	12	$41.57	$43.63	$0.00	$0.00	$41.60	$0.00	$0.00	$39.37	$0.00	$0.00	$40.04	$0.00	$0.00	$38.01	$0.00	$0.00	$35.89	$0.00	$0.00
2033	13	$40.10	$44.32	$0.00	$0.00	$42.18	$0.00	$0.00	$39.94	$0.00	$0.00	$40.62	$0.00	$0.00	$38.59	$0.00	$0.00	$36.35	$0.00	$0.00
2034	14	$40.72	$45.02	$0.00	$0.00	$42.75	$0.00	$0.00	$40.51	$0.00	$0.00	$41.20	$0.00	$0.00	$39.16	$0.00	$0.00	$36.93	$0.00	$0.00
2035	15	$41.34	$43.13	$0.00	$0.00	$40.97	$0.00	$0.00	$38.62	$0.00	$0.00	$39.76	$0.00	$0.00	$37.61	$0.00	$0.00	$35.37	$0.00	$0.00
2036	16	$39.96	$43.82	$48.09	$0.00	$41.55	$44.94	$0.00	$39.19	$42.95	$0.00	$40.34	$38.75	$0.00	$38.19	$36.89	$0.00	$35.94	$35.02	$0.00
2037	17	$41.59	$44.51	$49.19	$0.00	$42.13	$46.91	$0.00	$39.76	$44.53	$0.00	$41.04	$44.41	$0.00	$38.77	$42.25	$0.00	$36.40	$40.00	$0.00
2038	18	$42.17	$42.74	$49.84	$0.00	$40.46	$47.55	$0.00	$37.98	$45.17	$0.00	$39.60	$45.06	$0.00	$37.32	$42.90	$0.00	$34.95	$40.64	$0.00
2039	19	$40.85	$43.43	$49.73	$0.00	$41.04	$47.45	$0.00	$38.55	$45.06	$0.00	$40.18	$45.33	$0.00	$37.90	$43.17	$0.00	$35.52	$40.91	$0.00
2040	20	$40.43	$44.02	$50.51	$0.00	$41.62	$48.22	$0.00	$39.13	$45.70	$0.00	$40.88	$46.10	$0.00	$38.48	$43.82	$0.00	$35.99	$41.55	$0.00
2041	21	$37.31	$42.47	$51.28	$0.00	$40.07	$48.87	$0.00	$37.46	$46.34	$0.00	$39.55	$46.76	$0.00	$37.15	$44.46	$0.00	$34.65	$42.19	$0.00
2042	22	$49.81	$44.29	$49.04	$0.00	$41.78	$46.75	$0.00	$39.05	$44.22	$0.00	$41.27	$45.02	$0.00	$38.86	$42.72	$0.00	$36.36	$40.32	$0.00
2043	23	$49.92	$44.83	$49.82	$0.00	$42.31	$47.39	$0.00	$39.57	$44.86	$0.00	$41.91	$45.67	$0.00	$39.40	$43.37	$0.00	$36.77	$40.83	$0.00
2044	24	$50.00	$43.34	$50.60	$0.00	$40.71	$48.04	$0.00	$37.97	$45.50	$0.00	$40.65	$46.32	$0.00	$38.13	$44.02	$0.00	$35.50	$41.48	$0.00
2045	25	$48.49	$42.76	$48.48	$0.00	$39.45	$46.05	$0.00	$36.70	$43.38	$0.00	$37.60	$44.71	$0.00	$35.07	$42.28	$0.00	$32.44	$39.73	$0.00
2046	26	$48.47	$39.37	$49.26	$60.49	$36.84	$46.70	$56.52	$34.08	$44.02	$54.02	$37.35	$45.36	$48.74	$34.82	$42.93	$46.40	$32.18	$40.37	$44.05
2047	27	$48.55	$52.15	$50.04	$61.87	$48.27	$47.35	$59.00	$44.17	$44.66	$56.01	$48.07	$46.14	$55.85	$44.39	$43.58	$53.15	$40.72	$40.89	$50.32
2048	28	$48.54	$52.20	$48.06	$62.68	$48.36	$45.49	$59.81	$44.29	$42.67	$56.82	$48.20	$44.54	$56.67	$44.55	$41.96	$53.96	$40.80	$39.27	$51.12
2049	29	$48.62	$52.22	$48.84	$62.55	$48.43	$46.14	$59.68	$44.28	$43.31	$56.67	$48.31	$45.19	$57.01	$44.69	$42.62	$54.30	$40.86	$39.91	$51.45
2050	30	$48.71	$50.56	$49.49	$63.53	$46.69	$46.79	$60.65	$42.59	$43.95	$57.48	$46.96	$45.97	$57.99	$43.27	$43.27	$55.11	$39.46	$40.43	$52.26

1. Summaries of cashflows, replacement capital costs (debt service), and Outfall lease payments from Tables ADC-2 through ADC-5.

Appendix C *(cont.)*

Appendix C Table ADC-2 Cal-Am Desal Project - Total Cashflows from Customers1 ($mil.)

(These Projections include Adjustments for Inflation Based on Delayed Construction Dates but Do Not Include Replacement or Outfall Lease Costs)

Year		Base Case 6.4 MGD On Schedule	*Scen. #1* 4.8 MGD in 2026	*Scen. #2* 4.8 MGD in 2036	*Scen. #3* 4.8 MGD in 2046	*Scen. #4* 3.2 MGD in 2026	*Scen. #5* 3.2 MGD in 2036	*Scen. #6* 3.2 MGD in 2046	*Scen. #7* 1.6 MGD in 2026	*Scen. #8* 1.6 MGD in 2036	*Scen. #9* 1.6 MGD in 2046	*Scen. #10* 4.8 MGD Alt B in 2026	*Scen. #11* 4.8 MGD Alt B in 2036	*Scen. #12* 4.8 MGD Alt B in 2046	*Scen. #13* 3.2 MGD Alt B in 2026	*Scen. #14* 3.2 MGD Alt B in 2036	*Scen. #15* 3.2 MGD Alt B in 2046	*Scen. #16* 1.6 MGD Alt B in 2026	*Scen. #17* 1.6 MGD Alt B in 2036	*Scen. #18* 1.6 MGD Alt B in 2046
2021	1	$39.70	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2022	2	$40.00	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2023	3	$40.50	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2024	4	$40.40	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2025	5	$41.00	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2026	6	$41.70	$41.94	$0	$0	$39.25	$0	$0	$37.68	$0	$0	$33.53	$0	$0	$32.08	$0	$0	$30.62	$0	$0
2027	7	$40.00	$43.07	$0	$0	$41.16	$0	$0	$39.25	$0	$0	$38.80	$0	$0	$37.01	$0	$0	$35.22	$0	$0
2028	8	$40.50	$43.63	$0	$0	$41.72	$0	$0	$39.81	$0	$0	$39.36	$0	$0	$37.57	$0	$0	$35.78	$0	$0
2029	9	$41.10	$43.51	$0	$0	$41.61	$0	$0	$39.70	$0	$0	$39.59	$0	$0	$37.79	$0	$0	$36.00	$0	$0
2030	10	$39.50	$44.19	$0	$0	$42.28	$0	$0	$40.26	$0	$0	$40.26	$0	$0	$38.36	$0	$0	$36.56	$0	$0
2031	11	$40.10	$44.86	$0	$0	$42.84	$0	$0	$40.82	$0	$0	$40.82	$0	$0	$38.92	$0	$0	$37.12	$0	$0
2032	12	$40.70	$42.84	$0	$0	$40.94	$0	$0	$38.92	$0	$0	$39.25	$0	$0	$37.35	$0	$0	$35.44	$0	$0
2033	13	$39.20	$43.51	$0	$0	$41.50	$0	$0	$39.48	$0	$0	$39.81	$0	$0	$37.91	$0	$0	$35.89	$0	$0
2034	14	$39.80	$44.19	$0	$0	$42.06	$0	$0	$40.04	$0	$0	$40.37	$0	$0	$38.47	$0	$0	$36.45	$0	$0
2035	15	$40.40	$42.28	$0	$0	$40.26	$0	$0	$38.13	$0	$0	$38.92	$0	$0	$36.90	$0	$0	$34.88	$0	$0
2036	16	$39.00	$42.95	$47.04	$0	$40.82	$44.02	$0	$38.69	$42.26	$0	$39.48	$37.61	$0	$37.46	$35.97	$0	$35.44	$34.34	$0
2037	17	$39.60	$43.63	$48.30	$0	$41.38	$46.16	$0	$39.25	$44.02	$0	$40.15	$43.52	$0	$38.02	$41.51	$0	$35.89	$39.49	$0
2038	18	$40.20	$41.83	$48.93	$0	$39.70	$46.79	$0	$37.46	$44.65	$0	$38.69	$44.15	$0	$36.56	$42,14	$0	$34.43	$40.12	$0
2039	19	$38.90	$42.51	$48.80	$0	$40.26	$46.66	$0	$38.02	$44.53	$0	$39.25	$44.40	$0	$37.12	$42.39	$0	$34.99	$40.37	$0
2040	20	$38.50	$43.07	$49.56	$0	$40.82	$47.42	$0	$38.58	$45.15	$0	$39.93	$45.15	$0	$37.68	$43.02	$0	$35.44	$41.00	$0
2041	21	$35.40	$41.50	$50.31	$0	$39.25	$48.05	$0	$36.90	$45.78	$0	$38.58	$45.78	$0	$36.34	$43.65	$0	$34.09	$41.63	$0
2042	22	$34.20	$42.17	$48.05	$0	$39.81	$45.91	$0	$37.35	$43.65	$0	$39.14	$44.02	$0	$36.90	$41.88	$0	$34.65	$39.75	$0
2043	23	$34.80	$42.73	$48.80	$0	$40.37	$46.54	$0	$37.91	$44.27	$0	$39.81	$44.65	$0	$37.46	$42.51	$0	$35.10	$40.25	$0
2044	24	$35.40	$41.27	$49.56	$0	$38.80	$47.17	$0	$36.34	$44.90	$0	$38.58	$45.28	$0	$36.22	$43.14	$0	$33.87	$40.88	$0
2045	25	$34.40	$40.71	$47.42	$0	$37.57	$45.15	$0	$35.10	$42.76	$0	$35.55	$43.65	$0	$33.20	$41.38	$0	$30.84	$39.12	$0
2046	26	$34.90	$37.35	$48.17	$59.17	$34.99	$45.78	$55.37	$32.52	$43.39	$53.16	$35.33	$44.27	$47.30	$32.97	$42.01	$45.25	$30.62	$39.75	$43.19
2047	27	$35.50	$36.00	$48.93	$60.75	$33.53	$46.41	$58.06	$30.95	$44.02	$55.37	$34.32	$45.03	$54.74	$31.85	$42.64	$52.21	$29.50	$40.25	$49.68
2048	28	$36.00	$36.56	$46.92	$61.54	$34.09	$44.53	$58.85	$31.51	$42.01	$56.16	$34.88	$43.39	$55.53	$32.41	$41.00	$53.00	$29.94	$38.61	$50.47
2049	29	$36.60	$37.12	$47.67	$61.38	$34.65	$45.15	$58.69	$31.96	$42.64	$56.00	$35.44	$44.02	$55.85	$32.97	$41.63	$53.31	$30.39	$39.24	$50.78
2050	30	$37.20	$36.00	$48.30	$62.33	$33.42	$45.78	$59.64	$30.73	$43.27	$56.79	$34.54	$44.78	$56.79	$31.96	$42.26	$54.10	$29.38	$39.75	$51.57

1. Source: Dave Stoldt, *Summary of Assumptions and Results for Cal-Am Desal Project Alternatives*, Appendix A, March 6, 2018. These numbers are in millions and already include inflation as of 2021. Scenarios where construction is delayed beyond 2021 are adjusted for inflation.

2. Inflation rate = *2.32%* *(This only applies to the Scenarios starting after 2021)*

Source: Dave Stoldt, weighted average inflation assuming O&M costs of power (42%), PUC Labor (Escalation & Non-Escalation) of 58%. Referenced from CalAm model (Monterey

Appendix C *(cont.)*

Year		Base Case 6.4 MGD On Schedule	*Scen. #1* 4.8 MGD in 2026	*Scen. #2* 4.8 MGD in 2036	*Scen. #3* 4.8 MGD in 2046	*Scen. #4* 3.2 MGD in 2026	*Scen. #5* 3.2 MGD in 2036	*Scen. #6* 3.2 MGD in 2046	*Scen. #7* 1.6 MGD in 2026	*Scen. #8* 1.6 MGD in 2036	*Scen. #9* 1.6 MGD in 2046	*Scen. #10* 4.8 MGD Alt B in 2026	*Scen. #11* 4.8 MGD Alt B in 2036	*Scen. #12* 4.8 MGD Alt B in 2046	*Scen. #13* 3.2 MGD Alt B in 2026	*Scen. #14* 3.2 MGD Alt B in 2036	*Scen. #15* 3.2 MGD Alt B in 2046	*Scen. #16* 1.6 MGD Alt B in 2026	*Scen. #17* 1.6 MGD Alt B in 2036	*Scen. #18* 1.6 MGD Alt B in 2046
										Treatment/Chemical Replacement Costs[2]										
2021	1	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2022	2	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2023	3	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2024	4	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2025	5	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2026	6	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2027	7	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2028	8	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2029	9	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2030	10	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2031	11	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2032	12	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2033	13	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2034	14	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2035	15	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2036	16	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2037	17	$1,007,717	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2038	18	$964,812	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2039	19	$920,026	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2040	20	$875,231	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2041	21	$830,435	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2042	22	$785,640	$1,130,163	$0	$0	$1,130,163	$0	$0	$1,130,163	$0	$0	$1,130,163	$0	$0	$1,130,163	$0	$0	$1,130,163	$0	$0
2043	23	$740,844	$1,082,045	$0	$0	$1,082,045	$0	$0	$1,082,045	$0	$0	$1,082,045	$0	$0	$1,082,045	$0	$0	$1,082,045	$0	$0
2044	24	$696,049	$1,031,818	$0	$0	$1,031,818	$0	$0	$1,031,818	$0	$0	$1,031,818	$0	$0	$1,031,818	$0	$0	$1,031,818	$0	$0
2045	25	$651,253	$981,579	$0	$0	$981,579	$0	$0	$981,579	$0	$0	$981,579	$0	$0	$981,579	$0	$0	$981,579	$0	$0
2046	26	$606,458	$931,341	$0	$0	$931,341	$0	$0	$931,341	$0	$0	$931,341	$0	$0	$931,341	$0	$0	$931,341	$0	$0
2047	27	$561,662	$881,102	$0	$0	$881,102	$0	$0	$881,102	$0	$0	$881,102	$0	$0	$881,102	$0	$0	$881,102	$0	$0
2048	28	$516,866	$830,863	$0	$0	$830,863	$0	$0	$830,863	$0	$0	$830,863	$0	$0	$830,863	$0	$0	$830,863	$0	$0
2049	29	$472,071	$780,625	$0	$0	$780,625	$0	$0	$780,625	$0	$0	$780,625	$0	$0	$780,625	$0	$0	$780,625	$0	$0
2050	30	$427,275	$730,386	$0	$0	$730,386	$0	$0	$730,386	$0	$0	$730,386	$0	$0	$730,386	$0	$0	$730,386	$0	$0

Appendix C Table ADC-3 Cal-Am Desal Project Replacement Costs (Capital Only - in Dollars)
Treatment/Chemical Replacement Costs (Only)

1. Source: Dave Stoldt, *Summary of Assumptions and Results for Cal-Am Desal Project Alternatives* , Appendix C, March 6, 2018. These are debt service payments for replacement costs.
2. Treatment/Chemical Replacement Costs apply to all 7 Scenarios.
3. Inflation rate = *2.32%* *(This only applies to the Scenarios starting after 2021)*
Source: Dave Stoldt, weighted average inflation assuming O&M costs of power (42%), PUC Labor (Escalation & Non-Escalation) of 58%. Referenced from CalAm model (Monterey Water

Appendix C *(cont.)*

Appendix C Table ADC-4 Cal-Am Desal Project Replacement Costs (Capital Only - in Dollars)
Wells/Pumping Replacement Costs (Only)

Year		Base Case	Wells/Pumping Replacement Costs																	
			Scen. #1	Scen. #2	Scen. #3	Scen. #4	Scen. #5	Scen. #6	Scen. #7	Scen. #8	Scen. #9	Scen. #10	Scen. #11	Scen. #12	Scen. #13	Scen. #14	Scen. #15	Scen. #16	Scen. #17	Scen. #18
		6.4 MGD On Schedule	4.8 MGD in 2026	4.8 MGD in 2036	4.8 MGD in 2046	3.2 MGD in 2026	3.2 MGD in 2036	3.2 MGD in 2046	1.6 MGD in 2026	1.6 MGD in 2036	1.6 MGD in 2046	4.8 MGD Alt B in 2026	4.8 MGD Alt B in 2036	4.8 MGD Alt B in 2046	3.2 MGD Alt B in 2026	3.2 MGD Alt B in 2036	3.2 MGD Alt B in 2046	1.6 MGD Alt B in 2026	1.6 MGD Alt B in 2036	1.6 MGD Alt B in 2046
2021	1	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2022	2	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2023	3	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2024	4	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2025	5	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2026	6	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2027	7	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2028	8	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2029	9	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2030	10	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2031	11	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2032	12	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2033	13	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2034	14	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2035	15	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2036	16	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2037	17	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2038	18	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2039	19	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2040	20	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2041	21	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2042	22	$13,727,059	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2043	23	$13,255,392	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2044	24	$12,756,193	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2045	25	$12,256,848	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2046	26	$11,757,503	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2047	27	$11,258,157	$14,148,845	$0	$0	$12,921,845	$0	$0	$11,694,845	$0	$0	$11,752,360	$0	$0	$10,717,079	$0	$0	$9,700,969	$0	$0
2048	28	$10,758,812	$13,662,685	$0	$0	$12,477,845	$0	$0	$11,293,005	$0	$0	$11,348,544	$0	$0	$10,348,836	$0	$0	$9,367,640	$0	$0
2049	29	$10,259,466	$13,148,147	$0	$0	$12,007,928	$0	$0	$10,867,709	$0	$0	$10,921,157	$0	$0	$9,959,098	$0	$0	$9,014,854	$0	$0
2050	30	$9,760,121	$12,633,459	$0	$0	$11,537,874	$0	$0	$10,442,290	$0	$0	$10,493,645	$0	$0	$9,569,246	$0	$0	$8,661,965	$0	$0

1. Source: Dave Stoldt, *Summary of Assumptions and Results for Cal-Am Desal Project Alternatives*, Appendix C, March 6, 2018. These are debt service payments for replacement costs.
2. Treatment/Chemical Replacement Costs apply to all 7 Scenarios.

Appendix C *(cont.)*

Appendix C Table ADC-5 Cal-Am Desal Outfall Lease Payments to M1W1 (in Dollars)

Year		Base Case 6.4 MGD On Schedule	*Scen. #1* 4.8 MGD in 2026	*Scen. #2* 4.8 MGD in 2036	*Scen. #3* 4.8 MGD in 2046	*Scen. #4* 3.2 MGD in 2026	*Scen. #5* 3.2 MGD in 2036	*Scen. #6* 3.2 MGD in 2046	*Scen. #7* 1.6 MGD in 2026	*Scen. #8* 1.6 MGD in 2036	*Scen. #9* 1.6 MGD in 2046	*Scen. #10* 4.8 MGD Alt B in 2026	*Scen. #11* 4.8 MGD Alt B in 2036	*Scen. #12* 4.8 MGD Alt B in 2046	*Scen. #13* 3.2 MGD Alt B in 2026	*Scen. #14* 3.2 MGD Alt B in 2036	*Scen. #15* 3.2 MGD Alt B in 2046	*Scen. #16* 1.6 MGD Alt B in 2026	*Scen. #17* 1.6 MGD Alt B in 2036	*Scen. #18* 1.6 MGD Alt B in 2046
2021	1	$810,900	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2022	2	$695,400	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2023	3	$711,500	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2024	4	$728,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2025	5	$744,900	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2026	6	$762,200	$837,700	$0	$0	$728,300	$0	$0	$544,600	$0	$0	$909,400	$0	$0	$728,300	$0	$0	$544,600	$0	$0
2027	7	$779,900	$705,300	$0	$0	$593,300	$0	$0	$405,400	$0	$0	$705,300	$0	$0	$593,300	$0	$0	$405,400	$0	$0
2028	8	$798,000	$721,600	$0	$0	$607,100	$0	$0	$414,800	$0	$0	$721,600	$0	$0	$607,100	$0	$0	$414,800	$0	$0
2029	9	$816,500	$738,400	$0	$0	$621,100	$0	$0	$424,400	$0	$0	$738,400	$0	$0	$621,100	$0	$0	$424,400	$0	$0
2030	10	$835,400	$755,500	$0	$0	$635,500	$0	$0	$434,300	$0	$0	$755,500	$0	$0	$635,500	$0	$0	$434,300	$0	$0
2031	11	$854,800	$773,000	$0	$0	$650,300	$0	$0	$444,300	$0	$0	$773,000	$0	$0	$650,300	$0	$0	$444,300	$0	$0
2032	12	$874,700	$791,000	$0	$0	$665,400	$0	$0	$454,700	$0	$0	$791,000	$0	$0	$665,400	$0	$0	$454,700	$0	$0
2033	13	$895,000	$809,300	$0	$0	$680,800	$0	$0	$465,200	$0	$0	$809,300	$0	$0	$680,800	$0	$0	$465,200	$0	$0
2034	14	$915,700	$828,100	$0	$0	$696,600	$0	$0	$476,000	$0	$0	$828,100	$0	$0	$696,600	$0	$0	$476,000	$0	$0
2035	15	$937,000	$847,300	$0	$0	$712,800	$0	$0	$487,000	$0	$0	$847,300	$0	$0	$712,800	$0	$0	$487,000	$0	$0
2036	16	$958,700	$866,900	$1,053,600	$0	$729,300	$916,000	$0	$498,300	$685,000	$0	$866,900	$1,143,800	$0	$729,300	$916,000	$0	$498,300	$685,000	$0
2037	17	$980,900	$887,100	$887,100	$0	$746,200	$746,200	$0	$509,900	$509,900	$0	$887,100	$887,100	$0	$746,200	$746,200	$0	$509,900	$509,900	$0
2038	18	$1,003,700	$907,600	$907,600	$0	$763,500	$763,500	$0	$521,700	$521,700	$0	$907,600	$907,600	$0	$763,500	$763,500	$0	$521,700	$521,700	$0
2039	19	$1,027,000	$928,700	$928,700	$0	$781,300	$781,300	$0	$533,800	$533,800	$0	$928,700	$928,700	$0	$781,300	$781,300	$0	$533,800	$533,800	$0
2040	20	$1,050,800	$950,200	$950,200	$0	$799,400	$799,400	$0	$546,200	$546,200	$0	$950,200	$950,200	$0	$799,400	$799,400	$0	$546,200	$546,200	$0
2041	21	$1,075,200	$972,300	$972,300	$0	$817,900	$817,900	$0	$558,900	$558,900	$0	$972,300	$972,300	$0	$817,900	$817,900	$0	$558,900	$558,900	$0
2042	22	$1,100,100	$994,800	$994,800	$0	$836,900	$836,900	$0	$571,900	$571,900	$0	$994,800	$994,800	$0	$836,900	$836,900	$0	$571,900	$571,900	$0
2043	23	$1,125,700	$1,017,900	$1,017,900	$0	$856,300	$856,300	$0	$585,100	$585,100	$0	$1,017,900	$1,017,900	$0	$856,300	$856,300	$0	$585,100	$585,100	$0
2044	24	$1,151,800	$1,041,500	$1,041,500	$0	$876,200	$876,200	$0	$598,700	$598,700	$0	$1,041,500	$1,041,500	$0	$876,200	$876,200	$0	$598,700	$598,700	$0
2045	25	$1,178,500	$1,065,700	$1,065,700	$0	$896,500	$896,500	$0	$612,600	$612,600	$0	$1,065,700	$1,065,700	$0	$896,500	$896,500	$0	$612,600	$612,600	$0
2046	26	$1,205,800	$1,090,400	$1,090,400	$1,325,200	$917,300	$917,300	$1,152,100	$626,800	$626,800	$861,600	$1,090,400	$1,090,400	$1,438,600	$917,300	$917,300	$1,152,100	$626,800	$626,800	$861,600
2047	27	$1,233,800	$1,115,700	$1,115,700	$1,115,700	$938,600	$938,600	$938,600	$641,300	$641,300	$641,300	$1,115,700	$1,115,700	$1,115,700	$938,600	$938,600	$938,600	$641,300	$641,300	$641,300
2048	28	$1,262,400	$1,141,600	$1,141,600	$1,141,600	$960,400	$960,400	$960,400	$656,200	$656,200	$656,200	$1,141,600	$1,141,600	$1,141,600	$960,400	$960,400	$960,400	$656,200	$656,200	$656,200
2049	29	$1,291,700	$1,168,100	$1,168,100	$1,168,100	$982,600	$982,600	$982,600	$671,400	$671,400	$671,400	$1,168,100	$1,168,100	$1,168,100	$982,600	$982,600	$982,600	$671,400	$671,400	$671,400
2050	30	$1,321,700	$1,195,200	$1,195,200	$1,195,200	$1,005,400	$1,005,400	$1,005,400	$687,000	$687,000	$687,000	$1,195,200	$1,195,200	$1,195,200	$1,005,400	$1,005,400	$1,005,400	$687,000	$687,000	$687,000

1. Source: Bob Holden, email on 4-03-18. Year 1 and 2 numbers used were in $2016, and escalated at 3% to the actual first and second years, and then escalated at 3% per year thereafter.

2. Inflation rate for lease payments = *2.32%* Source: Dave Stoldt, weighted average inflation assuming O&M costs of power (42%), PUC Labor (Escalation & Non-Escalation) of 58%. Referenced from CalAm model (Monterey Water Supply Project Inputs), and Dave's email of 4-9-

APPENDIX D – SUMMARY OF ANNUAL FINANCING COSTS FOR REPLACEMENTS BY ALTERNATIVE, (TRADITIONAL UTILITY FINANCING)

Monterey Peninsula Water Supply Project
Screening Model - Traditional Utility Financing
$5.4 million in December 2036
Capital Cost Recovery Only
Prepared by David J. Stoldt for MPWMD

Treatment/Chemical Replacement Costs
These costs applies to all 7 Scenarios

Summary of Annual Costs

	Depreciation & Amortization	Total Pre-Tax Return	Ad Valorem Taxes	Total Revenue Requirement
2037	360,180	592,288	55,249	1,007,717
2038	360,180	553,044	51,588	964,812
2039	360,180	512,080	47,767	920,026
2040	360,180	471,106	43,945	875,231
2041	360,180	430,133	40,123	830,435
2042	360,180	389,159	36,301	785,640
2043	360,180	348,185	32,479	740,844
2044	360,180	307,212	28,657	696,049
2045	360,180	266,238	24,835	651,253
2046	360,180	225,265	21,013	606,458
2047	360,180	184,291	17,191	561,662
2048	360,180	143,318	13,369	516,866
2049	360,180	102,344	9,547	472,071
2050	360,180	61,371	5,725	427,275
2051	*357,480*	*20,550*	*1,917*	*379,947*
2052	*0*	*108*	*10*	*119*
2053	*0*	*1*	*0*	*1*
2054	*0*	*0*	*0*	*0*
2055	*0*	*0*	*0*	*0*
2056	*0*	*0*	*0*	*0*
2057	*0*			*0*
2058	*0*			*0*
2059	*0*			*0*
2060	*0*			*0*
2061	*0*			*0*
2062	*0*			*0*
2063	*0*	*0*	*0*	*0*
2064	*0*	*0*	*0*	*0*
2065	*0*	*0*	*0*	*0*
2066	*0*	*0*	*0*	*0*
2067	*0*	*0*	*0*	*0*
2068	*0*	*0*	*0*	*0*
2069	*0*	*0*	*0*	*0*
2070	*0*	*0*	*0*	*0*
2071	*0*	*0*	*0*	*0*
2072	*0*	*0*	*0*	*0*
2073	*0*	*0*	*0*	*0*
2074	*0*	*0*	*0*	*0*
2075	*0*	*0*	*0*	*0*
2076	*0*	*0*	*0*	*0*

These costs are Beyond the 30-Year Analysis Period

Inflation Rate for Adjustment = 2.32% (a)

(a) Source: Dave Stoldt, weighted average inflation factor assuming O&M costs of power (42%), PUC Labor (Escalation and Non-Escalation) of 58%. Reference from Cal Am model (Monterey Water Supply Project Inputs), and Dave's email of 4-9-18.

Note: No adjustment for uncollectibles.

Monterey Peninsula Water Supply Project
Screening Model - Traditional Utility Financing
$80.3 million in December 2041
Capital Cost Recovery Only
Prepared by David J. Stoldt for MPWMD

Wells/Pumping Replacement Costs
(Apply only to the Base Case)

Summary of Annual Costs

	Depreciation & Amortization	Total Pre-Tax Return	Ad Valorem Taxes	Total Revenue Requirement
2042	4,015,000	8,883,413	828,647	13,727,059
2043	4,015,000	8,451,989	788,403	13,255,392
2044	4,015,000	7,995,382	745,811	12,756,193
2045	4,015,000	7,538,642	703,206	12,256,848
2046	4,015,000	7,081,901	660,601	11,757,503
2047	4,015,000	6,625,161	617,996	11,258,157
2048	4,015,000	6,168,420	575,392	10,758,812
2049	4,015,000	5,711,680	532,787	10,259,466
2050	4,015,000	5,254,939	490,182	9,760,121
2051	*4,015,000*	*4,798,199*	*447,577*	*9,260,776*
2052	*4,015,000*	*4,341,458*	*404,972*	*8,761,430*
2053	*4,015,000*	*3,884,718*	*362,367*	*8,262,085*
2054	*4,015,000*	*3,427,977*	*319,762*	*7,762,740*
2055	*4,015,000*	*2,971,237*	*277,158*	*7,263,394*
2056	*4,015,000*	*2,514,496*	*234,553*	*6,764,049*
2057	*4,015,000*	*2,057,756*	*191,948*	*6,264,704*
2058	*4,015,000*	*1,601,015*	*149,343*	*5,765,358*
2059	*4,015,000*			*5,266,013*
2060	*4,015,000*			*4,766,667*
2061	*4,015,000*			*4,267,322*
2062	*21,528*			*22,853*
2063	*0*			*0*
2064	*0*	*0*	*0*	*0*
2065	*0*	*0*	*0*	*0*
2066	*0*	*0*	*0*	*0*
2067	*0*	*0*	*0*	*0*
2068	*0*	*0*	*0*	*0*
2069	*0*	*0*	*0*	*0*
2070	*0*	*0*	*0*	*0*
2071	*0*	*0*	*0*	*0*
2072	*0*	*0*	*0*	*0*
2073	*0*	*0*	*0*	*0*
2074	*0*	*0*	*0*	*0*
2075	*0*	*0*	*0*	*0*
2076	*0*	*0*	*0*	*0*
2077	*0*	*0*	*0*	*0*
2078	*0*	*0*	*0*	*0*
2079	*0*	*0*	*0*	*0*
2080	*0*	*0*	*0*	*0*
2081	*0*	*0*	*0*	*0*

These costs are Beyond the 30-Year Analysis Period

Inflation Rate for Adjustment = 2.32% (a)

(a) Source: Dave Stoldt, weighted average inflation factor assuming O&M costs of power (42%), PUC Labor (Escalation and Non-Escalation) of 58%. Reference from Cal Am model (Monterey Water Supply Project Inputs), and Dave's email of 4-9-18.

Note: No adjustment for uncollectibles.

Appendix D *(cont.)*

Monterey Peninsula Water Supply Project
Screening Model - Traditional Utility Financing

$73.8 million in December 2041
Capital Cost Recovery Only
Prepared by David J. Stoldt for MPWMD

Wells/Pumping Replacement Costs (Apply only to 4.8 MGD Scen.)

Summary of Annual Costs

	Depreciation & Amortization	Total Pre-Tax Return	Ad Valorem Taxes	Total Revenue Requirement	NBS Edit: Total Rev. Reqt. Adjusted to 2046 Construction
2042	3,690,000	8,164,332	761,571	12,615,903	0
2043	3,690,000	7,767,830	724,585	12,182,415	0
2044	3,690,000	7,348,184	685,440	11,723,624	0
2045	3,690,000	6,928,416	646,284	11,264,700	0
2046	3,690,000	6,508,647	607,128	10,805,774	0
2047	3,690,000	6,088,878	567,972	10,346,849	14,148,845
2048	3,690,000	5,669,109	528,816	9,887,924	13,662,685
2049	3,690,000	5,249,340	489,659	9,428,999	13,148,147
2050	3,690,000	4,829,571	450,503	8,970,074	12,633,459
2051	3,690,000	4,409,802	411,347	8,511,149	12,118,770
2052	3,690,000	3,990,033	372,191	8,052,224	11,604,082
2053	3,690,000	3,570,264	333,035	7,593,299	11,089,393
2054	3,690,000	3,150,495	293,879	7,134,373	10,574,705
2055	3,690,000	2,730,726	254,723	6,675,448	10,060,016
2056	3,690,000	2,310,957	215,567	6,216,523	9,545,328
2057	3,690,000	1,891,188	176,410	5,757,598	9,030,639
2058	3,690,000	1,471,419	137,254	5,298,673	8,515,951
2059	3,690,000			4,839,748	8,001,262
2060	3,690,000			4,380,823	7,486,573
2061	3,690,000			3,921,897	6,971,885
2062	19,786			21,003	6,457,196
2063	0			0	5,942,508
2064	0	0	0	0	5,427,819
2065	0	0	0	0	4,913,131
2066	0	0	0	0	4,398,442
2067	0	0	0	0	23,555
2068	0	0	0	0	0
2069	0	0	0	0	0
2070	0	0	0	0	0
2071	0	0	0	0	0
2072	0	0	0	0	0
2073	0	0	0	0	0
2074	0	0	0	0	0
2075	0	0	0	0	0
2076	0	0	0	0	0
2077	0	0	0	0	0
2078	0	0	0	0	0
2079	0	0	0	0	0
2080	0	0	0	0	0
2081	0	0	0	0	0

These costs are Beyond the 30-Year Analysis Period

Inflation Rate for Adjustme 2.32% (a)

(a) Source: Dave Stoldt, weighted average inflation factor assuming O&M costs of power (42%), PUC Labor (Escalation and Non-Escalation) of 58%. Reference from Cal Am model (Monterey Water Supply Project Inputs), and Dave's email of 4-9-18

Note: No adjustment for uncollectibles.

Monterey Peninsula Water Supply Project
Screening Model - Traditional Utility Financing

$67.4 million in December 2041
Capital Cost Recovery Only
Prepared by David J. Stoldt for MPWMD

Wells/Pumping Replacement Costs (Apply only to 3.2 MGD Scen.)

Summary of Annual Costs

	Depreciation & Amortization	Total Pre-Tax Return	Ad Valorem Taxes	Total Revenue Requirement	NBS Edit: Total Rev. Reqt. Adjusted to 2046 Construction
2042	3,370,000	7,456,314	695,527	11,521,841	0
2043	3,370,000	7,094,197	661,748	11,125,945	0
2044	3,370,000	6,710,943	625,998	10,706,941	0
2045	3,370,000	6,327,577	590,238	10,287,815	0
2046	3,370,000	5,944,211	554,477	9,868,688	0
2047	3,370,000	5,560,845	518,717	9,449,562	12,921,845
2048	3,370,000	5,177,479	482,956	9,030,435	12,477,845
2049	3,370,000	4,794,112	447,196	8,611,308	12,007,928
2050	3,370,000	4,410,746	411,435	8,192,181	11,537,874
2051	3,370,000	4,027,380	375,675	7,773,055	11,067,820
2052	3,370,000	3,644,014	339,914	7,353,928	10,597,766
2053	3,370,000	3,260,647	304,154	6,934,801	10,127,711
2054	3,370,000	2,877,281	268,393	6,515,674	9,657,657
2055	3,370,000	2,493,915	232,633	6,096,548	9,187,603
2056	3,370,000	2,110,548	196,872	5,677,421	8,717,549
2057	3,370,000	1,727,182	161,112	5,258,294	8,247,494
2058	3,370,000	1,343,816	125,351	4,839,167	7,777,440
2059	3,370,000			4,420,041	7,307,386
2060	3,370,000			4,000,914	6,837,331
2061	3,370,000			3,581,787	6,367,277
2062	18,070			19,182	5,897,223
2063	0			0	5,427,168
2064	0	0	0	0	4,957,114
2065	0	0	0	0	4,487,060
2066	0	0	0	0	4,017,006
2067	0	0	0	0	21,513
2068	0	0	0	0	0
2069	0	0	0	0	0
2070	0	0	0	0	0
2071	0	0	0	0	0
2072	0	0	0	0	0
2073	0	0	0	0	0
2074	0	0	0	0	0
2075	0	0	0	0	0
2076	0	0	0	0	0
2077	0	0	0	0	0
2078	0	0	0	0	0
2079	0	0	0	0	0
2080	0	0	0	0	0
2081	0	0	0	0	0

These costs are Beyond the 30-Year Analysis

Inflation Rate for Adjustme 2.32% (a)

(a) Source: Dave Stoldt, weighted average inflation factor assuming O&M costs of power (42%), PUC Labor (Escalation and Non-Escalation) of 58%. Reference from Cal Am model (Monterey Water Supply Project Inputs), and Dave's email of 4-9-18

Note: No adjustment for uncollectibles.

Appendix D *(cont.)*

Monterey Peninsula Water Supply Project
Screening Model - Traditional Utility Financing
$61.0 million in December 2041
Capital Cost Recovery Only
Prepared by David J. Stoldt for MPWMD

Wells/Pumping Replacement Costs (Apply only to 1.6 MGD Scen.)

Summary of Annual Costs

	Depreciation & Amortization	Total Pre-Tax Return	Ad Valorem Taxes	Total Revenue Requirement	NBS Edit: Total Rev. Reqt. Adjusted to 2046 Construction
2042	3,050,000	6,748,296	629,482	10,427,779	0
2043	3,050,000	6,420,564	598,912	10,069,476	0
2044	3,050,000	6,073,702	566,556	9,690,258	0
2045	3,050,000	5,726,739	534,191	9,310,931	0
2046	3,050,000	5,379,776	501,827	8,931,602	0
2047	3,050,000	5,032,812	469,462	8,552,274	11,694,845
2048	3,050,000	4,685,849	437,097	8,172,945	11,293,005
2049	3,050,000	4,338,885	404,732	7,793,617	10,867,709
2050	3,050,000	3,991,921	372,367	7,414,289	10,442,290
2051	3,050,000	3,644,958	340,002	7,034,960	10,016,870
2052	3,050,000	3,297,994	307,638	6,655,632	9,591,450
2053	3,050,000	2,951,031	275,273	6,276,304	9,166,030
2054	3,050,000	2,604,067	242,908	5,896,975	8,740,610
2055	3,050,000	2,257,104	210,543	5,517,647	8,315,190
2056	3,050,000	1,910,140	178,178	5,138,319	7,889,769
2057	3,050,000	1,563,177	145,813	4,758,990	7,464,349
2058	3,050,000	1,216,213	113,449	4,379,662	7,038,929
2059	3,050,000			4,000,334	6,613,509
2060	3,050,000			3,621,005	6,188,089
2061	3,050,000			3,241,677	5,762,669
2062	16,354			17,360	5,337,249
2063	0			0	4,911,829
2064	0	0	0	0	4,486,409
2065	0	0	0	0	4,060,989
2066	0	0	0	0	3,635,569
2067	0	0	0	0	19,470
2068	0	0	0	0	0
2069	0	0	0	0	0
2070	0	0	0	0	0
2071	0	0	0	0	0
2072	0	0	0	0	0
2073	0	0	0	0	0
2074	0	0	0	0	0
2075	0	0	0	0	0
2076	0	0	0	0	0
2077	0	0	0	0	0
2078	0	0	0	0	0
2079	0	0	0	0	0
2080	0	0	0	0	0
2081	0	0	0	0	0

These costs are Beyond the 30-Year Analysis

Inflation Rate for Adjustm 2.32% (a)

(a) Source: Dave Stoldt, weighted average inflation factor assuming O&M costs of power (42%), PUC Labor (Escalation and Non-Escalation) of 58%. Reference from Cal Am model (Monterey Water Supply Project Inputs), and Dave's email of 4-9-18

Note: No adjustment for uncollectibles.

Monterey Peninsula Water Supply Project
Screening Model - Traditional Utility Financing
$61.3 million in December 2041
Capital Cost Recovery Only
Prepared by David J. Stoldt for MPWMD

Wells/Pumping Replacement Costs (Apply only to 4.8 MGD Alt. B)

Summary of Annual Costs

	Depreciation & Amortization	Total Pre-Tax Return	Ad Valorem Taxes	Total Revenue Requirement	NBS Edit: Total Rev. Reqt. Adjusted to 2046 Construction
2042	3,065,000	6,781,484	632,578	10,479,063	0
2043	3,065,000	6,452,141	601,857	10,118,998	0
2044	3,065,000	6,103,573	569,343	9,737,915	0
2045	3,065,000	5,754,903	536,819	9,356,722	0
2046	3,065,000	5,406,234	504,295	8,975,528	0
2047	3,065,000	5,057,564	471,771	8,594,334	11,752,360
2048	3,065,000	4,708,894	439,247	8,213,140	11,348,544
2049	3,065,000	4,360,224	406,723	7,831,946	10,921,157
2050	3,065,000	4,011,554	374,199	7,450,752	10,493,645
2051	3,065,000	3,662,884	341,675	7,069,559	10,066,133
2052	3,065,000	3,314,214	309,151	6,688,365	9,638,621
2053	3,065,000	2,965,544	276,627	6,307,171	9,211,108
2054	3,065,000	2,616,874	244,103	5,925,977	8,783,596
2055	3,065,000	2,268,204	211,579	5,544,783	8,356,084
2056	3,065,000	1,919,534	179,055	5,163,589	7,928,572
2057	3,065,000	1,570,865	146,531	4,782,395	7,501,059
2058	3,065,000	1,222,195	114,007	4,401,201	7,073,547
2059	3,065,000			4,020,007	6,646,035
2060	3,065,000			3,638,813	6,218,522
2061	3,065,000			3,257,619	5,791,010
2062	16,435			17,446	5,363,498
2063	0			0	4,935,986
2064	0	0	0	0	4,508,473
2065	0	0	0	0	4,080,961
2066	0	0	0	0	3,653,449
2067	0	0	0	0	19,566
2068	0	0	0	0	0
2069	0	0	0	0	0
2070	0	0	0	0	0
2071	0	0	0	0	0
2072	0	0	0	0	0
2073	0	0	0	0	0
2074	0	0	0	0	0
2075	0	0	0	0	0
2076	0	0	0	0	0
2077	0	0	0	0	0
2078	0	0	0	0	0
2079	0	0	0	0	0
2080	0	0	0	0	0
2081	0	0	0	0	0

These costs are Beyond the 30-Year Analysis

Inflation Rate for Adjustment 2.32% (a)

(a) Source: Dave Stoldt, weighted average inflation factor assuming O&M costs of power (42%), PUC Labor (Escalation and Non-Escalation) of 58%. Reference from Cal Am model (Monterey Water Supply Project Inputs), and Dave's email of 4-9-18.

Note: No adjustment for uncollectibles.

Appendix D *(cont.)*

Monterey Peninsula Water Supply Project
Screening Model - Traditional Utility Financing
$55.9 million in December 2041
Capital Cost Recovery Only
Prepared by David J. Stoldt for MPWMD

Wells/Pumping Replacement Costs (Apply only to 3.2 MGD Alt. B)

Summary of Annual Costs

	Depreciation & Amortization	Total Pre-Tax Return	Ad Valorem Taxes	Total Revenue Requirement	*NBS Edit: Total Rev. Reqt. Adjusted to 2046 Construction*
2042	2,795,000	6,184,094	576,854	9,555,948	*0*
2043	2,795,000	5,883,763	548,839	9,227,602	*0*
2044	2,795,000	5,565,901	519,188	8,880,089	*0*
2045	2,795,000	5,247,946	489,530	8,532,476	*0*
2046	2,795,000	4,929,991	459,871	8,184,862	*0*
2047	2,795,000	4,612,036	430,212	7,837,248	*10,717,079*
2048	2,795,000	4,294,081	400,553	7,489,634	*10,348,836*
2049	2,795,000	3,976,126	370,894	7,142,020	*9,959,098*
2050	2,795,000	3,658,171	341,235	6,794,406	*9,569,246*
2051	*2,795,000*	*3,340,216*	*311,576*	*6,446,792*	*9,179,394*
2052	*2,795,000*	*3,022,260*	*281,917*	*6,099,178*	*8,789,542*
2053	*2,795,000*	*2,704,305*	*252,258*	*5,751,564*	*8,399,689*
2054	*2,795,000*	*2,386,350*	*222,599*	*5,403,950*	*8,009,837*
2055	*2,795,000*	*2,068,395*	*192,940*	*5,056,335*	*7,619,985*
2056	*2,795,000*	*1,750,440*	*163,281*	*4,708,721*	*7,230,133*
2057	*2,795,000*	*1,432,485*	*133,622*	*4,361,107*	*6,840,281*
2058	*2,795,000*	*1,114,530*	*103,964*	*4,013,493*	*6,450,429*
2059	*2,795,000*			*3,665,879*	*6,060,577*
2060	*2,795,000*			*3,318,265*	*5,670,724*
2061	*2,795,000*			*2,970,651*	*5,280,872*
2062	*14,987*			*15,909*	*4,891,020*
2063	*0*			*0*	*4,501,168*
2064	*0*			*0*	*4,111,316*
2065	*0*	*0*	*0*	*0*	*3,721,464*
2066	*0*	*0*	*0*	*0*	*3,331,611*
2067	*0*	*0*	*0*	*0*	*17,842*
2068	*0*	*0*	*0*	*0*	*0*
2069	*0*	*0*	*0*	*0*	*0*
2070	*0*	*0*	*0*	*0*	*0*
2071	*0*	*0*	*0*	*0*	*0*
2072	*0*	*0*	*0*	*0*	*0*
2073	*0*	*0*	*0*	*0*	*0*
2074	*0*	*0*	*0*	*0*	*0*
2075	*0*	*0*	*0*	*0*	*0*
2076	*0*	*0*	*0*	*0*	*0*
2077	*0*	*0*	*0*	*0*	*0*
2078	*0*	*0*	*0*	*0*	*0*
2079	*0*	*0*	*0*	*0*	*0*
2080	*0*	*0*	*0*	*0*	*0*
2081	*0*	*0*	*0*	*0*	*0*

These costs are Beyond the 30-Year Analysis Period

Inflation Rate for Adjustmen 2.32% (a)

(a) Source: Dave Stoldt, weighted average inflation factor assuming O&M costs of power (42%), PUC Labor (Escalation and Non-Escalation) of 58%. Reference from Cal Am model (Monterey Water Supply Project Inputs), and Dave's email of 4-9-18.

Note: No adjustment for uncollectibles.

Monterey Peninsula Water Supply Project
Screening Model - Traditional Utility Financing
$50.6 million in December 2041
Capital Cost Recovery Only
Prepared by David J. Stoldt for MPWMD

Wells/Pumping Replacement Costs (Apply only to 1.6 MGD Alt. B)

Summary of Annual Costs

	Depreciation & Amortization	Total Pre-Tax Return	Ad Valorem Taxes	Total Revenue Requirement	*NBS Edit: Total Rev. Reqt. Adjusted to 2046 Construction*
2042	2,530,000	5,597,767	522,161	8,649,928	*0*
2043	2,530,000	5,325,911	496,802	8,352,713	*0*
2044	2,530,000	5,038,186	469,963	8,038,149	*0*
2045	2,530,000	4,750,377	443,116	7,723,493	*0*
2046	2,530,000	4,462,568	416,269	7,408,837	*0*
2047	2,530,000	4,174,759	389,422	7,094,181	*9,700,969*
2048	2,530,000	3,886,950	362,575	6,779,525	*9,367,640*
2049	2,530,000	3,599,141	335,729	6,464,869	*9,014,854*
2050	2,530,000	3,311,332	308,882	6,150,213	*8,661,965*
2051	*2,530,000*	*3,023,522*	*282,035*	*5,835,557*	*8,309,076*
2052	*2,530,000*	*2,735,713*	*255,188*	*5,520,901*	*7,956,186*
2053	*2,530,000*	*2,447,904*	*228,341*	*5,206,245*	*7,603,297*
2054	*2,530,000*	*2,160,095*	*201,494*	*4,891,589*	*7,250,407*
2055	*2,530,000*	*1,872,286*	*174,647*	*4,576,933*	*6,897,518*
2056	*2,530,000*	*1,584,477*	*147,800*	*4,262,277*	*6,544,628*
2057	*2,530,000*	*1,296,668*	*120,953*	*3,947,621*	*6,191,739*
2058	*2,530,000*	*1,008,859*	*94,107*	*3,632,965*	*5,838,850*
2059	*2,530,000*			*3,318,309*	*5,485,960*
2060	*2,530,000*			*3,003,653*	*5,133,071*
2061	*2,530,000*			*2,688,997*	*4,780,181*
2062	*13,566*			*14,401*	*4,427,292*
2063	*0*			*0*	*4,074,402*
2064	*0*			*0*	*3,721,513*
2065	*0*	*0*	*0*	*0*	*3,368,624*
2066	*0*	*0*	*0*	*0*	*3,015,734*
2067	*0*	*0*	*0*	*0*	*16,150*
2068	*0*	*0*	*0*	*0*	*0*
2069	*0*	*0*	*0*	*0*	*0*
2070	*0*	*0*	*0*	*0*	*0*
2071	*0*	*0*	*0*	*0*	*0*
2072	*0*	*0*	*0*	*0*	*0*
2073	*0*	*0*	*0*	*0*	*0*
2074	*0*	*0*	*0*	*0*	*0*
2075	*0*	*0*	*0*	*0*	*0*
2076	*0*	*0*	*0*	*0*	*0*
2077	*0*	*0*	*0*	*0*	*0*
2078	*0*	*0*	*0*	*0*	*0*
2079	*0*	*0*	*0*	*0*	*0*
2080	*0*	*0*	*0*	*0*	*0*
2081	*0*	*0*	*0*	*0*	*0*

These costs are Beyond the 30-Year Analysis

Inflation Rate for Adjustment 2.32% (a)

(a) Source: Dave Stoldt, weighted average inflation factor assuming O&M costs of power (42%), PUC Labor (Escalation and Non-Escalation) of 58%. Reference from Cal Am model (Monterey Water Supply Project Inputs), and Dave's email of 4-9-18.

Note: No adjustment for uncollectibles.

Appendix D *(cont.)*

Monterey Peninsula Water Supply Project
Screening Model - Traditional Utility Financing

$8.5 million in December 2051

Capital Cost Recovery Only

Prepared by David J. Stoldt for MPWMD

These are not used - they occur after 30-yr period.

Summary of Annual Costs

	Depreciation & Amortization	Total Pre-Tax Return	Ad Valorem Taxes	Total Revenue Requirement
2052	566,950	932,305	86,966	1,586,221
2053	566,950	870,532	81,203	1,518,686
2054	566,950	806,051	75,189	1,448,190
2055	566,950	741,556	69,172	1,377,678
2056	566,950	677,060	63,156	1,307,167
2057	566,950	612,565	57,140	1,236,655
2058	566,950	548,070	51,124	1,166,144
2059	566,950	483,574	45,108	1,095,632
2060	566,950	419,079	39,092	1,025,121
2061	566,950			954,609
2062	566,950			884,097
2063	566,950			813,586
2064	566,950			743,074
2065	566,950			672,563
2066	562,700	32,347	3,017	598,064
2067	0	171	16	187
2068	0	1	0	1
2069	0	0	0	0
2070	0	0	0	0
2071	0	0	0	0
2072	0	0	0	0
2073	0	0	0	0
2074	0	0	0	0
2075	0	0	0	0
2076	0	0	0	0
2077	0	0	0	0
2078	0	0	0	0
2079	0	0	0	0
2080	0	0	0	0
2081	0	0	0	0
2082	0	0	0	0
2083	0	0	0	0
2084	0	0	0	0
2085	0	0	0	0
2086	0	0	0	0
2087	0	0	0	0
2088	0	0	0	0
2089	0	0	0	0
2090	0	0	0	0
2091	0	0	0	0

These costs are Beyond the 30-Year Analysis Period

Note: No adjustment for uncollectibles.

APPENDIX E – GWR ANNUAL COSTS AND INITIAL CAPITAL AND O&M COSTS

Table GWR-1
GWR Expansion Total Annual Costs (2,250 AFY)

Year		Fixed Debt Cost[1]	MCWD Pipeline Share[2]	O & M Expense[3]	Future Replacement[4]	Total GWR Cost
2021	1	3,045,501	-	2,186,331	-	5,231,832
2022	2	3,045,501	-	2,237,054	-	5,282,555
2023	3	3,045,501	-	2,288,954	-	5,334,454
2024	4	3,045,501	-	2,342,057	-	5,387,558
2025	5	3,045,501	-	2,396,393	-	5,441,894
2026	6	3,045,501	-	2,451,989	-	5,497,490
2027	7	3,045,501	-	2,508,875	-	5,554,376
2028	8	3,045,501	-	2,567,081	-	5,612,582
2029	9	3,045,501	-	2,626,638	-	5,672,138
2030	10	3,045,501	-	2,687,576	-	5,733,076
2031	11	3,045,501	-	2,749,927	-	5,795,428
2032	12	3,045,501	-	2,813,726	-	5,859,226
2033	13	3,045,501	-	2,879,004	-	5,924,505
2034	14	3,045,501	-	2,945,797	-	5,991,298
2035	15	3,045,501	-	3,014,140	-	6,059,640
2036	16	3,045,501	-	3,084,068	47,774	6,177,343
2037	17	3,045,501	-	3,155,618	47,774	6,248,893
2038	18	3,045,501	-	3,228,828	47,774	6,322,103
2039	19	3,045,501	-	3,303,737	47,774	6,397,012
2040	20	3,045,501	-	3,380,384	47,774	6,473,659
2041	21	3,045,501	-	3,458,809	172,874	6,677,184
2042	22	3,045,501	-	3,539,053	172,874	6,757,428
2043	23	3,045,501	-	3,621,159	172,874	6,839,534
2044	24	3,045,501	-	3,705,170	172,874	6,923,545
2045	25	3,045,501	-	3,791,130	172,874	7,009,505
2046	26	3,045,501	-	3,879,084	172,874	7,097,459
2047	27	3,045,501	-	3,969,079	172,874	7,187,454
2048	28	3,045,501	-	4,061,162	172,874	7,279,536
2049	29	3,045,501	-	4,155,380	172,874	7,373,755
2050	30	3,045,501	-	4,251,785	172,874	7,470,160

1. Source: Bob Holden's "Estimated Capital Costs for 2,250 AFY Expansion of PWM", email of 4-9-18.

2. Source: Dave Stoldt, Calculation of MCWD Pipeline Cost is part of the original PWM project, but are not assigned to the expansion.

3. Source: Bob Holden's "O&M AWPF & Injection 040918", email of 4-9-18. Includes annual replacement contributions for AWPF and Injection.

4. Future replacement of AWPF and Injection occur in years 15 and 20. Other replacements after year 30 are assumed to be outside the 30-year period of analysis and excluded.

Appendix E *(cont.)*

Table GWR-2

Calculation of GWR Annual O&M Expense

Year		Power $ [1]	Chemicals $ [1]	Labor $ [1]	Parts/ Material/ Other $ [1]	Annual Replacement Fund AWPF[2]	Annual Replacement Fund Injection[2]	MPWMD Expense[3]	Total Annual O&M
2021	1	$881,200	$835,600	$95,300	$231,200	$0	$0	$143,031	$2,186,331
2022	2	901,644	854,986	97,511	236,564	0	0	146,349	2,237,054
2023	3	922,562	874,822	99,773	242,052	0	0	149,745	2,288,954
2024	4	943,965	895,117	102,088	247,668	0	0	153,219	2,342,057
2025	5	965,865	915,884	104,456	253,414	0	0	156,773	2,396,393
2026	6	988,273	937,133	106,880	259,293	0	0	160,411	2,451,989
2027	7	1,011,201	958,874	109,359	265,308	0	0	164,132	2,508,875
2028	8	1,034,661	981,120	111,897	271,464	0	0	167,940	2,567,081
2029	9	1,058,665	1,003,882	114,493	277,762	0	0	171,836	2,626,638
2030	10	1,083,226	1,027,172	117,149	284,206	0	0	175,823	2,687,576
2031	11	1,108,357	1,051,002	119,867	290,799	0	0	179,902	2,749,927
2032	12	1,134,071	1,075,386	122,648	297,546	0	0	184,076	2,813,726
2033	13	1,160,382	1,100,335	125,493	304,449	0	0	188,346	2,879,004
2034	14	1,187,303	1,125,862	128,404	311,512	0	0	192,716	2,945,797
2035	15	1,214,848	1,151,982	131,383	318,739	0	0	197,187	3,014,140
2036	16	1,243,032	1,178,708	134,431	326,134	0	0	201,761	3,084,068
2037	17	1,271,871	1,206,055	137,550	333,700	0	0	206,442	3,155,618
2038	18	1,301,378	1,234,035	140,741	341,442	0	0	211,232	3,228,828
2039	19	1,331,570	1,262,665	144,007	349,363	0	0	216,132	3,303,737
2040	20	1,362,463	1,291,958	147,348	357,469	0	0	221,147	3,380,384
2041	21	1,394,072	1,321,932	150,766	365,762	0	0	226,277	3,458,809
2042	22	1,426,414	1,352,601	154,264	374,248	0	0	231,527	3,539,053
2043	23	1,459,507	1,383,981	157,843	382,930	0	0	236,898	3,621,159
2044	24	1,493,368	1,416,089	161,505	391,814	0	0	242,394	3,705,170
2045	25	1,528,014	1,448,943	165,252	400,904	0	0	248,018	3,791,130
2046	26	1,563,464	1,482,558	169,085	410,205	0	0	253,772	3,879,084
2047	27	1,599,736	1,516,953	173,008	419,722	0	0	259,659	3,969,079
2048	28	1,636,850	1,552,147	177,022	429,459	0	0	265,683	4,061,162
2049	29	1,674,825	1,588,157	181,129	439,423	0	0	271,847	4,155,380
2050	30	1,713,681	1,625,002	185,331	449,618	0	0	278,154	4,251,785
Escalate[4]:		*2.32%*	*2.32%*	*2.32%*	*2.32%*	*2.32%*	*2.32%*		

1. Overhead of 16.9% is included in Year 1 costs, then inflation was added as shown below.

2. Replacements are assumed to occur after useful life of existing assets and funded by debt.

3. MPWMD expense is 7% of total to cover billing and reporting obligations, as well as water accounting vis a vis reserves, etc. Source: Dave Stoldt.

4. Source: Dave Stoldt, weighted average inflation factor assuming O&M costs of power (42%), PUC Labor (Escalation and Non-Escalation) of 58%. Reference from Cal Am model (Monterey Water Supply Project Inputs), and Dave's email of 4-9-18.

Table GWR-3				
O&M Costs for Base Project	**PMW Expansion**	***Adjustments***		*From Bob's 4-12-18 email/update:*
Total Purified Water Produced	2,250			
Baseline 3,500 AFY paid for by Cal Am	0			
Drought Reserve paid for by MPWMD	0			
MCWD water paid for by MCWD	0			
Additional water for Expansion for Cal Am	2,250			
Total water paid for by Cal Am	2,250			
O&M costs		Cost with 16.9%		
Power (AWPF+Injection) kWh/yr.	6,679,688	Overhead Applied		
Power (AWPF+Injection) $	**$753,791**	***$881,200***		
Chemicals $	**$714,820**	***$835,600***		
Labor $	**$81,512**	***$95,300***		
Parts/Material/Other $	**$197,772**	***$231,200***		
Total $	**$1,747,895**			
Lease of Salinas Storm Water Ponds	**$0**			
Expected Interruptible Rate	**$0**	*Inflation*		
Annual Replacement Fund AWPF[1]	**$112,000**	*Adjustments*		*$110,470*
Electrical Equipment	$376,100	*81.98%*	*30 years*	*$461,585*
Instrumentation Equipment	$26,100	*90.54%*	*15 years*	*$28,849*
Pumps & Motors & Ozonators	$680,200	*87.59%*	*20 years*	*$776,559*
Injection Wells	$0	*81.98%*	*30 years*	
Annual Replacement Fund Injection[1]	**$242,000**			*$239,161*
Electrical Equipment	$232,600	*81.98%*	*30 years*	*$283,750*
Instrumentation Equipment	$46,600	*90.54%*	*15 years*	*$51,476*
Pumps & Motors & Ozonators	$428,100	*87.59%*	*20 years*	*$488,722*
Injection Wells	$1,689,300	*81.98%*	*30 years*	*$2,060,619*
Annual Replacement Fund Booster PS	$20,495			
Electrical Equipment	$65,600	*81.98%*	*30 years*	
Instrumentation Equipment	$4,500	*90.54%*	*15 years*	
Pumps & Motors & Ozonators	$35,700	*87.59%*	*20 years*	
Injection Wells	$0	*81.98%*	*30 years*	

1. Per Bob's email, these costs were escalated by 1.16% (based on 2.32% avg. inflation) to move them from mid-2020 dollars to 2021 dollars.

Assumptions:

1. Power, Chemicals, Labor, Part/Materials/Other not shown for Reclamation Ditch, Blanco Drain, Salinas Storm Water, or Pond Pump Station Projects as they are covered by the Interruptible Rate
2. Pipeline O&M covered separately
3. AWPF (including the product water pump station) and the Injection (including backwashes) are listed here
4. No overhead is included in power, chemicals, labor, parts/materials/other, lease, or replacement funds
5. Overhead is included in interruptible rate costs
6. Replacement fund does not include MCWD facilities
7. Replacement fund does not cover Reclamation Ditch, Blanco Drain, Salinas Storm Water, Ag Wash Water, or Pond Return facilities as that is covered in the interruptible rate
8. Replacement fund assumes 3% inflation per year over life of equipment

Appendix E *(cont.)*

Table GWR-4 Estimated Capital Costs for 2,250 AFY Expansion of PWM[1]	
Descriptions	**Amount**
Planning	$504,000
Environmental	$723,000
CPUC & Water Purchase Agreement	$385,000
Partner Agency Agreements	$33,000
Additional pathogen removal credit	$132,000
Permitting (Federal, State & Local) & ROW	$665,000
Pond Storage & Return *(Lining one pond with HDPE liner (37 of 104 acres))*	
Design	$680,000
Construction	$6,804,000
ESDC, CM, Legal & In-house Labor	$1,361,000
AWPF Expansion from 5.0 to 7.0 mgd & Product Water Pump Station	
Design	$874,000
Construction	$8,739,000
ESDC, CM, Legal & In-house Labor	$1,748,000
Product Water Pipeline	
Design	$110,000
Construction *(Booster PS built at Injection site)*	$1,101,000
ESDC, CM, Legal & In-house Labor	$220,000
Injection	
Design	$1,046,000
Construction	$10,462,000
ESDC, CM, Legal & In-house Labor	$2,092,000
Total Cost	**$37,679,000**
Pre-Construction Cost	*$2,442,000*
Costs Nov '17 thru Apr '18 (incl. in Pre-Constr.)	*$504,000*

1. Source: Bob Holden, MOW, emails of 4-9-18 through 4-12-18.

M1W Overhead should not apply to anything on this sheet

Appendix E *(cont.)*

Table GWR-5

Calculation of Capital Cost Recovery - GWR Loan Sizing

Year		Principal Due	Interest Due	Total Debt Service	Debt Service Reserve Used	Net Debt Service	GWR Portion of Net Debt Service	GWR Portion of Pond Lease Payment	GWR Portion Total Capital Costs
2021	1	$938,985	$2,106,516	$3,045,501	$0	$3,045,501	$3,045,501	$0	$3,045,501
2022	2	976,544	2,068,957	3,045,501	0	3,045,501	3,045,501	0	3,045,501
2023	3	1,015,606	2,029,895	3,045,501	0	3,045,501	3,045,501	0	3,045,501
2024	4	1,056,230	1,989,271	3,045,501	0	3,045,501	3,045,501	0	3,045,501
2025	5	1,098,479	1,947,021	3,045,501	0	3,045,501	3,045,501	0	3,045,501
2026	6	1,142,418	1,903,082	3,045,501	0	3,045,501	3,045,501	0	3,045,501
2027	7	1,188,115	1,857,385	3,045,501	0	3,045,501	3,045,501	0	3,045,501
2028	8	1,235,640	1,809,861	3,045,501	0	3,045,501	3,045,501	0	3,045,501
2029	9	1,285,065	1,760,435	3,045,501	0	3,045,501	3,045,501	0	3,045,501
2030	10	1,336,468	1,709,033	3,045,501	0	3,045,501	3,045,501	0	3,045,501
2031	11	1,389,927	1,655,574	3,045,501	0	3,045,501	3,045,501	0	3,045,501
2032	12	1,445,524	1,599,977	3,045,501	0	3,045,501	3,045,501	0	3,045,501
2033	13	1,503,345	1,542,156	3,045,501	0	3,045,501	3,045,501	0	3,045,501
2034	14	1,563,479	1,482,022	3,045,501	0	3,045,501	3,045,501	0	3,045,501
2035	15	1,626,018	1,419,483	3,045,501	0	3,045,501	3,045,501	0	3,045,501
2036	16	1,691,058	1,354,442	3,045,501	0	3,045,501	3,045,501	0	3,045,501
2037	17	1,758,701	1,286,800	3,045,501	0	3,045,501	3,045,501	0	3,045,501
2038	18	1,829,049	1,216,452	3,045,501	0	3,045,501	3,045,501	0	3,045,501
2039	19	1,902,211	1,143,290	3,045,501	0	3,045,501	3,045,501	0	3,045,501
2040	20	1,978,299	1,067,202	3,045,501	0	3,045,501	3,045,501	0	3,045,501
2041	21	2,057,431	988,070	3,045,501	0	3,045,501	3,045,501	0	3,045,501
2042	22	2,139,728	905,772	3,045,501	0	3,045,501	3,045,501	0	3,045,501
2043	23	2,225,318	820,183	3,045,501	0	3,045,501	3,045,501	0	3,045,501
2044	24	2,314,330	731,170	3,045,501	0	3,045,501	3,045,501	0	3,045,501
2045	25	2,406,903	638,597	3,045,501	0	3,045,501	3,045,501	0	3,045,501
2046	26	2,503,180	542,321	3,045,501	0	3,045,501	3,045,501	0	3,045,501
2047	27	2,603,307	442,194	3,045,501	0	3,045,501	3,045,501	0	3,045,501
2048	28	2,707,439	338,062	3,045,501	0	3,045,501	3,045,501	0	3,045,501
2049	29	2,815,737	229,764	3,045,501	0	3,045,501	3,045,501	0	3,045,501
2050	30	2,928,366	117,135	3,045,501	0	3,045,501	3,045,501	0	3,045,501
Total		**$52,662,900**	**$38,702,122**	**$91,365,022**	**$0**	**$91,365,022**	**$91,365,022**	**$0**	**$91,365,022**

Bond Sizing:

Total Project Cost	$37,679,000	$54,377,641
M1W Reimbursement	$504,000	
M1W Pre-Construction Costs	$2,442,000	
2 Extraction Wells	11,516,485	
Amount to Finance	52,141,485	
Capitalized Interest	-	
Debt Service Reserve Fund	-	
Debt Issuance Costs	521,415	
Balancing Amount	-	
Issuance Amount	52,662,900	
Assume Internal Reserve?	Yes	

Assumptions:

Maturity of Bonds	30 years
Interest-Only Period	0 years
Interest Rate on Bonds	4.00%
MCWRA Contribution[1]	$0
GWR Share of Loan Payment	100.0%
Ponds Lease Payment[2]	$0
GWR Share of Lease Payment	100.0%
Lease Escalation[3]	2.5%

1. PWM expansion serves only Cal-Am potable supply, hence no MCWRA contribution.

2. Salinas ponds lease captured in Phase 1 of Pure Water Monterey and does not increase with expansion.

3. Salinas ponds lease share and escalation not relevant because lease does not increase with expansion.

Appendix E *(cont.)*

Table GWR-6

Capital Cost Recovery - GWR REPLACEMENT Loan Sizing

Year		AWPF 15-Yr. Repl. Debt Service	AWPF 20-Yr. Repl. Debt	Injection 15-Yr. Repl. Debt Service	Injection 20-Yr. Repl. Debt Service	MPWMD Expense (7%)	Total Replacement Debt Service
2021	1	$ -	$ -	$ -	$ -	$ -	$ -
2022	2	-	-	-	-	$ -	-
2023	3	-	-	-	-	$ -	-
2024	4	-	-	-	-	$ -	-
2025	5	-	-	-	-	$ -	-
2026	6	-	-	-	-	$ -	-
2027	7	-	-	-	-	$ -	-
2028	8	-	-	-	-	$ -	-
2029	9	-	-	-	-	$ -	-
2030	10	-	-	-	-	$ -	-
2031	11	-	-	-	-	$ -	-
2032	12	-	-	-	-	$ -	-
2033	13	-	-	-	-	$ -	-
2034	14	-	-	-	-	$ -	-
2035	15	-	-	-	-	$ -	-
2036	16	4,241	-	40,408	-	$ 3,125	47,774
2037	17	4,241	-	40,408	-	$ 3,125	47,774
2038	18	4,241	-	40,408	-	$ 3,125	47,774
2039	19	4,241	-	40,408	-	$ 3,125	47,774
2040	20	4,241	-	40,408	-	$ 3,125	47,774
2041	21	4,241	45,159	40,408	71,756	$ 11,310	172,874
2042	22	4,241	45,159	40,408	71,756	$ 11,310	172,874
2043	23	4,241	45,159	40,408	71,756	$ 11,310	172,874
2044	24	4,241	45,159	40,408	71,756	$ 11,310	172,874
2045	25	4,241	45,159	40,408	71,756	$ 11,310	172,874
2046	26	4,241	45,159	40,408	71,756	$ 11,310	172,874
2047	27	4,241	45,159	40,408	71,756	$ 11,310	172,874
2048	28	4,241	45,159	40,408	71,756	$ 11,310	172,874
2049	29	4,241	45,159	40,408	71,756	$ 11,310	172,874
2050	30	4,241	45,159	40,408	71,756	$ 11,310	172,874
Total		**$63,618**	**$451,594**	**$606,115**	**$717,564**	**$128,722**	**$1,967,613**

Bond Sizing:		**Injection**	**AWPF**	
Replac. Cost ($2021)		$2,884,567	$ 1,266,993	
15-year costs		$51,476	$ 490,434	
20-year costs		$488,722	$ 776,559	
30-year costs		$2,344,369	$0	
Replac. Cost (Inflat	Replacement Yr.			Total Future $
15-year costs	*2036*	$72,613	$691,813	**$764,426**
20-year costs	*2041*	$773,166	$1,228,528	**$2,001,694**
30-year costs	*2051 (Excluded)*	$0	$0	$0

Assumptions:

Maturity of Bonds	30 years
Interest Rate on B	4.00%
Inflation Rate[1]:	*2.32%*
Issuance costs[2]:	*1.00%*

1. Source: Dave Stoldt, weighted average inflation factor assuming O&M costs of power (42%), PUC Labor (Escalation ar Non-Escalation) of 58%. Reference from Cal Am model (Monterey Water Supply Project Inputs), and Dave's email of 4-5

2. Same assumption used for Desal project funding.

Appendix E *(cont.)*

Total GWR (Includes MCWD)

Description	Total AWT	Civil, Process Piping & Electrical-Instr.	Source Water PS	Ozone System	MF-RO System	UV-AOP System	Post Stabilization	Post Treatment	Product Water PS	Waste Equalization PS	Pipeline to MCWD	
Equipment (Not included in construction contract) Cost	$6,829,836	$0	$0	$2,140,800	$3,930,956	$758,080	$0	$0	$0	$0	$0	
Total Electrical & I/C	5,865,678	2,570,434	167,182	$650,691	1,715,111	incl in MF,	239,355	198,685	160,628	122,483	41,108	
Parts/Material/Other	$ 575,875	$0	$0	$76,049	$401,409	$66,349	$32 069	$0	$0	$0	$0	
PWM Base Project--Replacement Fund	**$366,659**											
Electrical Equipment	**$ 2,346,271**	1,028,174	66,873	260,277	686,045	0	95,742	79,474	64,251	48,993	16,443	
Instrumentation Equipment	**$ 146,642**	64,261	4,180	16,267	42,878	0	5,984	4,967	4,016	3,062	1,028	
Pumps & Motors & Ozonators	**$ 1,789,420**	0	160,000	856,320	174,000	50,000	229,100	0	300,000	20,000	0	
Injection Wells	**$ -**	0	0		0	0	0	0	0	0	0	
PWM Expansion Project--Replacement Fund	**$110,470**	**$0**	**$5,303**	**$69,744**	**$26,368**	**$944**	**$0**	**$0**	**$6,838**	**$1,273**	**$0**	Escalated 1.5 years @ 3%
Electrical Equipment	**$ 461,585**	0	17,476	181,384	239,049	0	0	0	13,433	10,243	0	
Instrumentation Equipment	**$ 28,849**	0	1,092	11,337	14,941	0	0	0	840	640	0	
Pumps & Motors & Ozonators	**$ 776,559**	0	41,813	596,761	60,629	10,453	0	0	62,720	4,181	0	
Injection Wells	**$ -**	0	0	0	0	0	0	0	0	0	0	
Parts/Materials/Other	$197,772	$0	$0	50,699	133,803	13,270	0	0	0	0	0	
Total 7 mgd PWM Project--Replacement Fund	**$477,130**											
Electrical Equipment	**$ 2,807,856**											
Instrumentation Equipment	**$ 175,491**											
Pumps & Motors & Ozonators	**$ 2,565,979**											
Injection Wells	**$ -**											
Parts/Materials/Other	$ 773,647											

Appendix E *(cont.)*

Injection Site

Description	Total GWR GWR Injection, Expansion	Electrical Buildings for 2 injection wells	1 Deep Injection Wells	1 Vadose Zone Wells	1 set of Monitoring Wells at 2 depths (2 wells)	
Construction Budget:	2 deep injection wells, 1 vadose zone wells, &3 sets montitoring wells & Electrical Bldg	K/J 033018 Cost Estimate				69.50% $ 4,429,380 3078263
Construction Cost	$3,801,083	$ 1,140,994	$ 939,662	$ 181,295	$ 199,823	Well and building costs only
Replacement	$239,161	$28,304	$98,094	$14,668	$0	
Electrical Equipment-30 yrs	$283,750	$283,750	$0	$0	$0	included in building
Instrumentaion Equipment-15 years	$51,476	$51,476	$0	$0	$0	included in building
Pumps & Motors-20 years	$488,722	$0	$244,361	$0	$0	1/2 well material
Wells-30 years	$2,060,619	$0	$939,662	$181,295	$0	monitoring wells over 40 years so not included
O&M Costs ($) after overhead						
Power	$19,920	$0	$9,960	$0	$0	Inflated to 2021
Chemicals	$0	$0	$0	$0	$0	
Labor hours	488	0	208	0	24	labor or vadose well and bldg included with injection
Labor	$44,217	$0	$18,847	$0	$2,175	labor or vadose well and bldg included with injection
Parts & Equipment (trucks @ 22.03/hr, CalTrans rate)	$22,146	$0	$9,439	$0	$1,089	assume parts = equipment
Marterials	$0	$0	$0	$0	$0	
Other (laboratory analysis)	$16,834	$0	$0	$0	$5,611	
Total O&M Cost	$103,605	$0	$38,454	$0	$8,899	