Seawater Desalination Projects Evaluation

Submitted to:
Monterey Peninsula Water Management District

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Abbreviations and Acronyms

- ASR – Aquifer Storage and Recovery
- AWCC – American Water Capital Corporation
- AWWC – American Water Works Company
- B-E – Bookman Edmonston
- Cal-Am – California American Water Company
- CDHS – California Department of Health Services
- CDR – Concept Design Report (CWP and MBRSDP)
- CEQA – California Environmental Quality Act
- CWP – Coastal Water Project
- DBP_s – Disinfection By-Products
- DWCS – Desalinated Water Conveyance System
- HDD – Horizontal Directionally Drilled
- MBRSDP – Monterey Bay Regional Seawater Desalination Project
- MCL – Maximum Contaminant Level
- MF – Micro Filtration
- MLPP – Moss Landing Power Plant
- MPWMD – Monterey Peninsula Water Management District
- NPDES – National Pollution Discharge Elimination System
- NRMC – National Refractories and Minerals Corporation
- O&M – Operation and Maintenance
- OTC – Once-Through Cooling

- P/SM, PSMCSD – Pajaro/Sunny Mesa Community Services District
- PEA – Proponent's Environmental Assessment (CWP)
- PUC – Public Utilities Commission
- RO – Reverse Osmosis
- SCDP – Sand City Desalination Project
- SOC_s – Synthetic Organic Chemicals
- SWRCB – State Water Resources Control Board
- TOC – Total Organic Carbon

Executive Summary

Bookman-Edmonston (B-E), a Division of GEI Consultants, Inc., along with sub-consultants Malcolm Pirnie, Inc. and Separation Processes, Inc., is providing engineering support to the Monterey Peninsula Water Management District (MPWMD) to review and evaluate three seawater desalination projects that have been proposed for the Monterey Peninsula. The three projects and their respective sponsors are:

1. California American Water (Cal-Am) – Coastal Water Project (CWP). This project includes an aquifer storage and recovery (ASR) component in the Seaside Groundwater Basin.

2. Pajaro/Sunny Mesa Community Services District (P/SM) in cooperation with Poseidon Resources Corporation (Poseidon) – Monterey Bay Regional Seawater Desalination Project (MBRSDP)

3. MPWMD – 7.5 million-gallon-per day (MGD) Sand City Desalination Project (SCDP)

Project Summaries

The three projects are in the conceptual or preliminary stage and all three have as their objective to assist the affected Monterey Peninsula communities to comply with the State Water Resources Control Board (SWRCB) Order No. 95-10. Brief summaries of the projects are:

Project name:	Coastal Water Project (CWP)
Proponent(s):	California American Water (Cal-Am)
Location:	Moss Landing Power Plant, Moss Landing
Purpose:	Primarily (Basic Coastal Water Project), to comply with State of California Water Resources Control Board Order No. 95-10 by replacing the Carmel River shortfall and to offset a portion of the Seaside Basin overdraft. Secondarily (Regional Coastal Water Project), as a regional water supply project to meet the Monterey Peninsula build-out water demands, the water needs of the Marina Coast Water District and the water needs of Moss Landing, Castroville and North Monterey County. The project is currently progressing as the Basic Coastal Water Project
Production volume:	Basic Coastal Water Project: 11,730 Ac-Ft per year (includes 1,300 Ac-Ft per year from Seaside Basin ASR) Regional Coastal Water Project: 20,272 Ac-Ft per year (includes 1,300 Ac-Ft per year from Seaside Basin ASR)

Project name:	Monterey Bay Regional Seawater Desalination Project (MBRSDP)
Proponent(s):	Pajaro/Sunny Mesa Community Services District in cooperation with Poseidon Resources Corporation
Location:	The former National Refractories and Minerals Corporation plant site, Moss Landing
Purpose:	To replace and augment existing water supplies serving the Monterey Peninsula, certain areas of northern Monterey County, the service area of the Pajaro/Sunny Mesa Community Services District and portions of the Pajaro Valley Water Management Agency service area.
Production volume:	20 MGD (22,400 Ac-Ft per year capacity) (20,930 Ac-Ft per year demand identified)

Project name:	Sand City Desalination Project (SCDP)
Proponent(s):	Monterey Peninsula Water Management District
Location:	The desalination plant would be constructed at one of three potential sites within the City of Sand City. Seawater collection wells would be in the City of Sand City and on the property of the of the former Fort Ord. Brine disposal would be through the Monterey Regional Water Pollution Control Agency outfall north of Marina
Purpose:	To assist Cal-Am to develop a legal water supply to meet the provisions of the State Water Resources Control Board Order No. 95-10.
Production volume:	7.5 MGD (8,400 Ac-Ft per year)

Project Function

The primary purpose of the Basic CWP and the SCDP is to resolve the issues associated with SWRCB Order No. 95-10 and the overdraft of the Seaside Groundwater Basin. In addition to resolving these two issues the Regional CWP and the MBRSDP would provide solutions to regional water supply issues.

Each of the projects has primarily identified customers within Cal-Am's service area due to the implications of SWRCB Order No. 95-10. In addition, the Regional CWP and the MBRSDP have identified potential customers to the north. The only commitment by these northern customers would be for the MBRSDP in the PSMCSD service area.

The proposed technology for the seawater intake and brine discharge for the three projects varies. The primary difference is the proposal to use wells for feed water at the SCDP compared to ocean intakes for the CWP and the MBRSDP. Wells may avoid significant pretreatment and its associated cost. A great deal of information on the appropriate seawater desalination technology will be obtained during the pilot plant testing scheduled for the CWP and the MBRSDP.

Brine discharge for the CWP would be via the MLPP outfall. For the MBRSDP, the primary option for brine discharge is the National Refractories and Minerals Corporation (NRMC) outfall, with the MLPP outfall as an alternative. Technically, either of these discharge options may be possible, however additional studies are needed to determine the NRMC outfall's structure integrity and the fate of the brine if discharged at this location. Brine discharge for the SCDP would be via horizontal directionally drilled wells along the coastline north of Sand City in former Fort Ord, or via the Monterey Regional Water Pollution Control Agency outfall as an alternative. Additional studies will be needed to determine if brine discharge to HDD wells is feasible and if seasonal storage is needed if the outfall is utilized.

The biggest issues with the waste stream fate are institutional constraints. There are long-term issues associated with one-pass power plants discharges to the ocean and the impact of concentrated seawater brine discharge to the ocean. These issues will need to be resolved for any project that moves forward.

CWP proponents have produced the most comprehensive supporting documentation of the three projects. The CWP is the only project that has produced an environmental document beyond the draft level. The CWP has a number of site specific studies that appear to have been useful in the preparation of their supporting construction cost information and provides a solid foundation for any future design work.

The MSRSDP has the most comprehensive information for its pilot plant work. The project is in the process of obtaining the necessary permits to construct and operate the pilot plant. The MSRSDP is also the only one of the three projects that has an agreement or has secured rights to the land for their proposed treatment plant project.

The SCDP has been developed conceptually but has not yet concluded on the location of the desalination facility or determined a treated water pipeline alignment. Additional technical work on the use of the MRWPCA outfall is also needed to determine what seasonal storage requirements would be needed.

Projected Performance

Several potential water quality issues were identified for the CWP in its Conceptual Design Report (CDR). One issue is the formation of significant chlorinated disinfection by-products (DBPs). DBPs could result from the reaction of total organic carbon (TOC) in the MLPP Units 6 & 7 intake, with the proposed amount of free chlorine and a combined 21 minutes of contact time in the coagulation and flocculation processes.

Other concerns are the allocation of the physical pathogen removal credits, identification of a target for total dissolved solids (TDS), and the possible presence of synthetic organic chemicals (SOCs) in Moss Landing Harbor. The CWP Concept Design Report (CDR) does not specify how the physical pathogen removal credits for *Giardia*, *Cryptosporidium*, and viruses will be allocated throughout the treatment process by the State of California

Department of Health Services (CDHS) nor does it identify a target for TDS. All these issues warrant more detailed planning as the CWP enters the pilot stage.

Areas of concern for the MBRSDP are the information gaps provided by the MBRSDP CDR regarding the allocation of physical pathogen removal credits, pesticides and agricultural runoff, and the use of chloramines to comply with CDHS disinfection requirements. However, the CDR does note that formation of DBPs would not be a concern due to the low TOC levels compared with CWP TOC levels.

In addition to the information gaps, the most significant water quality concerns associated with the MBRSDP involve the diverse systems owned by the Pajaro/Sunny Mesa Community Services District (PSMCSD). The MBRSDP CDR indicates that the water produced by the plant is compatible with the water in the PSMCSD's distribution system. However, with customers not yet identified and a variety of disparate water qualities among the systems owned by the PSMCSD, this claim cannot be substantiated. If the water quality is moderately different, it may be infeasible to treat the desalinated water to match that of the receiving water of each system. Moreover, additional pipe loop and/or coupon testing may need to be conducted for the piping in each receiving system.

A major area of concern for the SCDP is the occasional non-point source pollution, which could potentially cause the beach wells to become infiltrated with enteric viruses, SOCs, pharmaceutical residuals, and/or endocrine disruptors. Because there are no test wells constructed at this stage of project development, the potential for such contamination cannot be accurately assessed. However, the acknowledgement and awareness of this possible contamination is important at this early stage of project development.

Economics

The three projects are in various stages of development. The CWP and the SCDP are at a conceptual or preliminary level, but the CWP is more developed. More work on resolving site specific technical issues for the CWP has been performed; therefore a more complete assessment of the associated construction costs has been made. Construction costs for the SCDP were estimated based on potential alignments due to the fact that the SCDP does not have a preferred treatment plant site or preferred pipeline alignment. The MPRSDP is the least developed and is at a screening level of development. Construction cost estimates are apparently developed from projects of similar nature. The breakdowns of costs for the three projects are provided in Section 5.

The estimated capital cost for the CWP is $151M (2005 dollars) (excludes costs of the aquifer storage and recover (ASR) component) and the total O&M cost with membrane replacement is $8.12 M/year (excludes ASR costs). Long-term financing for the capital investment required to implement the CWP has not been secured by Cal-Am, but it is clear that the company has an avenue to secure such financing when required.

Poseidon Resources Corporation has indicated that the total capital cost for the MBRSDP is $132M (desalination facility only) and the total O&M cost is $16.9M/year. Transmission pipeline costs to the Cal-Am service area would be on the order of $39M. The desalination component values used for the estimate were derived from quotes received on other projects with substantially similar equipment, albeit different size. Poseidon can potentially become the lead entity responsible for the project financing. It is a United States corporation whose largest shareholder is Warburg Pincus, an international investment firm. With Warburg Pincus, it appears that Poseidon has extensive private equity financing resources if obligated to obtain financing for the proposed MBRSDP in-lieu of the PSMCSD not pursuing municipal bond financing.

The Monterey Peninsula Water Supply Project Phase 2 Technical Memorandum, dated June 23, 2004, provides a desalination plant cost component of $28.5M. This cost is a reasonable value for the SCDP and a 25% contingency is appropriate, considering the level of estimate provided. A financing plan for the SCDP by the MPWMD has not been developed. However, two prior water supply projects proposed by MPWMD provide examples of likely financing avenues to be taken if the Sand City Project is formalized.

The capital cost estimates of all three projects were based on preliminary level design which warrants a larger contingency than employed in the CWP and MBRSDP estimates. A 10-15% greater contingency is recommended on those projects. The Operation and Maintenance cost estimates of the three projects were generally considered reasonable, with the exception of SCDP, which indicated substantially higher energy consumption for the RO process than currently anticipated for high efficiency designs.

The following table summarizes the three projects' current cost status. The costs have been refined by the B-E team as described in the table's footnotes. Of particular note is the cost per Acre-Ft for the CWP Regional Project and MBRSDP being within 15 percent of one another. Given some of the unknown cost elements as described in Section 5, the 15 percent represents a very small difference. The CWP Basic project's Acre-Ft costs would be expected to be higher due to the economies of scale.

Table ES-1 - Summary of Desalination Project Capacities and Estimated Costs

Project	Plant Capacity	Annual Production	Estimated Total Capital Cost (Year)	Estimated Total O&M Costs (Year)	Cost per Acre-Ft
Coastal Water Project (desal portion only [1])					
Proposed project (meets SWRCB Order No. 95-10)	10 MGD [2]	10,430 Ac-Ft/ year [3]	$151,103,920 [4] (2005)	$8,117,000 [6] (2005)	$1944 [8 11]
Regional project	18 MGD	18,972 Ac-Ft/ year	$237,803,000 [7] (2005)	$10,484,000 [9] (2005)	$1562 [8 12]
Monterey Bay Regional Seawater Desalination Project	20 MGD	22,400 Ac-Ft/ year capacity (20,930 Ac-Ft/ year demand identified)	$169,026,926 [5,9] (2006)	$16,900,000 [5,9] (2006)	$1352 [8 13]
Sand City Desalination Project	7.5 MGD	8,400 Ac-Ft/ year	$176,200,000 – $193,000,000 (ENR CCI [10] = 7,644 [San Francisco, Dec. 2002])	$8,740,000 - $9,090,000 (ENR CCI [10] = 7,644 [San Francisco, Dec. 2002])	$2729-$2931 [8 14]

/1 Costs for the aquifer storage and recovery component of the Coastal Water Project have been subtracted from the total project costs provided by Cal-Am.
/2 million gallons per day
/3 acre-feet per year
/4 $110,780,000 capital costs, 24% implementation and 10% contingency. Excludes ASR costs. Excludes pilot plant estimated costs of $2,585,000 and ROW/easement costs of $2,000,000.
/5 Desalination Facility Capital and implementation costs and contingency are co-mingled without identification. No ROW/Easement costs are identified. Transmission pipeline costs include 23.5% implementation costs and a 25% contingency.
/6 From CWP data excluding Terminal Reservoir/ASR Pump Station operating and Segunda/ASR System costs. Includes all CWP supplied repairs and replacement costs.
/7 $174,342,377 capital costs, 24% implementation and 10% contingency. Excludes ASR costs. Excludes Pilot Plant estimated costs of $2,585,000 and ROW/Easement Costs.
/8 Capital cost amortized over 30 years at 7%
/9 Estimated costs for the two regional projects do not include distribution system facilities that would be required for serving areas other than the Monterey Peninsula.
/10 Engineering News Record, Construction Cost Index
/11 $2,104 per acre-ft if capital cost contingency is adjusted 15% as recommended
/12 $1,699 per acre-ft if capital cost contingency is adjusted 15% as recommended.
/13 $1,434 per acre-ft if capital cost contingency is adjusted 15% as recommended.
/14 $2,491 - $2,693 if power consumption is reduced by recommended 33%.

Regional Water Supply Considerations

The CWP will serve the Cal-Am territories on the Monterey Peninsula and adjacent areas. It will provide enough desalinated water to comply with SWRCB Order No. 95-10. An option is under consideration to upsize to the Regional CWP to allow for future increased deliveries to the Monterey Peninsula and to supply water to the Marina Coast Water District, Moss Landing, Castroville, and North Monterey County.

The MBRSDP will serve the Monterey Peninsula, North Monterey County, PSMCSD service areas and portions of the Pajaro Valley Water Management Agency. Contemplated major

distribution system serving areas north, east, and west of the National Refractories treatment plant site could be added incrementally in the future.

The SCDP is intended to serve only the Cal-Am territories and will only partially offset Order No. 95-10 reductions. The project should be capable of expansion, provided additional planning is performed.

Implementability

Mitigating impingement and entrainment impacts from seawater intake is a major issue for the CWP and the MBRSDP. The proposed CWP desalination plant would not have a separate direct ocean water intake. It would instead receive raw seawater from the MLPP cooling water return system. Water withdrawn from MLPP would not alter the operations of the MLPP nor would it change the volume and velocity of water entering the MLPP intakes. Also the implementation of the desalination facility would not alter the potential impacts associated with operation of the MLPP. Therefore, as long as the MLPP is permitted to operate, the CWP would not have any adverse impacts on the aquatic resources of the associated marine environment.

The proposed water intake for the MBRSDP would be from one of two sources: 1) direct pumping from the Monterey Bay via the existing National Refractories intake, and/or 2) the cooling water from Units 6 & 7 at the MLPP. For the full-scale MBRSDP facility the heated water from the MLPP is the preferred source. No evidence was found to indicate that the cooling water system operations would result in an adverse impact on the populations of fish and invertebrates inhabiting Moss Landing Harbor, Elkhorn Slough and Monterey Bay. Assessment of potential impacts of operating the National Refractories outfall could not be conducted due to damage to the outfall.

The SCDP would include either an array of horizontal directionally-drilled or radial collector wells for seawater collection located along the coastal beachfront of Sand City. Because the intake for the seawater is below the sea floor, it is assumed no potential impacts from impingement or entrainment would result from seawater withdrawal. However, additional studies are needed to determine the efficiency of such a system.

Schedules for the CWP and the MBRRSD are similar, with the target of delivering water by 2010. The SCDP currently does not have an updated schedule.

All three projects would have similar permitting requirements. Little activity has been done in this area. Primarily, permitting activities for the CWP and MBRSDP have focused on the pilot plant. PSMCSD has obtained a permit for the MBRSDP pilot plant from Monterey County but still have to obtain a permit from the Coastal Commission. Cal-Am has yet to secure either permit for the CWP.

1 Introduction

Bookman-Edmonston (B-E), a Division of GEI Consultants, Inc., along with sub-consultants Malcolm Pirnie, Inc. and Separation Processes, Inc., (collectively, the B-E team) is providing engineering support to the Monterey Peninsula Water Management District (MPWMD) to review and evaluate three seawater desalination projects that have been proposed for the Monterey Peninsula. The three projects, their respective sponsors, and proposed locations are:

1. California American Water (Cal-Am) – Coastal Water Project (CWP) – proposed plant location at the Moss Landing Power Plant in Moss Landing (MLPP). This project includes an aquifer storage and recovery (ASR) component in the Seaside Groundwater Basin.

2. Pajaro/Sunny Mesa Community Services District (P/SM) in cooperation with Poseidon Resources Corporation (Poseidon) – Monterey Bay Regional Seawater Desalination Project (MBRSDP) – proposed plant location at the former National Refractories and Minerals Corporation (NRMC) plant site in Moss Landing.

3. MPWMD – 7.5 million-gallon-per-day (MGD) Sand City Desalination Project (SCDP) – proposed plant location is one of three sites in Sand City.

The B-E team has been retained by MPWMD to provide an independent, unbiased, third-party assessment of three proposed desalination projects to make recommendations on each project's technical merit, completeness and readiness to proceed. This assessment will be used in support of the MPWMD Board's determination of the best project or projects to support to comply with the MPWMD's mission and to comply with the State Water Resources Control Board (SWRCB) Order No. 95-10.

The MPWMD is responsible for managing the water resources on the Monterey Peninsula, Seaside Basin and Carmel River drainage. Cal-Am is an investor-owned public utility responsible for providing water service to a majority of the residents within the MPWMD. A substantial portion of Cal-Am's water supply is water pumped from wells along the Carmel River. In 1995, the SWRCB, in its Order No. 95-10 determined that the Carmel Valley alluvial aquifer is considered water flowing in a subterranean stream, rather than percolating groundwater and that Cal-Am had been pumping up to 10,730-Ac-Ft per year without a valid basis of right, and an equivalent supply is now required.

2 Project Summaries

The following project summaries provide key information for each of the projects. Each summary includes:

- Project name
- Proponent(s)
- Location
- Purpose
- Production volume
- Key features
- Facility map
- Key information provided to review team
- Persons interviewed

The three projects are distinctly dissimilar and are at various stages of development. Each of the projects has identified a unique location, although the CWP and MBRSDP have adjacent proposed locations in Moss Landing at the MLPP and NMRC site respectively. Similarly, the proposed treated water pipeline alignment from the proposed desalination plants to the southern users differ, although the CWP and MBRSDP alignments have similar elements.

Each of the three proposed desalination plant treatment capacities is different. These differences are due primarily to differing project purposes. The CWP is currently progressing as the Basic CWP with the intent to address SWRCB Order No. 95-10 and a portion of the Seaside Basin overdraft. However, the Regional CWP has capacities and intended users similar to the MBRSDP.

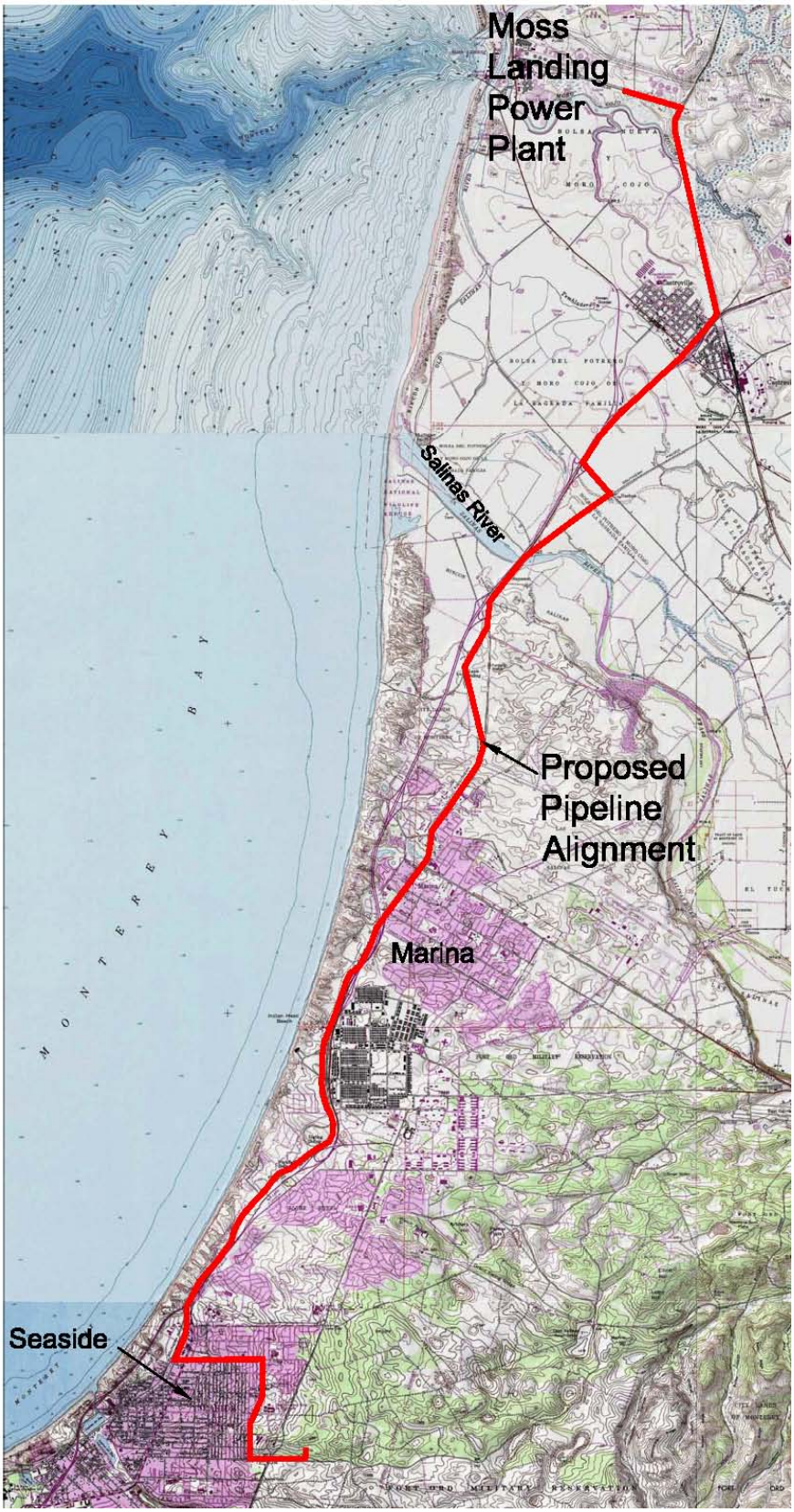
2.1 Coastal Water Project

Project name:	Coastal Water Project (CWP)
Proponent(s):	California American Water (Cal-Am)
Location:	Moss Landing Power Plant, Moss Landing
Purpose:	Primarily (Basic Coastal Water Project), to comply with State of California Water Resources Control Board Order No. 95-10 by replacing the Carmel River shortfall and to offset a portion of the Seaside Basin overdraft. Secondarily (Regional Coastal Water Project), as a regional water supply project to meet the Monterey Peninsula build-out water demands, the water needs of the Marina Coast Water District and the water needs of Moss Landing, Castroville and North Monterey County. The project is currently progressing as the Basic Coastal Water Project

Production volume:	Basic Coastal Water Project: 11,730 Ac-Ft per year Seawater desalination plant: 10,430 Ac-Ft per year (10MGD) Aquifer storage and recovery: 1,300 Ac-Ft per year Regional Coastal Water Project: 20,272 Ac-Ft per year Seawater desalination plant: 18,972 Ac-Ft per year (18 MGD) Aquifer storage and recovery: 1,300 Ac-Ft per year
Key features:	1. Raw water pipeline will be used to transfer seawater from the Moss Landing Power Plant cooling water discharge stream to the desalination plant site proper. 2. Return water discharge will return concentrated seawater brine back to the Moss Landing Power Plant cooling water discharge stream. 3. Equalization basin will receive and store the incoming raw water. 4. Raw water pumping station will convey seawater from the equalization basin to a pre-filtration process. 5. Raw water pretreatment process 6. Reverse osmosis (RO) process 7. Post-treatment process 8. Treated water storage 9. Treated water pumping station 10. Treated water pipeline
Key Information provided to review team:	1. Coastal Water Project Conceptual Design Report California American Water – September 2005 2. Proponents Environmental Assessment for the Coastal Water Project – July 2005
Persons interviewed:	1. Sarah Hardgrave, RBF Consulting 2. John C. Klein, Cal-Am

Figure 1 on the following page shows the MLPP site and the proposed pipeline alignment.

Figure 1 - Coastal Water Project Location Map



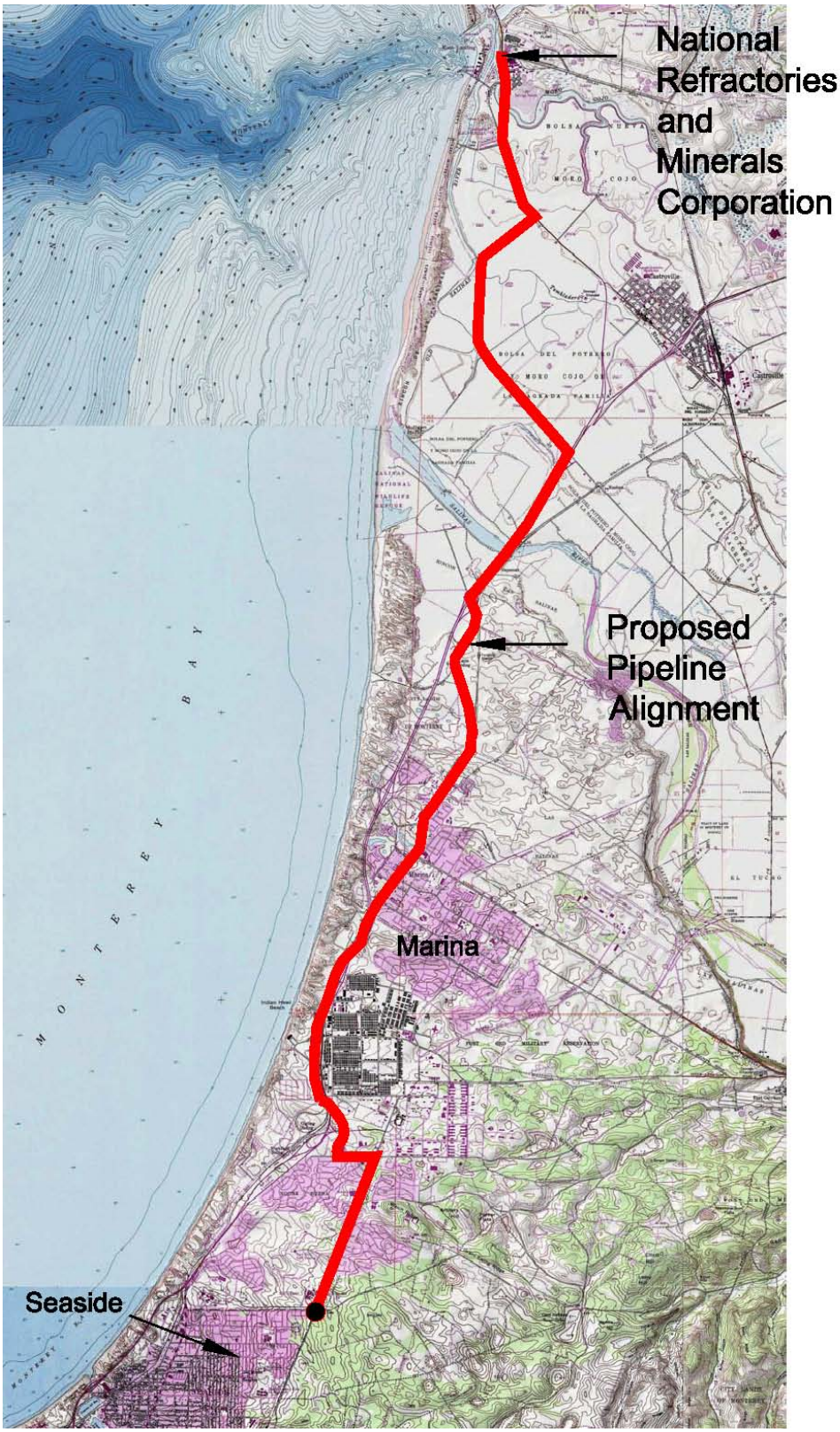
Coastal Water Project, Conceptual Design Report (Draft), September 16, 2005

2.2 Monterey Bay Regional Seawater Desalination Project (P/SM)

Project name:	Monterey Bay Regional Desalination Project (MBRSDP)
Proponent(s):	Pajaro/Sunny Mesa Community Services District in cooperation with Poseidon Resources Corporation
Location:	The former National Refractories and Minerals Corporation plant site, Moss Landing
Purpose:	To replace and augment existing water supplies serving the Monterey Peninsula, certain areas of northern Monterey County, the service area of the Pajaro/Sunny Mesa Community Services District and portions of the Pajaro Valley Water Management Agency service area.
Production volume:	20 MGD (22,400 Ac-Ft per year capacity) (20,930 Ac-Ft/ year demand identified)
Key features:	1. Pump station and raw water pipeline which will be used to transfer seawater from the Moss Landing Power Plant cooling water discharge stream and/or from the existing seawater intake at the National Refractories site to the desalination plant site proper. 2. Return water discharge which will return concentrated seawater brine to the National Refractories Ocean Outfall. 3. Source water fine screens which will be 3/8-inch or smaller opening mechanical screens to remove debris from entering the desalination plant treatment facilities. 4. Sedimentation basins which will provide initial clarification. 5. Pre-treatment filters consisting of either granular media filtration or micro-screening and membrane filtration. 6. Reverse osmosis (RO) process 7. Post-treatment process 8. Treated water storage 9. Treated water pumping station 10. Treated water pipeline
Information provided to review team:	1. Monterey Bay Regional Desalination Project, Conceptual Design Report – April 2006 2. Monterey Bay Regional Desalination Project, Report of Waste Discharge – March 2006 3. Monterey Bay Regional Desalination Project, Report of Waste Discharge Application for Renewal NPDES Permit CA 0007005, National Refractories Ocean Outfall – November 1, 2005 4. Monterey Bay Regional Seawater Desalination Pilot Project – Proposition 50 Grant Application - March 22, 2006 5. Monterey Peninsula Water Management District Comparative Matrix of Water Supply Projects – September 8, 2005
Persons interviewed:	1. Peter MacLaggan, Poseidon Resources Corporation

Figure 2 on the following page shows the NRMC site and the proposed pipeline alignment.

Figure 2 - Monterey Bay Regional Seawater Desalination Project Location Map



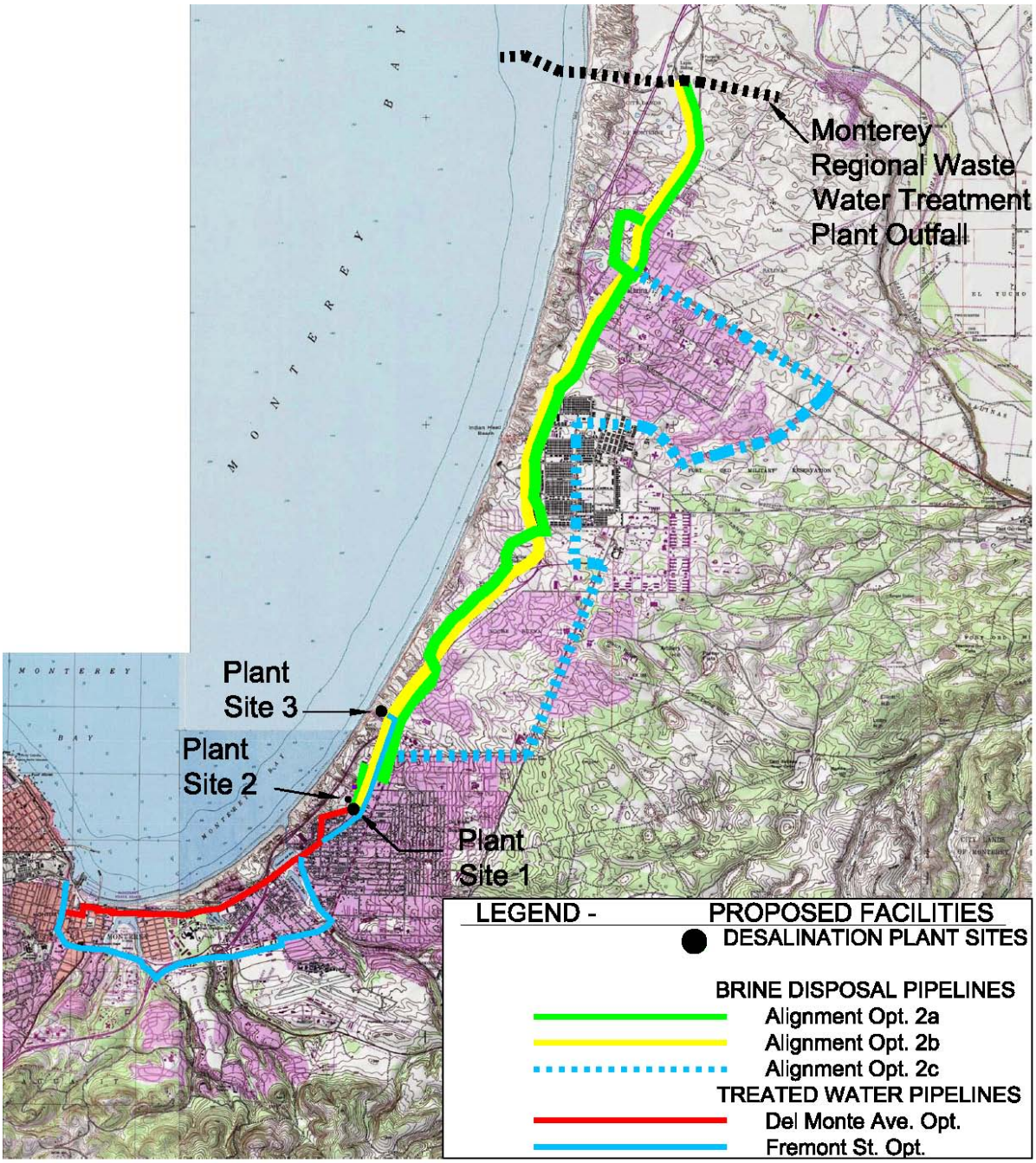
Pajaro Sunny Mesa Community District, Monterey County, California: Proposed Transmission Pipeline Alignment, July 2004

2.3 Sand City Desalination Project (MPWMD)

Project name:	Sand City Desalination Project
Proponent(s):	Monterey Peninsula Water Management District
Location:	The desalination plant would be constructed at one of three potential sites within the City of Sand City. Seawater collection wells would be located within the City of Sand City and on former Fort Ord lands. Brine disposal would be through beach wells (radial wells and/or horizontal directionally drilled wells) in former Fort Ord or via the Monterey Regional Water Pollution Control Agency outfall north of Marina.
Purpose:	To assist Cal-Am to develop a legal water supply to meet the provisions of the State Water Resources Control Board Order No. 95-10.
Production volume:	8,400 Ac-Ft per year (7.5 MGD)
Key features:	1. Seawater collection through horizontal directionally drilled (HDD) wells and/or radial wells located along the beach in Sand City and the former Fort Ord. 2. Seawater collection manifold pipeline through city streets. 3. Return water discharge will return concentrated seawater brine to the ocean via beach wells or the Monterey Regional Water Pollution Control Agency outfall north of Marina. 4. Reverse osmosis (RO) process 5. Post-treatment process 6. Treated water storage 7. Treated water pumping station 8. Treated water pipeline
Information provided to review team:	1. Monterey Peninsula Water Supply Project Alternatives (Phase 1 Technical Memorandum) – March 2003 2. Monterey Peninsula Water Supply Project Phase 2 Technical Memorandum – October 2003 3. MPWMD Water Supply Project, Board Review Draft Environmental Impact Report – December 2003 4. Sand City Desalination Project Feasibility Study – April 16, 2004
Persons interviewed:	1. Andrew Bell, MPWMD 2. David Berger, MPWMD 3. Joseph Oliver, MPWMD 4. Craig Von Bargen, Camp Dresser & McKee, Inc.

Figure 3 shown on the following page shows the potential treatment plant sites and potential treated and brine discharge pipeline alignments.

Figure 3 - Sand City Desalination Project Location Map



Monterey Peninsula Water Management District Water Supply Project, Board Review Draft Environmental Impact Report, December 2003

3 Project Function

This section provides the following information for each project:

- Project purpose
- Customers identified
- Technology appropriate/demonstrated on this or similar supply
- Waste stream fate identified
- Availability of historic feedwater quality data and sanitary survey
- Quality of supporting documentation
- Supports regional MPWMD objectives
- Omissions or fatal flaws

The primary purpose of the Basic CWP and the SCDP is to resolve the issues associated with SWRCB Order No. 95-10 and the overdraft of the Seaside Groundwater Basin. The Regional CWP and the MBRSDP would provide additional water supplies to meet regional water demand as well as resolving SWRCB Order No. 95-10 and Seaside Basin overdraft issues.

Each of the projects has primarily identified customers within Cal-Am's service area due to the implications of SWRCB Order No. 95-10. In addition, the Regional CWP and the MBRSDP have identified water demands of potential customers on the Monterey Peninsula and to the north. The only existing commitments by the MBRSDP are customers in the PSMCSD service area.

The proposed technology for the each of the three projects varies as described in detail below. A major difference is the proposal to use wells for feed water at the SCDP compared to ocean intakes for the CWP and the MBRSDP. A great deal of information on the appropriate seawater desalination technology will be obtained during the pilot plant testing scheduled for the CWP and the MBRSDP.

Brine discharge for the CWP would be via the MLPP outfall. For the MBRSDP the primary option for brine discharge is the NRMC outfall with the MLPP outfall as an alternative. Brine discharge for the SCDP would be via radial wells or horizontal directionally drilled wells along the coastline north of Sand City in former Fort Ord, or via the Monterey Regional Water Pollution Control Agency (MRWPCA) outfall as an alternative. Technically, all of these discharge options may be possible. However, additional studies are needed to determine the adequacy of the condition of the NRMC outfall and the fate of the brine plume as it enters the receiving waters. Additional analyses are needed to determine the adequacy of using horizontal directional drilled wells for brine disposal.

An underwater video obtained on the NRMC outfall shows that some of the joints have failed and many of the diffusers are clogged. However, repairs can be made and the outfall could

be put back into service. Use of the MRWPCA outfall could be accomplished but additional studies will need to be done to determine how to manage seasonal flow variations.

The biggest issues with the waste stream fate are institutional constraints that are discussed in more detail in Section 7. There are long-term issues associated with one-pass power plants, ocean water cooling systems and the impact of concentrated seawater brine discharges to the ocean environment.

The CWP has the most comprehensive supporting documentation of the three projects. The CWP is the only project that has an Environmental Assessment beyond the draft level. The CWP has produced a number of site specific studies that appear to have been useful in the preparation of their supporting construction cost information and provides a solid foundation for any future design work.

The MBRSDP has the most comprehensive information for its pilot plant. A permit for the pilot plant has been obtained from Monterey County, but an additional permit is required from the Coastal Commission. Once the Coastal Commission permit is obtained Pajaro/Sunny Mesa will be able to proceed with construction and testing. The MBRSDP is also the only one of the three projects that has an agreement for siting their proposed treatment plant.

The SCDP has been developed conceptually but has not yet determined the location of the desalination facility or treated water pipeline alignment. Additional technical work on the use of the MRWPCA outfall is also need to determine what seasonal storage requirements would be needed.

Table 1 presents a summary of project sizes, intake locations, and waste streams.

Table 1 - Intake and Waste Stream Comparison

Project Name	Coastal Water Project	Monterey Bay Regional Seawater Desalination Project	Sand City Desalination Project
Production volume	10,430 Ac-Ft per year[/1]	22,400 Ac-Ft per year	8,400 Ac-Ft per year[/2]
Production rate	10 MGD	20 MGD	7.5 MGD
Provides 10,730 Ac-Ft per year order 95-10 replacement supply	Yes	Yes	No
Intake location	Moss Landing Power Plant discharge stream	Moss Landing Power Plant discharge stream and/or National Refractories outfall	Radial or HHD wells in Sand City and former Fort Ord
Residual streams			
Brine	Moss Landing Power Plant disengagement basin thence to MLPP outfall	National Refractories outfall (alternative: MLPP outfall)	Radial or HHD wells in former Fort Ord (alternative: MRWPCA[/3] outfall north of Marina)
Petreatment solids	Sanitary landfill	Sanitary landfill	None expected
Pretreatment sludge	Return Flow Pipeline	National Refractories outfall	None expected
Membrane cleaning solutions	Treatment or collection and storage	National Refractories outfall	Not specified

[/1] Expandable to 18,972 Ac-Ft per year
[/2] 8,400 Ac-ft per year represents replacement supply needed to meet current water production as limited by SWRCB Order No. 95-10.
[/3] Monterey Regional Water Pollution Control Agency

3.1 Coastal Water Project

Project Purpose

Cal-Am proposes the CWP as a viable alternative to the Carmel River Dam and Reservoir Project to enable Cal-Am to comply with SWRCB Order No. 95-10 and provide California American Water customers with a reliable and legal water supply[1].

Customers Identified

The Basic CWP would provide water to existing Cal-Am service area customers to comply with SWRCB Order No. 95-10 and to reduce overdraft of the Seaside Groundwater basin by 1,000 Ac-Ft/ year.

The Regional CWP alternative would provide water to existing Cal-Am service area customers and supply 3,572 Ac-Ft/year for future additional demands within the Cal-Am service area. It would also provide water to Marina Coast Water District service area customers and to water customers in Moss Landing, the city of Castroville and North Monterey County.

Technology Appropriate/Demonstrated on this or Similar Supply

The treatment technology for the Coastal Water Project (CWP) is described in several documents. The most recent of these documents, obtained in the course of this study, is the CWP Conceptual Design Report (CDR)[2] prepared by RBF Consultants for Cal-Am. Descriptions of the treatment approach in the CDR are generally consistent with the earlier Proponent's Environmental Assessment[3] (PEA). The PEA includes additional supporting data which were included in this evaluation.

The proposed overall treatment process is based on the use of reverse osmosis to accomplish the desalination treatment objectives of the project. Substantial pretreatment systems have been included to provide suitable feed water to the RO process and post-treatment chemical addition is provided to condition the product water to meet aesthetic, compatibility and regulatory objectives.

Pretreatment System

The CDR provides a general description and process flow diagram of the proposed pretreatment process, which indicates the use of membrane filtration (microfiltration or ultrafiltration) possibly augmented by the use of coagulant addition. No representations are

[1] Amended Application to California Public Utilities Commission for CWP (A.04-09-019) – July 14, 2005
[2] *Coastal Water Project Conceptual Design Report* (Draft) - September 16, 2005
[3] *Proponent's Environmental Assessment for the Coastal Water Project* - July 14, 2005

made regarding the water quality expected from this open intake seawater source. The magnitude of variations in suspended solids, algal activity and oil concentrations are not stated or predicted in the documents. The possibility exists that some form of clarification, possibly dissolved–air flotation, prior to the filtration process would be optimum. While the CDR does include possible coagulant addition, the feedwater quality may justify the inclusion of a clarification process to optimize the membrane filtration system cost and performance. The use of membrane filtration is considered an appropriate selection for this open intake seawater supply. While existing full-scale implementation of this technology on seawater is not extensive, the track record as RO pretreatment on other challenging source waters (e.g. municipal wastewater) is substantial. Additionally, several long-term seawater pilot studies have provided strong indication of successful application of membrane filtration on seawater. The CDR states that pilot testing of the pretreatment will be required to make a final determination of actual chemical requirements and dosages. There are also other critical membrane filtration design criteria, some of which are not defined in the CDR, which must be verified through pilot testing. These include the design flux, which defines the filtrate hydraulic loading on the membrane, typically in units of gallons per square foot of membrane area per day (gfd). The flux defines the membrane area needed for production of design capacity. The omission of design flux prevents assessment of the level of conservatism in the membrane filtration design. The CDR indicates the use of chlorination of the feed water for biological control and subsequent dechlorination, an approach which has been identified at other projects as problematic[4]. Long-term pilot testing is needed to validate a chlorination/dechlorination biological control strategy.

Reverse Osmosis

The CDR describes a traditional approach to seawater RO design which has been successfully implemented at other sites. However, the operating flux of the RO system has not been identified, which is a customary design value to be defined in a CDR. While the stated characteristics of the CWP RO process are considered to be reasonably conservative and conducive to an efficient, reliable process, the indicated RO operating pressure (900 psi) is possibly low. The documents do not provide clear indication of the operating temperature and flux assumed to arrive at this pressure value. Underestimating the operating pressure would impact the operation and maintenance (O&M) expense estimates. The level of redundancy in the treatment system design has not been stated. The RO design includes the use of an energy recovery device, which recovers energy from the high pressure (800-950 psi) concentrate stream being discharged. The use of the energy recovery device reduces the power requirements for the RO feed pump, a substantial component of the cost of desalination. Energy recovery technology has seen significant advancement in the past few years and it is important that proposed projects reflect the latest developments. The energy recovery device performance stated in the CDR is reasonable and appropriate.

[4] Hamida, A. & Moch, I., Controlling Biological Fouling in Open Sea Intake RO Plants without Continuous Chlorination, International Desalination and Water Reuse Quarterly Nov/Dec 1996

Conclusion

The component treatment technologies (membrane filtration and reverse osmosis) selected for the CWP are appropriate for the application. Important design parameters of the membrane filtration and RO must be defined through long-term pilot testing. Some aspects of the described chemical addition approach (coagulation and biological control) must also be developed and/or verified though pilot testing. Definition of the feedwater temperature range and level of redundancy are important fundamental design parameter which has not been adequately addressed in the CDR.

Waste Stream Fate Identified

Brine disposal would be via the Return Flow Pipeline to the Moss Landing Power Plant (MLPP) disengagement basin where the brine would be mixed with MLPP cooling water and then discharged to the ocean via the MLPP cooling water outfall. The MLPP cooling water outfall is currently used as part of the MLPP operation.

The effect of discharges from the CWP desalination plant on the receiving water quality in Monterey Bay has been evaluated using computational fluid dynamics modeling. The study is included as an appendix to the PEA.

The desalination process will produce residual streams from the source water fine screening process, continuous waste flow from the pretreatment process, and waste cleaning solutions from the cleaning of the pretreatment membranes and RO membranes. Fine screened materials would be pumped into the Return Flow Pipeline. Cleaning chemicals would require either separate treatment or collection and storage prior to disposal. The pilot study will better define the pretreatment process and the cleaning requirements.

Solids produced from the MF waste treatment would be processed and dried on-site for ultimate disposal at a landfill. The site plan includes a new rail spur to facilitate material handling.

Availability of Historic Feedwater Quality Data and Sanitary Survey

The PEA includes a section on potable water quality. Water samples that were used for the water quality data contained in this section were obtained from the MLPP Surge Chamber Unit 6. This sample location differs from the proposed seawater diversion location at the MLPP Disengaging Basin but is expected to have similar water quality. The obtained water quality data was used extensively in a number of studies prepared in support of the project.

A sanitary survey has not been prepared but would be required for submitted to the California Department of Health Services for approval prior to operation of the facility.

Quality of Supporting Documentation

The CWP has the most comprehensive documentation of the three projects. The most specific project documentation includes the Conceptual Design Report and the Proponent's Environmental Assessment.

The Conceptual Design Report (CDR) includes the following sections:

- Source Water Intake and Brine Disposal
- Desalination Plant
- Desalination Water Conveyance System
- Aquifer Storage and Recovery Facilities
- Proposed Project Costs

The CDR provides studies and layouts of many of the proposed facilities. The quality of the work is good and it provides a good understanding of the design concepts, thus facilitating the accuracy of the construction cost estimating.

The CDR includes, as appendices, pipeline alignment drawings and project costs. The pipeline alignment drawings, at a scale of 1" = 80', show the alignment on aerial photographs. Profile information has been limited to critical crossings such as water courses and highways. The information shown is of good quality and this conceptual information would assist the CWP team's construction cost estimating efforts.

The PEA is another well prepared document showing project-specific detail appropriate to the project status. The body of the PEA includes site specific information including relevant conceptual designs and environmental impacts. Included in the PEA are detailed studies shown in the Appendices and Technical Memoranda.

Appendices to the PEA for the CWP are as follows:

- Air Quality Data
- Computational Fluid Dynamics Modeling for Moss Landing Power Plant
- Addendum to Computational Fluid Dynamics Modeling for Moss Landing Power Plant
- Flow Science: Draft Working Documents
- Visual Simulation Methodology for the Coastal Water Project
- Public Scoping Summary
- Flow Science: Draft Technical Memorandum
- List of Property Owners for the Coastal Water Project
- California American Water Monterey County Coastal Water Project Marine Biological Resources Phase II Report
- Noise Data for the Coastal Water Project
- California American Water Monterey County Coastal Water Project Terrestrial Biological Resources Phase II Report

- Cultural Resources Assessment Technical Report
- Preliminary Geotechnical Evaluation Monterey County Coastal Water Project
- Preliminary Hazardous Materials Assessment

Technical Memoranda included in the PEA are as follows:

- ASR Wellfield Conceptual Design, Modeling Analysis and Preliminary Enviromental Assessment
- Aquifer Storage and Recovery (ASR) / Segunda Conveyance System
- Brine Disposal
- MLPP Cooling Water Supply
- Desalination Plant at the Duke Energy East Site
- Desalinated Water Conveyance System (DWCS)
- Feasibility of Using HDD Wells for Water Supply
- HDD Well Supply
- North Marina Site Alternative Desalination Plant
- Site Comparison
- System Flow Management and Hydraulics
- Terminal Reservoir

Supports Regional and MPWMD Objectives

The CWP supports the goals of the MPWMD objectives by resolving the water supply issues associated with SWRCB Order No. 95-10. The project further supports the MPWMD objectives by providing potential expansion to the regional supply system.

Omissions or Fatal Flaws

None.

3.2 Monterey Bay Regional Seawater Desalination Project

Project Purpose

The MBRSDP is proposed by Pajaro/Sunny Mesa Community Services District (PSMCSD) to enable the Monterey Peninsula area to comply with SWRCB Order No. 95-10 and to provide supplemental water supplies to serve portions of North Monterey County.

Customers Identified

The MBRSDP will serve the Monterey Peninsula, the service area of the PSMCSD, and other areas of North Monterey County and portions of the Pajaro Valley Water Management

Agency[5] service area. A regional desalination plant capable of meeting the regional requirements is envisioned. The plant would be constructed in phases as additional users are brought into the system.

However, although at present the identified project water demands include 10,730 Ac-Ft/year to comply with SWRCB order No. 95-10 and 3,000 Ac-Ft/year to reduce overdraft of the Seaside Groundwater Basin, no additional supply is proposed to meet future demands in the Monterey Peninsula area.

Technology Appropriate/Demonstrated on this or Similar Supply

The technical description for the MBRSDP is included the Conceptual Design Report (CDR)[6] and the project's Proposition 50 Pilot Project Grant Application to California Department of Water Resources[7]. Both documents were prepared by Poseidon Resources for Pajaro/Sunny Mesa CSD.

The proposed treatment process is based on the use of reverse osmosis to accomplish the water quality objectives of the project. The proposed feed water source has been documented to experience high turbidity, and extensive pretreatment systems have been included to provide suitable feed water to the RO process.

Pretreatment

Currently, clarification followed by filtration is anticipated to be the major pretreatment steps. The project will rely on pilot testing to identify the optimum pretreatment approach. Both sedimentation and dissolved-air flotation (DAF) are considered options for the initial clarification. Conventional granular media filtration and membrane filtration are options for the filtration step. The project's Prop 50 grant application for pilot testing provides a thorough description of the pilot approach. It is anticipated that this pilot testing could develop the information necessary to design an effective and reliable pretreatment process. The consideration of DAF is appropriate, considering the possible presence of oil and algae in the feed water.

One area of concern is the selection of DynaSand technology by Poseidon Resources as a "conventional" filtration on other projects. This filtration technology does not have successful full-scale experience on seawater. While successful pilot performance at another site has been reported, this process may introduce a higher level of risk than traditional granular media filtration, such as dual-media filtration. Selection of the granular media filtration style for piloting has not been identified by the project proponent.

[5] Monterey Bay Regional Desalination Project, Conceptual Design Report. April, 2006
[6] *Monterey Bay Regional Desalination Project Conceptual Design Report.* April 2006

[7] Proposition 50 PSMCSD Pilot Demonstration Project Grand Application. March 22, 2006.

Reverse Osmosis

The CDR describes a traditional approach to seawater RO design which has been successfully implemented at other sites. Feed temperature is not well defined in the documents and will have substantial impact on the performance and economics of the project.

Conclusion

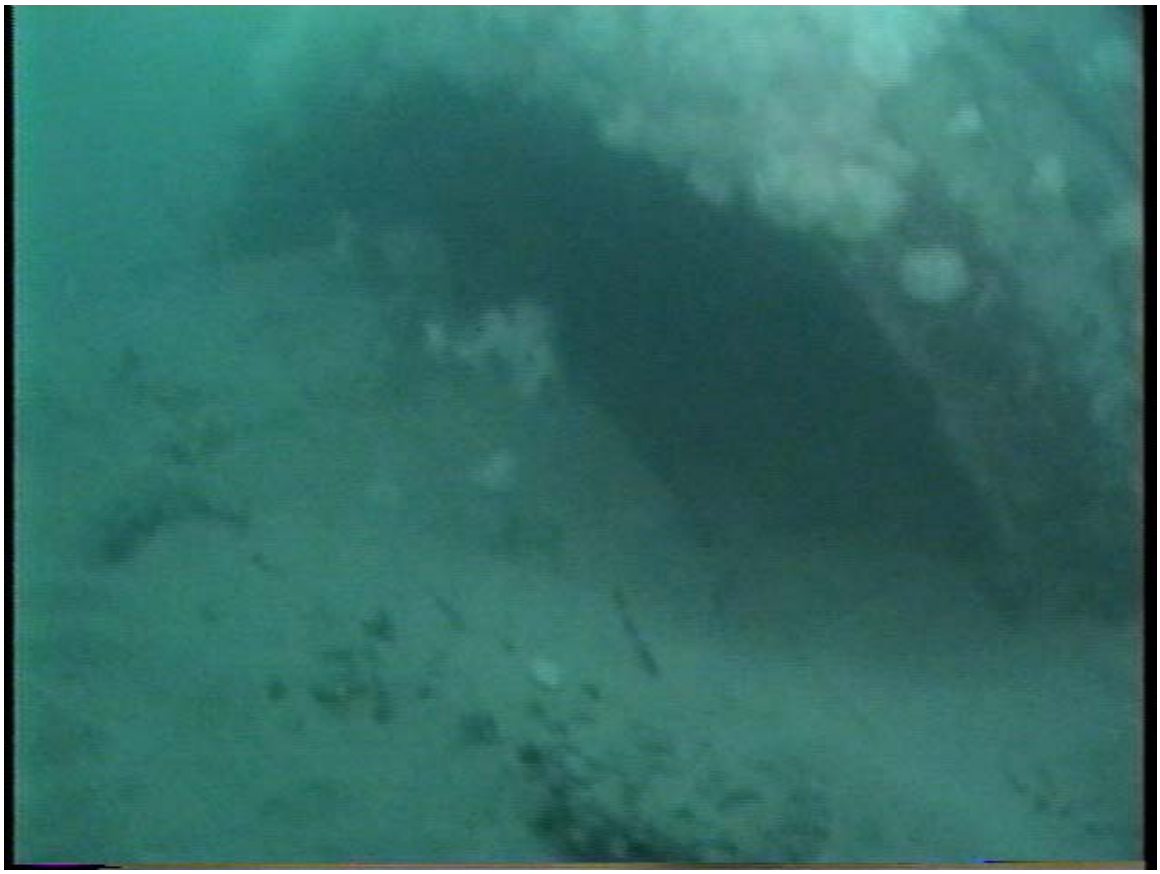
In general, the component treatment technologies (clarification, filtration and reverse osmosis) selected for piloting are appropriate for the application. Important design parameters must be established through long-term pilot testing. Pilot testing plans have been well documented. The disciplined execution of this pilot testing will be critical to the development of an effective and optimized design.

Waste Stream Fate Identified

Waste brine from the RO process will be discharged to the National Refractories ocean outfall[8] or the MLPP discharge stream. The National Refractories ocean outfall is currently not in use and is in need of repair, as is indicated in the following photographs (Figure 4 and Figure 5). Project cost estimates have addressed the need to repair the outfall but a description of the extent of repair has not been presented. Therefore, an assessment as to the reasonableness of the repair costs could not be made.

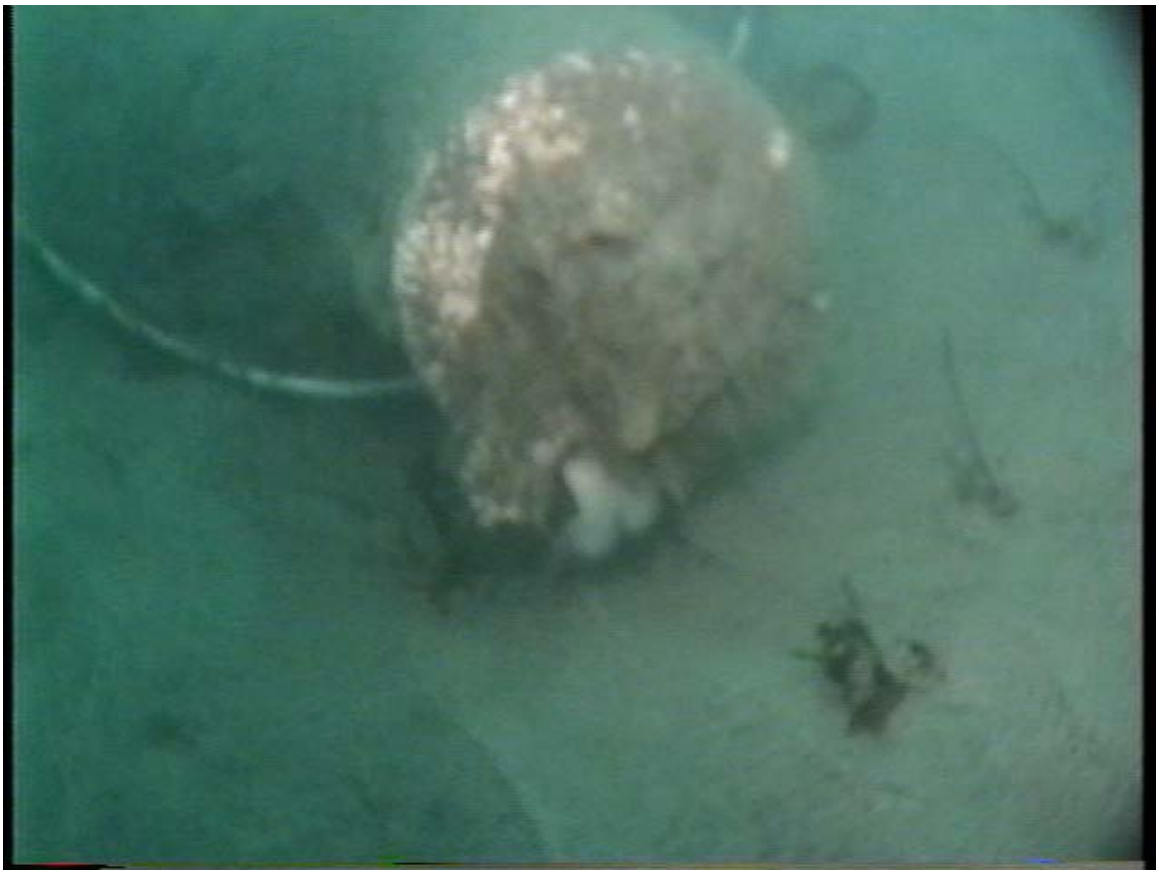
[8] *Monterey Bay Regional Desalination Project, Conceptual Design Report*. April 2006

Figure 4 - Joint Separation on National Refractories Outfall



Joint Separation on Outfall

Figure 5 - Clogged Diffusers on National Refractories Outfall



Clogged Diffuser

Residual streams from clarified sludge and granular pretreatment filter waste backwash are proposed to be discharged to the National Refractories ocean outfall. Chemicals used for membrane cleaning will be stored and neutralized prior to discharge to the National Refractories ocean outfall.

Solids from the source water screening will be retained in storage bins and hauled to a sanitary landfill.

Availability of Historic Feedwater Quality Data and Sanitary Survey

The Monterey Bay Regional Desalination Project Report of Waste Discharge (Application for Renewal NPDES Permit CA0007005 National Refractories Ocean Outfall dated November 1, 2005) contains data on seawater influent quality. These data were used to project effluent quality contained in the document. The document states: “Comprehensive data characterizing the quality of the seawater influent to the MBRSDP will be developed as part of the proposed pilot plant test program”.

A sanitary survey has not been prepared but would be required for submittal to the California Department of Health Services for approval prior to operation of the facility.

Quality of Supporting Documentation

The most comprehensive document provided or obtained in support of the full scale MBRSDP is the Monterey Bay Regional Desalination Project Conceptual Design Report dated April, 2006. The report describes:

- the proposed plant location
- general project implementation schedule
- project progress to date
- project description
- facility operation and maintenance
- project costs

The project description includes:

- photos of pilot plant filter equipment
- an enhanced aerial photo showing key desalination plant facilities
- a general configuration of a seawater RO system train
- a table showing key intake seawater design characteristics
- a table summarizing the seawater RO basic design criteria

The Conceptual Design Report provides little information on the treated water pipeline(s). However, a figure has been provided that shows an alignment which is shown herein as Figure 2.

Supports Regional and MPWMD Objectives

The MBRSDP supports the goals of the MPWMD objectives by resolving the water supply issues associated with SWRCB Order No. 95-10 and by providing 3,000 Ac-Ft/year to reduce overdraft of the Seaside Groundwater Basin. No additional supply is proposed to meet future demands in the Monterey Peninsula area. The project would supply water to the PSMCSD service area, portions of the Pajaro Valley Water Management Agency service area, and certain other areas in North Monterey County.

Omissions or Fatal Flaws

Additional studies are needed to determine the adequacy of using the National Refractories ocean outfall for brine disposal and the fate of the brine plume in the receiving waters.

3.3 Sand City Desalination Project

Project Purpose

The proposed 7.5 MGD/8,400 Ac-Ft per year desalination plant would allow Cal-Am to meet the provisions of SWRCB Order No. 95-10, provide a legal supply to meet the current total system production limit of 15,285 Ac-Ft per year and continue to provide a reliable supply of water to existing Monterey Peninsula customers.

Customers Identified

The project would provide water to existing Cal-Am service area customers.

Technology Appropriate/Demonstrated on this or Similar Supply

The technical description for this project is included in both the Final Phase 1 Technical Memorandum[9] and the Board Review Draft Environmental Impact Report (EIR)[10]. A notable aspect of this project is that the source seawater is obtained from a shoreline well field.

While the proposed treatment process is based on the use of reverse osmosis to accomplish the desalination treatment objectives of the project, the extensive pretreatment required for open-intake feed sources is avoided with this well source. Post-treatment chemical addition is still provided to condition the product water to meet aesthetic, compatibility and regulatory objectives.

Pretreatment System

The ability of seawater wells to reliably provide RO feed low in suspended solids has been demonstrated in numerous full-scale installations. The benefit of this source vs. open intakes include the avoidance of the capital and O&M expense of the pretreatment avoidance of entrainment impacts, increased reliability and often reduced RO membrane fouling. The pretreatment equipment defined for this project consists of cartridge filtration and antiscalant addition, which is sufficient for this application. While the wells do not yet exist, preventing verification of the feed water quality, it is reasonable to anticipate suspended solids levels which are acceptable for RO.

Reverse Osmosis

The Final Phase 1 Technical Memorandum and the Board Review Draft EIR describe a traditional approach to seawater RO design which has been successfully implemented at other sites. The design consists of four 33% capacity RO trains, which provide substantial

[9] Monterey Peninsula Water Supply Project Alternatives – Final Phase 1 Technical Memorandum. March 2003.

[10] Monterey Peninsula Water Management District Water Supply Project Board Review Draft Environmental Impact Report. December 2003.

redundancy and reliability to the treatment facility. The stated operating pressures are reasonable for this application. Considering that the conceptual design effort for this project occurred 2-3 years ago, it is expected the energy recovery performance anticipated is relatively conservative compared to current approaches which benefit from recent advances in energy recovery devices.

Conclusion

The treatment design for the Sand City project, consisting of RO operated directly on well water is an appropriate approach, which has been successfully implemented at many locations. The design has been developed only to the conceptual level. However, no serious omissions or fatal flaws in the treatment process are anticipated.

Waste Stream Fate Identified

Brine from the desalination process would be disposed either in HDD wells or connection to the MRWPCA's treated wastewater outfall to the Pacific Ocean.[11] Descriptions of the fate of cleaning chemicals and other waste streams were not identified.

Studies considering an HDD system for brine disposal have determined that such a system is technically feasible in the Fort Ord area. However, such a disposal concept could be an issue because the regional aquiclude (Seaside Clay) is absent in the area, creating a window with direct hydrologic communication with the underlying aquifer (the Poso Robles Aquifer system). Additional modeling is needed to determine the potential affects of mixing desalination brine and seawater with freshwater in the Paso Robles aquifer.

Brine discharge to the MRWPCA's treated water wastewater outfall is technically feasible although initial studies indicate that capacity may not be available for all outfall flow conditions. Additional studies are needed to determine if storage or operational modifications can be made to accommodate all outfall operating parameters.

Availability of Historic Feedwater Quality Data and Sanitary Survey

No source water quality information was provided in any of the reviewed documents. Additional work will be needed to develop this data. Future test wells would need to be drilled and water quality samples obtained. Long-term water quality impacts will also need to be evaluated.

Quality of Supporting Documentation

The quality of the work prepared in support of this project is good; however, much of the work has been to determine the project's feasibility. A good portion of this feasibility related

[11] Monterey Peninsula Water Management District, Water Supply Project, Draft Environmental Impact Report, December 2003

work is focused on seawater intake and brine disposal. Since there is limited data available on similar types of installations, the amount of feasibility level assessments is appropriate.

Specific desalination treatment plant sites and specific pipeline alignments have not been determined. The reviewed material showed various alternatives for the proposed facilities.

Supports Regional and MPWMD Objectives

The SCDP supports the goals of the MPWMD objectives by resolving the water supply issues associated with SWRCB Order No. 95-10.

Omissions or Fatal Flaws

Additional study on the use of radial wells or horizontal directionally drilled wells is needed to determine their appropriate for use in this application.

4 Projected Performance

This section discusses the following topics for each proposed project:

- TDS objective(s)
- Title 22 drinking water standards (i.e., primary standards, pathogen control, DBP minimization, etc.)
- Corrosion control in the distribution system
- Blending with existing distribution system water
- Disinfection practices sufficient

4.1 Coastal Water Project

In general, the Coastal Water Project (CWP) Conceptual Design Report (CDR)[12] specifies appropriate, conceptual state treatment process information for assessing desalination plant performance relative to drinking water quality with no significant gaps or deficiencies. However, there are some potential issues that warrant more detailed planning as the project enters the pilot stage. (See Table 1 for project intake and outfall locations).

For example, the CDR indicates that 3.0 mg/L of free chlorine will be added just prior to the coagulation and flocculation pretreatment processes. Although not explicitly specified in the CDR, this disinfection step is likely intended to satisfy the various state and federal requirements for primary disinfection for surface water treatment plants. No information is provided in the CDR to justify the sufficiency of this dose for achieving the 0.5-log *Giardia* inactivation credit that will almost certainly be required by the California Department of Health Services. In addition, data provided by Duke Energy Power Services[13] from its National Pollution Discharge Elimination System (NPDES) permit renewal sampling in 1999 indicated that total organic carbon (TOC) levels in the power plant Units 6 and 7 intake and discharge are approximately 10 mg/L, an amount that is unusually high for a surface water source as well as for seawater. This level of TOC, coupled with a 3.0 mg/L chlorine dose and a combined 21 minutes of contact time in the coagulation and flocculation processes, as well as addition contact time in the submerged membrane filtration basins, could result in the formation of significant chlorinated disinfection by-products (DBPs), which are strictly regulated in drinking water systems. The reaction of this TOC with the applied chlorine would diminish the disinfection potential for inactivating pathogens. Both the efficacy of primary disinfection and the potential for DBP formation, as well as the possible removal of these DBPs via the reverse osmosis (RO) processes, needs to be explicitly evaluated during the pilot phase, as noted in the CDR. Note that while the feed for the seawater desalination

[12] *Coastal Water Project Conceptual Design Report* (Draft). September 16, 2005.

[13] CWP Source Water Monitoring Documents. Transmitted from Lela Adams at California American Water to Larry Gallery at RBF Consulting. December 14, 2004.

plant is planned to be withdrawn from the discharge for Units 1 and 2 prior to the point at which the cooling water flow is combined with that from Units 6 and 7 prior to discharge, both the Units 1 and 2 and Units 6 and 7 utilize intakes in Moss Landing Harbor and may have similar water quality.

The CDR also does not specify how the physical pathogen removal credits for *Giardia*, *Cryptosporidium*, and viruses would be allocated to the various treatment processes by the California Department of Health Services (CDHS); however, it is likely that the combination of membrane filtration, cartridge filtration, and RO would achieve the required pathogen removal objectives.

Another potential water quality issue is the possible presence of synthetic organic chemicals (SOCs) in the watershed. A report developed by The Watershed Institute at California State University Monterey Bay[14] indicated the detection of the pesticides chloropyrifos (up to 0.145 μg/L) and diazinon (up to 0.682 μg/L) in Moss Landing Harbor. While there are no maximum contaminant levels (MCLs) for these two compounds, the levels detected are in the same range as the MCLs for some other regulated SOCs, which also could be present in the watershed that drains into Moss Landing Harbor. Because the ability of the RO process to remove various SOCs can vary depending on the compound and may not be well documented in the literature, the pilot phase should include a full screen for SOCs (as well as for all regulated drinking water parameters) in both the feed and RO permeate water. Note that the 1999 NPDES permit renewal sampling did not detect the presence of any regulated SOCs in the intake water for power plant Units 6 and 7.

The CDR specifies that the hardness, alkalinity, and pH of the RO permeate would be adjusted via chemical applications both for aesthetic considerations and to protect the distribution system piping. The CDR also indicates that a corrosion inhibitor may be needed. In addition, the Proponent's Environmental Assessment[15] indicates that RO post-treatment would be applied with consideration for blending with other water supplies. However, no total dissolved solids (TDS) target is specified, nor is the potential impact of these chemical additions on the ability of the treatment process to meet that target.

The CDR states an assumption of five percent downtime for maintenance, but indicates an annual average daily capacity that is 97 percent of the design daily capacity. Nonetheless, this on-line time would require redundancy in all treatment processes and pumping facilities. No references are made to the redundancy levels in the treatment plant design or to the basis of the cost estimates.

[14] *Monitoring Chloropyrifos and Diazinon in Impaired Surface Waters of the Lower Salinas Region.* March 31, 2004.

[15] *Proponent's Environmental Assessment for the Coastal Water Project.* July 14, 2005.

4.2 Monterey Bay Regional Seawater Desalination Project

The Conceptual Design Report (CDR) provides significant general information about the Monterey Bay Regional Desalination Project (MBRSDP)[16], although in many cases there is less supporting detail than would typically be provided at the conceptual level. For example, the CDR indicates that the desalination plant will be in compliance with the applicable requirements of both the Federal Safe Drinking Water Act (SDWA) and Title 22 of the California Code of Regulations, although it does not specify how the required pathogen removal and inactivation credits will be achieved. While the proposed treatment process, including clarification, media or membrane filtration, cartridge filtration, and reverse osmosis (RO) should be sufficient for meeting the physical pathogen removal requirements, there is no indication of how the CDHS would allocate the removal credit among these processes.

Similarly, the CDR indicates that chloramines will be added downstream of the product water storage tank, and that the product water transfer line would provide adequate contact time to comply with CDHS disinfection requirements. However, chloramines constitute a relatively weak primary disinfectant, and no supporting detail is provided to justify its use. Likewise, the CDR notes that pesticides and agricultural runoff will not be a factor for source water quality, but there is no rationale or supporting water quality data provided to substantiate this assertion. A full water quality analysis for all regulated drinking water contaminants should be conducted during the piloting phase prior to full-scale project implementation. The CDR does cite low total organic carbon (TOC) levels (more consistent with typical ambient seawater concentrations than those reported by Duke Energy for its Moss Landing Harbor Units 6 and 7 intake and discharge), and coupled with the use of coagulation and polymer in the pretreatment process prior to any chlorine addition, the formation of chlorinated disinfection by-products should not be an issue.

In addition to these information gaps, the most significant water quality concerns associated with the MBRSDP involve the diverse systems owned by the Pajaro/Sunny Mesa Community Services District (PSMCSD) that could potentially receive water from the proposed seawater desalination plant, as well as other systems that could purchase the water which have yet to be identified.[17,18] The CDR indicates that the water produced by the seawater desalination plant will be compatible with the water in the distribution systems to which it is delivered; however, with customers not yet identified and a variety of disparate water qualities among the systems owned by the PSMCSD, this claim cannot be substantiated. If the water quality is even moderately different among the various systems to which the desalinated seawater would be delivered, it may be infeasible to treat the desalinated water to match that of the receiving waters of each system for aesthetics, residual

[16] *Monterey Bay Regional Desalination Project Conceptual Design Report.* April 2006.

[17] *Monterey County Local Agency Formation Commission's North County Municipal Services Review* (Revised Final Draft). February 2006.

[18] "PUC OKs Water Systems Sale – Alisal Water Corporation Ordered to Sell Them." The Salinas Californian. May 16, 2006.

disinfection, total dissolved solids (TDS), and corrosion control. Moreover, additional pipe loop and/or coupon testing may need to be conducted for the piping in each receiving system. If this custom post-treatment conditioning and corrosion testing is not conducted as a component of the MBRSDP, then any system purchasing desalinated seawater from the PSMCSD would have to assume responsibility for these project elements, effectively increasing the cost of water to the respective ratepayers. This cost, as applicable, should be factored into the overall cost of desalinated seawater, in addition to the purchase price from the PSMCSD.

The CDR provides discussion of redundancy and peak flow provisions in the design. At average flow the RO has five duty and one standby train. Similarly, redundancy of the product pumping facilities is provided. It would appear that a sound redundancy approach is being applied system wide.

4.3 Sand City Desalination Project

Both the Final Phase 1 Technical Memorandum[19] and the Board Review Draft Environmental Impact Report (EIR)[20] explicitly indicate that the combination of sand filtration provided by beach wells, reverse osmosis (RO), and disinfection using free chlorine (via sodium hypochlorite) should be sufficient to achieve the 4-log virus and 3-log *Giardia* reduction required by the CDHS using a combination of physical removal and chemical inactivation. Although *Cryptosporidium* reduction would also need to be achieved, it is expected that the CDHS would award the process the 3-log reduction in conjunction with the virus and *Giardia* reduction (notwithstanding any additional *Cryptosporidium* reduction required under the newly promulgated federal Long-Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR), if applicable). The Board Review Draft EIR also acknowledges that this process includes the capacity to comply with the likely CDHS requirement for a minimum of 2-log virus inactivation using 10 minutes of free chlorine contact time after the RO membranes. However, the CDHS typically requires the more conservative disinfection requirement of either 2-log virus or 0.5-log *Giardia* inactivation, and with the use of free chlorine the *Giardia* benchmark is the more stringent requirement. In any case, with a treated water storage tank of approximately 2.5 million gallons and a treatment plant flow of 7.5 MGD, the contact time in this tank should be sufficient to achieve either of these inactivation requirements for typical chlorine doses applied for primary disinfection.

Although no source water quality information is provided, the total organic carbon (TOC) is generally low in seawater and may be somewhat lower using a beach well intake; thus, the precursor material for disinfection by-product (DBP) formation is expected to be minimal. The Final Phase 1 Technical Memorandum notes that occasional non-point source pollution

[19] Monterey Peninsula Water Supply Project Alternatives – Final Phase 1 Technical Memorandum. March 2003.

[20] Monterey Peninsula Water Management District Water Supply Project, Board Review Draft Environmental Impact Report. December 2003.

could potentially cause the beach wells to become infiltrated with enteric viruses, synthetic organic chemicals (SOCs), pharmaceutical residuals, and/or endocrine disruptors. Because there are no test wells constructed at this stage of project development, the potential for such contamination cannot be accurately assessed. While no available documentation regarding the Sand City Desalination Project specifically called for increased monitoring for these contaminants and the ability of the proposed treatment process to remove them either during a piloting stage or at full scale, the acknowledgement and awareness of this possible contamination is important at this early stage of project development.

Both the Board Review Draft EIR and Final Phase 1 Technical Memorandum indicate that lime and carbon dioxide would be use for post-treatment conditioning to produce a "non-corrosive water," and the Final Phase 1 Technical Memorandum also notes that the total dissolved solids (TDS) of the RO permeate (product water) is expected to be in the range of 200 – 300 mg/L. However, neither document accounts for matching the finished water to the receiving distribution system in terms of pH, alkalinity, and TDS (including the addition of post-treatment chemicals for conditioning).

Appropriate redundancy is indicated for the collector wells, treatment process and pumping station.

5 Economics

This section provides a review of the economics of each of the three projects. Reviewed items include:

- Capital cost
- Operating cost
- Unit cost
- Total energy consumption/efficiency
- Quality of cost estimate (conceptual, preliminary, bid, etc.)
- Age of cost estimate
- Energy cost assumptions
- Financing – identified & adequacy

The three projects have supporting documentation that is in various stages of development. The CWP is at a conceptual or preliminary level. This assessment is based on the supporting documentation that has been provided. The CWP has done the most work on resolving site specific technical issues. With this knowledge the estimators are able to make a more complete assessment of the associated construction costs, thus allowing a lower contingency for the estimate.

The SCDP is also at a conceptual or preliminary level but is less developed than the CWP. The SCDP does not have a preferred treatment plant site or preferred pipeline alignment, although it has construction cost estimates for potential alignments. Some site specific information has been developed but at this time it is very general.

The MBRSDP is the least developed and is at a screening level of development. Construction cost estimates are apparently developed from projects of a similar nature.

As each of the projects progresses and more detailed construction cost estimates are made we would expect the estimates to more accurately reflect the specific site conditions. Since many of those site conditions are unknown at this time, the construction cost estimates may not accurately reflect the ultimate construction costs. More accurate estimates would be expected to develop as the projects develop.

The basic technology used for any of the three desalination plants would be similar. Although there are differing philosophies on the pretreatment requirements, the bulk of the desalination system requirements will be comparable; therefore we would expect any of the three desalination facilities to have similar unit costs with small deviations due to varying site conditions. This is also assuming that the same quality and grade of materials are used for each project. There may, however, be some savings for a larger capacity plant due to the economies of scale. Any present differences in the unit cost of the desalination facilities

appear to be due to the methodology used to prepare the cost estimate or to differing assumptions on material selection.

The three projects also have differing treated water capacities and are proposed to be located in different locations. These factors affect the length and diameter of the proposed treated water pipelines.

The CWP and MBRSDP would be located within or adjacent to the MLPP. Both projects could benefit from purchasing power directly from the power plant and not be subject to power costs from the power grid. The reduced power rates are estimated to be on the order of 40 percent and represent a considerable savings in power cost over the project life. The SCDP would have to pay the going rate for power from the power grid for their facilities.

The following table summarizes the three projects' current cost status. The costs have been refined by the B-E team as described in the table's footnotes. Of particular note is the cost per Acre-Ft for the CWP Regional Project and MBRSDP being within 15 percent of one another. Given some of the unknown cost elements as described in this section, 15 percent represents a very small difference. The CWP Basic project's per Acre-Ft costs would be expected to be higher due to the economies of scale.

Table 2 - Summary of Desalination Project Capacities and Estimated Costs

Project	Plant Capacity	Annual Production	Estimated Total Capital Cost (Year)	Estimated Total O&M Costs (Year)	Cost per Acre-Ft
Coastal Water Project (desal portion only [1])					
Proposed project (meets SWRCB Order No. 95-10)	10 MGD [2]	10,430 Ac-Ft/ year [3]	$151,103,920 [4] (2005)	$8,117,000 [6] (2005)	$1944 [8 11]
Regional project	18 MGD	18,972 Ac-Ft/ year	$237,803,000 [7] (2005)	$10,484,000 [9] (2005)	$1562 [8 12]
Monterey Bay Regional Seawater Desalination Project	20 MGD	22,400 Ac-Ft/ year capacity (20,930 Ac-Ft/year demand identified)	$169,026,926 [5,9] (2006)	$16,900,000 [5,9] (2006)	$1352 [8 13]
Sand City Desalination Project	7.5 MGD	8,400 Ac-Ft/ year	$176,200,000 – $193,000,000 (ENR CCI [10] = 7,644 [San Francisco, Dec. 2002])	$8,740,000 - $9,090,000 (ENR CCI [10] = 7,644 [San Francisco, Dec. 2002])	$2729-$2931 [8 14]

/1 Costs for the aquifer storage and recovery component of the Coastal Water Project have been subtracted from the total project costs provided by Cal-Am.

/2 million gallons per day

/3 acre-feet per year

/4 $110,780,000 capital costs, 24% implementation and 10% contingency. Excludes ASR costs. Excludes pilot plant estimated costs of $2,585,000 and ROW/easement costs of $2,000,000.

/5 Desalination Facility Capital and implementation costs and contingency are co-mingled without identification. No ROW/easement costs are identified. Transmission pipeline costs include 23.5% implementation costs and a 25% contingency.

/6 From CWP data excluding Terminal Reservoir/ASR Pump Station operating and Segunda/ASR System costs. Includes all CWP supplied repairs and replacement costs.
/7 $174,342,377 capital costs, 24% implementation and 10% contingency. Excludes ASR costs. Excludes Pilot Plant estimated costs of $2,585,000 and ROW/easement costs.
/8 Capital cost amortized over 30 years at 7%
/9 Estimated costs for the two regional projects do not include distribution system facilities that would be required for serving areas other than the Monterey Peninsula.
/10 Engineering News Record, Construction Cost Index
/11 $2,104 per acre-ft if capital cost contingency is adjusted 15% as recommended
/12 $1,699 per acre-ft if capital cost contingency is adjusted 15% as recommended.
/13 $1,434 per acre-ft if capital cost contingency is adjusted 15% as recommended.
/14 $2,491 - $2,693 if power consumption is reduced by recommended 33%.

5.1 Coastal Water Project

Capital Cost

Capital costs were derived for a 10-MGD RO seawater desalination plant, Desalinated Water Conveyance System (DWCS), source water and brine disposal facilities, and a 6.3-MGD injection/ 12.9-MGD extraction (up to 1,300 Ac-Ft per year) aquifer storage and recovery (ASR) system[21]. Capital costs were estimated using budgetary quotes from vendors and suppliers of equipment and material and estimates of labor requirements based on crew requirements and prevailing wages. As shown in Table 3, the estimated capital cost to implement the Proposed Project is $178,000,000 (2005 dollars).

Table 3 - CWP 2005 Capital Cost

Facility	Cost
Desalination Facilities	
Seawater Feed and Brine Disposal	$6,260,000
Residuals Handling and Treatment	$1,220,000
Desalination Processes	$77,200,000
Subtotal, Desalination Facilities	*$84,680,000*
Desalination Water Conveyance Pipelines	
Moss Landing DWSC Pipeline	$6,900,000
TAMC RR DWSC Pipeline	$11,700,000
Seaside DWSC Pipeline	$4,100,000
Subtotal, DWCS Pipelines	*$22,700,000*
Terminal Reservoir and ASR Pump Station	*$5,400,000*
Subtotal this page	*$112,780,000*

[21] *Coastal Water Project Conceptual Design Report* (Draft) - September 16, 2005

Facility	Cost
Segunda/ ASR System	
Tarpy Flats Pump Station	$3,900,000
Segunda Pump Station Upgrade	$360,000
Segunda Pipeline	$4,800,000
ASR Pipeline	$1,500,000
ASR Wells	$3,560,000
Subtotal, Segunda/ ASR System	*$14,120,000*
Total Construction Costs	$126,900,000
Implementation Costs @ 24%	$30,456,000
ROW/ Easement/ Land Costs	$2,000,000
Capital Costs without Contingency	$159,356,000
Contingency @ 10%	$15,935,600
Pilot Plant	$2,585,000
Capital Cost with Contingency	**$178,000,000**

The original basis of the estimated capital costs was derived from a report by JR Conkey & Associates, entitled "Estimate of Probable Construction Costs – California American Water – Coastal Water Project – Regional Project -2004" (Conkey Report). The Conkey Report was prepared based upon the Regional Coastal Water Project and provides a detailed accounting of anticipated labor, equipment, material and subcontractor costs. In turn the Conkey Report obtained costs for the microfiltration and reverse osmosis equipment from a Pridesa define/describe "budget" for the mechanical equipment. Pridesa is a Spanish water treatment contractor with experience supplying large scale desalination facilities in Europe. When the estimate was prepared, Pridesa was a "sister" company of Cal-Am in that they were owned by the same firm. Pridesa provided Cal-Am a "preliminary budget" for the mechanical equipment.

As part of the Coastal Water Project Conceptual Design Report (September 16, 2005) the Conkley Report estimated numbers were refined to reflect the costs associated with the Basic Coastal Water Project. The Conkley report numbers were also increased to obtain current (at the time of the report) 2005-dollars. The Pridesa MF and RO mechanical equipment quotes were reduced by 33% to account for the difference plant capacity, costs were inflated 4% to obtain current 2005 values, and $1.5M was added to each process as allowance for "containment structures". Implementation costs (engineering, environmental documentation, permitting, admin., etc.) of 24% were added to the Total Construction Costs. A contingency of 10% was applied to the total capital cost.

Comments on the reasonableness of the quantities and unit costs of the capital cost estimate are as follows:

- The original Pridesa Preliminary Budget value for the MF system is considered relatively high for this capacity. Competitive procurement of this equipment is expected to be 25% lower than the indicated value.
- The RO costs include $1.5M for "RO containment structures". It is not apparent what this item is and if it is appropriate.
- The basis for the 33% reduction factor to adjust the Conkey Regional scale project to the Proposed Project has not been provided.
- Following the stated method employed to revise the Pridesa/Conkey pretreatment and RO process values to 2005 Proposed Project costs, results in substantially lower values than indicated in Table 6-3 of the Conceptual Design Report.
- A 10% contingency may be appropriate for a Preliminary Design estimate which uses component costs for the Proposed Project. However this estimate is based on factoring costs from an estimate for a project double the size of the Proposed Project and applying an inflation factor to bring it to current dollars. A contingency of at least 25% is recommended for this estimate.

Operation and Maintenance Costs

The September 16, 2005 CWP Conceptual Design Report includes the Operations, Repairs, and Replacement Annual Costs Summary table reproduced as Table 4 below.

Table 4 – CWP 2005 Operations, Repairs, and Replacement Annual Costs Summary

Facility	Cost
Desalination Facilities Operations Cost	$6,252,000
DWCS Operations	$417,000
Terminal Reservoir / ASR Pump Station Operations	$72,000
Segunda/ ASR System	$651,000
Subtotal, O&M Costs	*$7,392,000*
Subtotal, Repairs and Replacements	*$1,448,000*
Total O&M with Membrane Replacement	**$8,840,000**

The CWP treatment facility O&M costs are thorough and consistent with expected values for a full-scale MF/RO facility. Electrical costs are assumed to be $0.07/kWh for "within the fence" power to the treatment facility and $0.12/kWh for off-site pumping stations. These costs are consistent with our understanding of the current power rate structure.

Financing –Identification & Adequacy

Cal-Am has served the Monterey area since it acquired utility properties from California Water and Telephone Company in 1966. Cal-Am is one of the state's largest regulated water utilities with rates subject to authorization from the California Public Utilities Commission

(PUC). Cal-Am is also part of the American Water Works Company's (AWWC) family of subsidiaries operating in many states across the country. AWWC is one of the largest regulated water utilities in the country, and is part of investor-owned RWE of Germany, Europe's third largest utility. RWE is considering divesting itself of AWWC properties through a public stock offering.

Cal-Am initially finances capital expenditures through short term debt borrowed against a line of credit, as authorized by its Board of Directors, followed by subsequent securing of long-term financing. Moneys borrowed short term are repaid either annually or biannually with proceeds from the sale of long term debt securities of Cal-Am to an affiliate, American Water Capital Corporation (AWCC). AWCC is a wholly owned subsidiary of AWWC and acts on behalf of financing needs for related AWWC affiliated utility companies across the country. Interest rates associated with borrowed money on a short term basis are determined by current market conditions. PUC filed documents indicate that interest rates for short term debt are a blended rate resulting from various borrowing with different maturities. Borrowings from the primary lending source of AWCC are priced at the London Inter Bank Offered Rates (LIBOR) and borrowing from back-up credit lines of AWCC is priced at a LIBOR interest rates plus 25 basis points. The company indicates that interest rates for long term debt are comparable to interest rates for public debt securities issued by companies with ratings similar to AWCC. The PUC has approved the financing relationship between Cal-Am Water Company and AWCC (Decision 00-10-067).

The rate application to the PUC to recover all present and future costs relating to the CWP indicates that pre-construction and construction costs will be financed on an annual basis by short term borrowings. Further, the company states that depending on market variables and the possibility of a joint and/or public project, there are a number of options for financing. Cal-Am, in conjunction with any public partners, will strive to find the best mix of debt and equity/or public financing that will result in the lowest cost financing available.

In a cost of capital exhibit filed as part of an application to increase rates for water service in its Monterey District, Cal-Am indicated it will issue more than $308 million in new long term debt securities from the end of 2004 through 2008 to replace maturing debt securities and fund additional capital improvements. The company anticipates that new debt will have an annual interest rate of between 6.90 to 7.03 percent for years 2006 through 2008.

Currently, Cal-Am is requesting authority from the PUC to apply rate surcharges in order to recover pre-2007 costs (estimated at $18.6 million to include environmental studies, engineering, the pilot project and similar costs) and surcharges for construction cost offsets. The purpose of these surcharges is to reduce rate shock that would be generated by the cost of the Coastal Water Project if recovery is deferred until the project is completed. The company is also requesting that the average and recovered balance on incurred and approved charges be allowed to accrue interest at Cal-Am's current authorized rate of return for the Monterey District (8.1 percent).

Although Cal-Am has not secured long-term financing for the capital investment required to implement the CWP, it is clear that the company has an avenue to secure such financing when required. It should, of course, be noted that the long term anticipated financing rate of about 7 percent is not the entire financial burden the ratepayers will ultimately bear. Capital costs for the CWP will have both a financing and equity allocation which will result in an overall project cost in excess of 8 percent as reflected in the required rate of return to rate base within which the CWP investment will be recognized. This project at 8 percent by Cal-Am can be compared with potential financing by a municipal agency which currently is able to obtain revenue bonds at about 4.5 percent.

Quality of Cost Estimate

The CWP construction cost estimate is currently at a conceptual or preliminary level. Detailed assessments of certain specific site requirements have been compiled and the costs of those specific requirements are accounted for in the estimates. For example, the detail shown on the pipeline alignment has allowed the estimator to address specific critical crossing requirements (i.e., water courses or highways) and their associated costs.

Additionally, detailed studies have been made of the proposed desalination site requirements and spatially constraints. Analyses of on-site pipeline alignments, facility configurations, connections to existing facilities and other site specific information are available to the estimator. This detail allows the estimator to better refine his costs and make a more accurate prediction of the anticipated costs.

Methodology of developing this capital cost estimate justifies use of a greater contingency factor. The root cost values used for the major microfiltration equipment are “budgetary” and appear to be relatively high. Net impact is that a higher capital cost estimate may be appropriate

5.2 Monterey Bay Regional Seawater Desalination Project

Capital Cost

Capital costs for the desalination facilities are provided in the Monterey Bay Regional Desalination Project Conceptual Design Report dated April 2006 with the costs presented in Table 5.

Table 5 – MBRSDP 2006 Capital Cost

Construction Costs – Desalination Plant 2006	
Site improvements	
Seawater Intake Facilities	
Pretreatment System	
SWRO System	

Construction Costs – Desalination Plant 2006	
Permeate Conditioning and Disinfection Facilities	
Waste Stream Management Facilities	
Instrumentation, Monitoring and Control System	
Electrical Supply System	
Service and Support Facilities	
Yard Piping	
Other Construction Costs	
Engineering, Construction Management and Oversight	
Permitting	
Financing	
Startup and Commissioning	
Contractor Fees, Insurance and Bonding	
Other Direct Costs	
Contingencies	
Total Capital Costs	**$130,000,000**

The information was provided as shown without line item summaries of the anticipated costs.

The capital costs shown above are solely for the desalination facilities and do not include costs for the transmission pipelines, and pumping and storage components.

By an application dated March 24, 2006, P/SM submitted the Monterey Bay Regional Seawater Desalination Pilot Project to California Department of Water Resources for a Proposition 50 PSMCSD Pilot Demonstration Project Grant. Total capital project costs of $2,970,000 were presented. This total is comparable to the CWP Pilot Plant capital cost estimate of $2,585,000 (see above). It should be noted that the CWP cost shown in Table 3 includes the cost of the pilot plant. The MBRSDP costs shown in this section do not include the pilot plant costs

Included in the North Monterey County Desalination Project Monterey Peninsula Water Management District Decision Matrix by Kennedy/Jenks Consultants dated September 10, 2004 was the Preliminary Capital Cost Breakdown presented in Table 6.

Table 6 - MBRSDP Preliminary Capital Cost

ITEM	QUANTITY	UNITS	COST	
DESALINATION COOMPONENTS				**$74,000,000**
Intake Pipeline Rehabilitation	1	Lump Sum	$500,000	

ITEM	QUANTITY	UNITS	COST	
	1	Lump Sum	$72,000,000	
Outfall Pipeline Rehabilitation	1	Lump Sum	$1,500,000	
PUMPING & STORAGE COMPONENTS				**$14,000,000**
Finished Water Storage & Pumping Facilities	1	Lump Sum	$14,000,000	
TRANSMISSION PIPELINE				**$16,830,000**
Transmission Pipeline – Paved/Hwy 1 R-O-W	20000	L.F.	$5,000,000	
Transmission Pipeline – Unpaved R-O-W	47900	L.F.	$9,580,000	
Mojo Cojo Slough Crossing	500	L.F.	$750,000	
Tembladero Slough Crossing	100	L.F.	$250,000	
Salinas River Crossing	1000	L.F.	$1,250,000	
Energy Facilities	Undetermined			
ASR Costs	None Proposed		-----	
Distribution System Requirements	None Proposed		-----	
Construction Subtotal			$104,830,000	
ADMIN, LEGAL, ENGINEERING & ENVIRONMENTAL			**$24,635,050**	
Right-of-Way			**-----**	
Environmental Review, Permits	3%	Of Subtotal	$3,144,900	
Mitigation Measures	Undetermined		-----	
Design Engineering	10%	Of Subtotal	$10,483,000	
Construction Management	7.50%	Of Subtotal	$7,862,250	
Administration/Legal	3%	Of Subtotal	$3,144,900	
Profit	None		0	
Project Subtotal			$129,465,050	
Contingencies	25%		$32,366,263	**$32,366,263**
Project Total			**$162,000,000**	**$162,000,000**

* In Appendix A: Project Information Form, line 8.

The line item cost for the Pumping & Storage Components and Transmission Pipeline are $14,000,000 and $16,830,000, respectively. If we apply the percentage for the various items included for the line item Admin, Legal, Engineering and Environmental and the 25% contingency to the above amounts we obtain a total cost for the Pumping & Storage Components and Transmission Pipelines of $39,026,926.

Although there are no costs shown for right-of-way, the project includes a pipeline between Moss Landing and the Monterey Peninsula. There would no doubt be costs for pipeline right-of-way, even though much of the alignment would be in publicly-owned roadways and other public rights-of-way.

There would also be costs for use of the plant site and intake and outfall facilities. In the agreement between PSMCSD and the current owner of the plant site (Property and Pipeline Capacity Lease Agreement between the Pajaro/Sunny Mesa Community Services District and HMBY, L.P., A California Limited Partnership, dated March 3, 2004), the following provisions relate to project right-of-way costs:

"3. RENT. Rent for the subject Premises and Tenant's use of all ancillary facilities, easements, intake and outfall pipelines, tanks, pumps, and all appurtenances thereto shall be paid as follows:
(a) The base rent for the subject Premises shall be $.05 (five cents) per square foot per year for vacant land and $.10 (ten cents) per square foot for the open water holding tanks on the twenty (20) acre "premises" site. On the first day of the beginning of the fourth year of the lease, and on the first day of every year of the lease, or the Lease extension, thereafter, the base rent shall be increased at a rate of 5% per year. . .
(b) In addition to the base rent, Tenant agrees to pay Landlord, as partial rent for subject Premises, including the intake and outfall pipeline and flow capacities, and amount for each acre foot of potable water produced for municipal of human use or consumption as follows:
i. A base payment of $100 per acre-foot for each acre-foot of potable water produced by Tenant for municipal, agricultural, or human consumption during the term of this lease.
ii. Beginning on the first day of Year Three (3) after the first day that potable water is produced and sold for commercial consumption by for municipal, agricultural, or human uses, the base payment shall increase at a rate of 10% per year for every year of the lease from the beginning of Year Three until the end of Year Ten. The adjusted rate per acre-foot shall increase thereafter (beginning in Year Eleven) at a fixed rate of 5% per year for each remaining year of the lease or its extension.
iii. Payment for the first 50,000 acre feet of water to be produced by Tenant shall be prepaid to Landlord on or before the first day that potable water is sold by Tenant for commercial consumption by municipal, agricultural, and human use. ..."

Based on the above agreement a cost of $2.24 million per year (22,400 acre-feet x $100 / acre-foot, plus per-square-foot charge for the "base rent") would ensue, once the plant is in operation.

In response to MPWMD's requests for further detail, Poseidon Resources offered to prove certain portions of that information only on a confidential basis to MPWMD's consultants. Poseidon Resources executed a Confidentiality Agreement with Bookman-Edmonston (B-E) and Separation Process Inc. (SPI). Subsequently, Poseidon Resources provided SPI and B-E a breakdown of total capital and O&M costs and other project information requested by MPWMD.

The capital cost breakdown for the desalination facilities generally follows the list above for the desalination plant. While the estimate is subject to the confidentiality agreement, Poseidon has indicated the Total Capital Cost figure can be disclosed. That figure is $132,000,000 (interestingly, in 2005 dollars vs. 2006 in the CDR). No basis for the values are provided which would indicate the level of estimate that this reflects (screening, conceptual, preliminary, etc.). Discussions with Poseidon on this point indicate the component values were derived from quotes received on other projects with substantially similar equipment, albeit different size. It is the reviewer's assessment that the component values are reasonable and generally in their expected ranges. However, it is not possible to assess if the contingency amount is appropriate without specific knowledge of the source of the component costs estimates. Based on the limited backup information that is available, it is the reviewer's opinion the contingency included in the capital estimate is low and an additional 10-15% is appropriate.

Operation and Maintenance Costs

The total O&M cost provided by Poseidon is $16,900,000/year. The breakdown of this value includes all items normally considered in O&M estimates of this type. Electrical consumption is consistent with current designs using high energy efficiency components and energy recovery devices. The unit cost of electricity is a reasonable value if anticipating negotiation of inside-the-fence power directly from the power producer is anticipated. The O&M costs contain a substantial value identified as Management and Operator Fees. These are in addition to labor cost (labor cost include Plant Manager and Administrative Assistant). Poseidon explained that the Management and Operator Fees include capital reserve, unforeseen risk, insurance, legal expenses, permit compliance, contingency for changes in law and profit for Poseidon and a contract operating company. This item would require further breakdown in order for the reviewer to assess the reasonableness of the value. All other line items in the O&M estimate are considered reasonable for the described treatment facilities.

Financing – Identification & Adequacy

According to Peter MacLaggan, Senior Vice President of Poseidon Resources Corporation, the development contractor for the PSMCSD Monterey Bay Regional Seawater Desalination project, PSMCSD has the right of first refusal to arrange for long term financing of the capital costs for the MBRSDP. However, the District does not have the obligation to provide financing of capital costs or any obligation for short-term funding of pre-construction costs necessary to implement the project. The Development and Long-Term Management Agreement executed between PSMCSD and Poseidon to implement the project further specifies that the District has the right to provide financing provided that such financing does not increase the price of water as set forth in the agreement (indicated to range from $1,100 to $1,200 per acre-foot in 2005 dollars). Mr. MacLaggan indicated that no decision has been made by PSMCSD to undertake financing of the proposed project. However, he indicated that if such financing is undertaken by the District, in all probability it would be municipal tax-exempt revenue bonds. B-E was told that to the extent PSMCSD elects not to provide financing for the project, Poseidon has the right to arrange private equity financing. This scenario is outlined in the Development and Management Agreement between the parties. It was Mr. MacLaggan's opinion that private equity financing could be arranged for a comparable net cost on the order of one half of one percent higher than municipal tax-exempt financing and, of course, would not be tax exempt. The current market for non-taxable municipal revenue bond rates is about 4.5% which would also be the estimated rate if the District undertakes financing for the project. If Posidon implements financing the comparable rate is expected to be on the order of 5%

Project development costs such as engineering, permitting, legal, environmental documents, obtaining regulatory permits and approvals and other related development costs will be initially incurred by Poseidon. Mr. MacLaggan indicated that internal corporate funds would be employed to meet these ongoing costs in order to implement the project. Such costs will

be capitalized as part of the project capital cost for eventual reimbursement to Poseidon. Poseidon is also responsible for financing and implementing a pilot project to demonstrate the feasibility of desalination at the site. PSMCSD submitted an application for a grant from the Department of Water Resources utilizing Proposition 50 funding to finance 50 percent of an estimated $3 million pilot plant project cost. The project is not recommended by DWR staff for grant funding, according to the June 12, 2006 Staff Funding Recommendation for the 2006 Proposition 50 funding cycle.

In view of Poseidon Corporation potentially becoming the lead entity responsible for project financing, a brief review was made of the background of Poseidon Resources, Inc. Poseidon was founded in 1995 for the goal of developing and financing water industry projects. According to the company, it is the largest private owner of water facilities in Mexico as well as a leading developer of water and wastewater public private partnerships in North America. The company is in the process of developing several high-profile desalination projects, including two in southern California at Carlsbad and Huntington Beach. A recent desalination project experience at Tampa Bay, Florida resulted in the project being taken over by the local water authority after plant operational failure and two contractor bankruptcies. Financing was problematic with the Tampa Bay project because of a legal challenge to the project from local homeowners, which resulted in only about half of the financing being secured for the project up front. The second contractor-related bankruptcy created an obstacle to obtaining required financing for the rest of the project.

Poseidon is a United States corporation whose largest shareholder is Warburg Pincus, an international investment firm. This partner-owned investment company has holdings in more than 120 companies located in North and South America, Asia and Europe. Projects in the water industry are only a small portion of the investment activities of Warburg Pincus. However, the company's only business focus is as private equity investing. With Warburg Pincus, it appears that Poseidon Resources has extensive private equity financing resources if obligated to obtain financing for the proposed MBRSDP in-lieu of the district not pursuing municipal bond financing.

Quality of Cost Estimate

The current status of the cost estimate appears to be at a screening level. Very little information provided in support of the project was site specific. Supporting information provided showed general arrangements and very conceptual site specific layouts. The lack of supporting documentation and discussions with project proponents has led us to believe that the construction cost data submitted relies on cost data from similar facilities recently bid.

Use of a larger contingency would be appropriate for the capital costs provided. The O&M cost estimate is for treatment process is considered reasonable.

The exception to the above is information provided for the pilot plant. Comprehensive material has been prepared and submitted for this facility.

5.3 Sand City Desalination Project

Capital Cost

Capital costs for the proposed facilities are provided in the Monterey Peninsula Water Supply Project Phase 2 Technical Memorandum, dated June 23, 2004. The anticipated project costs are summarized in Table 7.

Table 7 - SCDP 2004 Capital and O&M Costs

Description	Project Option			
	HDD Wells for Collection and Disposal	HDD Wells for Collection and Pipeline to Regional Outfall for Brine Disposal		
		Beach Range Road Alignment	Union Pacific ROW Alignment	General Jim Moore Blvd Alignment
Collection System (1)	$21,600,320	$21,600,320	$21,600,320	$21,600,320
Brine Disposal System (1)	$18,555,000	$18,656,500	$19,185,000	$27,127,000
Desalination Plant	$28,250,000	$28,250,000	$28,250,000	$28,250,000
Treated Water Pipelines (2)	$12,692,500	$12,692,500	$12,692,500	$12,692,500
Electrical Transmission Upgrades Allowance (3)	$1,000,000	$1,000,000	$1,000,000	$1,000,000
Subtotal Construction Cost	$82,097,820	$82,199,320	$82,727,820	$90,669,820
Field Office Overhead (8%)	6,567,826	6,575,946	6,618,226	7,253,586
Subtotal	$88,665,646	$88,775,266	$89,346,046	$97,923,406
Contractor Markups (Home Office OH, Insurance, Bond: 16.25%)	$14,408,167	$14,425,981	$14,518,732	$15,912,553
Subtotal	$103,073,813	$103,201,246	$103,864,772	$113,835,959
Contingency (25%)	$25,768,453	$25,800,312	$25,966,195	$28,458,990
Subtotal	$128,842,266	$129,001,558	$129,830,973	$142,294,949
Capital Cost Markups (Engineering, CM, Admin, Env, Legal: 30%)	38,652,680	38,700,467	38,949,292	42,688,485
Subtotal Capital Cost	$167,494,946	$167,702,025	$168,780,264	$184,983,433
Subtotal Capital Cost – Rounded	$164,500,000	$167,700,000	$168,800,000	$185,000,000
Land Acquisition				
Collection System Easements	$2,400,000	$2,400,000	$2,400,000	$2,400,000
Desalination Site (acquisition) (4)	$3,400,000	$3,400,000	$3,400,000	$3,400,000
Brine Disposal System Easements	$3,300,000	$700,000	$100,000	$200,000
	$9,100,000	$6,500,000	$5,900,000	$6,000,000
Hydrogeologic Feasibility Investigations/Test Well	$2,000,000	$2,000,000	$2,000,000	$2,000,000
Total Capital Cost	$178,600,000	$176,200,000	$176,700,000	$193,000,000
Annualized Capital Cost (7%, 30 years)	$14,100,000	$14,200,000	$2,000,000	$2,000,000
Operating and Maintenance Costs				
RO O&M Costs	$1,300,000	$1,300,000	$1,300,000	$1,300,000
RO Power Costs	$5,900,000	$5,900,000	$5,900,000	$5,900,000
Intake/Discharge Facilities Non-Power O&M (5)	$240,000	$240,000	$240,000	$240,000
Intake/Discharge Facilities Power Costs (6)	$1,300,000	$1,350,000	$1,350,000	$1,650,000
Total O&M Costs	$8,740,000	$8,790,000	$8,790,000	$9,090,000
Total Annual Costs	$23,140,000	$22,990,000	$22,990,000	$24,690,000
Project Unit Costs ($/AF)				
Annual Capital Recovery	$1,714	$1,690	$1,690	$1,857
Annual O&M Cost	$1,040	$1,046	$1,046	$1,082
Total Unit Cost	$2,755	$2,737	$2,737	$2,939

(1) Costs to Plant Site 1 or 2
(2) Costs for Alignment Option 2
(3) Allowance for PG&E Grid Improvement
(4) Costs for Site 1. Re-location of existing business not included.
(5) UPRR Alignment would also include annual lease fee which is not included
(6) Includes collection wells, brine disposal power, treated water pump station power

Cost basis: ENR CCI = 7,644 (San Francisco, December 2002).

The Desalination Plant cost component of $28,500,000 is a reasonable value for this capacity (no breakdown of this value was provided) and the 25% contingency is appropriate, considering the level of estimate provided.

Operation and Maintenance Costs

The O&M cost estimate includes power consumption, which is 50% higher than currently considered state-of-the-art. Electrical cost is indicated to be $0.125/kWh. While this value is valid for the gross energy cost there is no adjustment to reflect high efficiency design. This adjustment would reduce the annual RO power cost by $2M. While little itemization of O&M costs is provided, the balance of values appear reasonable for the project as described.

Financing –Identification & Adequacy

In view of the absence of a specific project currently being proposed, a financing plan for the SCDP by the MPWMD has not been developed. However, two prior water supply projects proposed by MPWMD provide examples of likely financing avenues to be taken if the Sand City Project is formalized.

In 1993, the District sponsored a 3-MGD Near-Term Desalination Project to provide a water supply to Zone No. 5. Estimated costs totaled $32 million (1994 dollars). The District proposed to implement the project by a private company contract to design, build and operate the facility. The District envisioned financing through issuance of certificates of participation to finance the capital costs, or relying on the contractor to provide financing with repayment based on a unit water cost (contract standby amount or actual water produced). Final selection of a financing alternative was to be made following a successful voter election. Connection fees and user fees were part of either financing alternative at the time; project related costs were based on financing at 8 percent for a 20-year term. Ultimately, voter approval was not successful.

The second major project proposed in 1995 involved a Los Padres Dam and Reservoir Project on the Carmel River for an estimated cost of $101.5 million. The District envisioned retaining a consultant to perform design and construction management, public building for construction, and project implementation through a prioritization contract with Cal-American. Project financing was proposed to be implemented through issuance of revenue bonds under the Revenue Bond Law of 1941. The sources of repayment were from user fees, connection charges and other non-identified revenue sources. Funding was dependent on voter approval. The District also indicated it intended to continue considering other funding

alternatives including certificates of participation and a public-private partnership with debt and equity participation (Cal-Am or other entity). The financial consultant evaluated rate impacts for a 20-year term for both the historical average interest rate (7.40 percent) and the then current rate of interest at 6.05 percent. As with the 1992 proposed project, voters did not approve this subsequent project.

The District is not required to obtain voter approval for all proposed water supply projects, according to MPWMD's General Counsel. For example, the issuance of certificates of participation in 1992 for $33.9 million to finance the cost of recycled water project facilities was done without the need for voter approval. Water supply projects undertaken for the common benefit of the District as a whole may not require voter approval.

Quality of Cost Estimate

The treatment plant capital cost estimate is not very detailed, but the values are considered reasonable for this size facility. O&M costs are considered to be higher than expected, due to a high electrical consumption assumption. An adjustment of this assumption could reduce the total cost of water by approximately $250/Ac-Ft. The costs presented for the SCDP do not include any costs for pilot studies of the treatment process.

6 Regional Water Supply Considerations

In this section, each of the three projects is qualitatively evaluated on its potential to:

- Provide regional solutions
- Expand to meet future needs
- Impede or preclude future projects
- Impact disadvantaged communities

6.1 Coastal Water Project

Currently, the CWP is progressing as the Basic CWP which will provide enough desalinated water to comply with SWRCB Order No. 95-10. A larger regional project providing an additional 8,542 acre-feet per year to meet planned growth on the Monterey Peninsula and to supply water to North Monterey County, Castroville and Marina has been studied. An option is under consideration to upsize the CWP conveyance pipelines between Moss Landing and the Monterey Peninsula to allow for future increased deliveries to the Monterey Peninsula.

The Coastal Water Project and the Monterey Bay Regional Seawater Desalination Project would each provide water to the Cal-Am customer base on the Monterey Peninsula, and for practical purposes are mutually exclusive.

If the CWP conveyance pipelines are not upsized as part of the initial project, it will be significantly more expensive to provide incremental capacity to meet future demands on the Peninsula.

There are no disadvantaged communities[22] in the project service area.

Table 8 - Summary of Project Size and Areas Served

Project Name	Coastal Water Project	Monterey Bay Regional Desalination Project	Sand City Desalination Project
Areas served	Cal-Am service territory on the Monterey Peninsula	Monterey Peninsula, North Monterey County, P/SM CSD service areas, portions of PVWMA[/2]	Cal-Am service territory on the Monterey Peninsula
Production Volume	10,430 Ac-Ft/ year[/1]	22,400 Ac-Ft/year[/3]	8,400 Ac-Ft/year
Production Rate	10 MGD	20 MGD	7.5 MGD
Provides 10,730 Ac-Ft per year Order No. 95-10 replacement supply	Yes	Yes	No

[1/] Expandable to 18,972 Ac-Ft/ year for a regional project and to serve build-out demand on the Monterey Peninsula
[2/] Pajaro Valley Water Management Agency
[3/] Demands totaling 20,930 Ac-Ft/ year have been identified

[22] The State of California defines a disadvantaged community as one where the median household income is less than 80 percent of the statewide average.

6.2 Monterey Bay Regional Seawater Desalination Project

The MBRSDP is envisioned as a regional project, supplying water to the Monterey Peninsula and a large portion of northern Monterey County. Water from the project would be delivered to customers within PSMCSD and recently acquired service territories (e.g., Moss Landing), but no other entity has contracted for a supply from the MBRSDP. Contemplated major distribution systems serving areas north, east, and south of the National Refractories treatment plant site could be added incrementally in the future.

The Monterey Bay Regional Seawater Desalination Project and the Coastal Water Project share the major customer base on the Monterey Peninsula, and for practical purposes are mutually exclusive. If water was wholesaled for resale by Cal-Am in its service territory impacts to Cal-Am might be minimal. The August 5, 2005 Development and Management Agreement between Poseidon Resources and PSMCSD contains the following provision: "The Parties acknowledge that it is the intention of the Parties to reach an agreement with the California-American Water Company, or its successor in interest, in order to facilitate the development of a single desalination facility in the Moss Landing area."

The larger contemplated projects could have beneficial water quality impacts to disadvantaged communities in northern Monterey County.

6.3 Sand City Desalination Project

The Sand City Desalination Project was sized to provide a replacement supply to meet current water production as limited by SWRCB Order No. 95-10 and is intended to serve only the Cal-Am service area. Because of the unique features of the well intakes, the project should be capable of expansion, provided additional planning of distribution and collection systems is performed and providing trunk mains are constructed with this expansion in mind.

Because the project would serve 40 to 70 percent of the supply contemplated for the MBRSDP and the CWP, removing this large portion of the customer base could make the other desalination projects uneconomic.

There are no disadvantaged communities in the project service area.

7 Implementability

- Schedule identified
- Permits identified, secured, and/or degree of difficulty
- Easements and agreements identified or secured
- Environmental impacts or environmental documentation

Permits Identified, Secured, and/or Degree of Difficulty

The permits and consultations[23] required for withdrawal of seawater are many. The list in Table 9 of this report is taken from the environmental documentation provided for this review by the proponents of the three projects discussed in this report.

The environmental document reviewed for the Coastal Water Project (CWP) is the Proponent's Environmental Assessment (PEA)[24] submitted by California American Water (Cal-Am) to the California Public Utilities Commission (PUC) as part of Cal-Am's application for a Certificate of Public Convenience and Necessity (CPCN) to build, own, and operate the CWP.

Documents reviewed for the Monterey Bay Regional Seawater Desalination Project (MBRSDP) state that the temporary pilot plant test facility is exempt from the requirements of the California Environmental Quality Act (CEQA). Pajaro/Sunny Mesa Community Services District (the project proponent) states that they will be the lead agency in evaluating CEQA compliance for the full-scale MBRSDP. P/SM anticipates that an Environmental Impact Report will be prepared for the project.

The environmental document reviewed for the Sand City Desalination Project is the Board Review Draft EIR for the MPWMD Water Supply Project, December 2003.

Although there were no specific list of requirements or regulations identified for this review nor is the specific status of the regulatory process documented at this time, the following table lists requirements, reviews, approvals and permits that may be required as projects progress.

[23] Consultation is used here in a general sense and not in a legal sense used to describe guidance and established national policy for conducting consultation and conferences pursuant to section 7 of the Endangered Species Act of 1973.
[24] The PEA is submitted pursuant to PUC regulations described in Section 2.3.1 (CPUC CEQA Compliance).

Current permitting activities center around the PUC for the CWP and permitting for the pilot study for the CWP and MBRSDP. The MBRSDP needs only Coastal Commission approval while the CWP needs to obtain Monterey County and Coastal Commission approval.

Table 9– Regulatory Requirements

		Project		
Regulatory Requirement	**Agency**	**Coastal Water Project**	**Monterey Bay Regional Seawater Desalination Project**	**Sand City Desalination Project**
Certificate of Public Convenience and Necessity	California Public Utilities Commission	Yes	No	No
California Environmental Quality Act (CEQA)	State of California	Applies to all discretionary activities proposed, implemented, or approved by California public agencies		
SWRCB Order WR 95-10[25]	State Water Resources Control Board	Yes	Yes	Yes
Well Permit	Monterey County Environmental Health Department	NA (unless drilling required)	NA (unless drilling required)	soil boring/monitoring well permits
Master Plan	City of Sand City	Yes	Yes	Yes
Master Plan	City of Seaside	Yes	Yes	Yes
Master Plan	California Department of Parks and Recreation	Yes	Yes	Yes
Underground Services Alert (USA)		NA (unless drilling required)	NA (unless drilling required)	Notification required 3 working days prior to drilling.
Monterey Bay National Marine Sanctuary Management Plan	The National Oceanic and Atmospheric Administration (NOAA)	The Monterey Bay National Marine Sanctuary (MBNMS) provides sanctuary approval on RWQCB and other agency permits. Before construction of the proposed project, a Request for National Marine Sanctuary Authorization from MBNMS must be obtained for activities within the sanctuary.		
Central Coast Regional Water Quality Control Board Basin Plan	Central Coast Regional Water Quality Control Board	Yes	Yes	Yes

[25] Must comply but no permit or approval needed.

		Project		
Regulatory Requirement	**Agency**	**Coastal Water Project**	**Monterey Bay Regional Seawater Desalination Project**	**Sand City Desalination Project**
Carmel Valley Master Plan	Monterey County	No	No	No
Monterey County General Plan	Monterey County	Yes	Yes	Yes
North County Coastal LCP Land Use Plan	Monterey County	Yes	Yes	No
Castroville Community Plan	City of Castroville	Yes	Yes	No
Greater Monterey Peninsula Area Plan	Monterey County	Yes	Yes	Yes
City of Marina General Plan and LCP	City of Marina	Yes	Yes	No
Fort Ord Reuse Plan (FORP)	Fort Ord Reuse Authority	Yes	Yes	No
City of Seaside General Plan	City of Seaside	Yes	Yes	Yes
City of Del Rey Oaks General Plan	City of Del Rey Oaks	Yes	Yes	Yes
City of Monterey General Plan	City of Monterey	Yes	Yes	Yes
Distribution expansion permits	Monterey Peninsula Water Management District	Yes	Yes	Yes
Encroachment and construction permits	Monterey County and Cities of Monterey, Del Rey Oaks, Seaside, Sand City, Carmel-by-the-Sea, Pacific Grove	Yes	Yes	Yes

		Project		
Regulatory Requirement	**Agency**	**Coastal Water Project**	**Monterey Bay Regional Seawater Desalination Project**	**Sand City Desalination Project**
Coastal Development Permit	California Coastal Commission (CCC)	CCC is one of California's two designated coastal management agencies for the purpose of administering the federal Coastal Zone Management Act (CZMA) in California. The most significant provisions of the federal CZMA give state coastal management agencies regulatory control (federal consistency review authority by USACE) over all federal activities and federally licensed, permitted or assisted activities, wherever they may occur (i.e., landward or seaward of the respective coastal zone boundaries fixed under state law) if the activity affects coastal resources.		
Section 1600 Streambed Alteration Permit and Incidental Take permits	California Department of Fish and Game (CDFG)	Yes	Yes	Yes
National Pollutant Discharge Elimination System (NPDES) and Permit/401 Certification [26]	Regional Water Quality Control Board (RWQCB).	Yes	Yes	Yes[27]
Clean Water Act (CWA)Section 10 and 404 Permits U.S.	Army Corps of Engineers (USACE)	Yes	Yes	Yes
Endangered Species Act (ESA) Section 7 Consultation[28]	U.S. Fish & Wildlife Service (USFWS) and National Oceanographic and Atmospheric Administration (NOAA) Fisheries	Yes	Yes	Yes

[26] Section 316(b) of the Federal Clean Water Act requires the Environmental Protection Agency to ensure that the location, design, construction, and capacity of cooling water intake structures reflect the best technology available to protect aquatic organisms from being killed or injured by impingement (being pinned against screens or other parts of a cooling water intake structure) or entrainment (being drawn into cooling water systems and subjected to thermal, physical, or chemical stress).

[27] Although the HDD seawater withdrawal system may not require a NPDES permit, this will have to be determined.

[28] Review of and comments on USACE and USFWS permits by the U.S. Coast Guard and NOAA Fisheries review of activities and discharges into waters and wetlands of the Monterey Bay National Marine Sanctuary (MBNMS)

		Project		
Regulatory Requirement	**Agency**	**Coastal Water Project**	**Monterey Bay Regional Seawater Desalination Project**	**Sand City Desalination Project**
Fish and Wildlife Coordination Act	US Fish and Wildlife Service	Requires federal agencies to provide equal consideration to fish and wildlife resources in the planning of and proposals for water resource development projects		
Section 2080 of the Fish and Game Code	California Department of Fish and Game	Prohibits "take" of any state-listed species that the State Fish and Game Commission determines to be endangered or threatened		
California Endangered Species Act (CESA)	State of California	Allows for "take" incidental to otherwise lawful development projects		
Section 10 of the Rivers and Harbors Act of 1899	US Army Corps of Engineers	Permits to authorize certain structures or work in or affecting navigable waters of the United States		
Regional Water Quality Control Board (RWQCB)	State of California Central Coast RWQCB	Develops and enforces water quality objectives and implementation plans, which will best protect the beneficial uses of the state's waters, recognizing local differences in climate, topography, geology and hydrology. This mission is accomplished through the provisions of the National Pollutant Discharge Elimination System (NPDES) program. Section 316(b) of the Federal Clean Water Act		
Local Coastal Plans	Local Agencies	identify the location, type, densities and other ground rules for future development in the coastal zone		

U.S. Environmental Protection Agency Power Plant Regulation (Phase II Section 316(b))

In July 2004, the U.S. Environmental Protection Agency (EPA) published a final rule to implement Section 316(b) of the Clean Water Act[29] for certain existing power producing facilities that have a cooling water intake structure and are designed to withdraw 50 million gallons per day or more of water from rivers, streams, lakes, reservoirs, estuaries, oceans, or other waters of the United States for cooling purposes. The rule constitutes Phase II of EPA's section 316(b) regulation development and establishes national requirements, and procedures for implementing those requirements, applicable to the location, design, construction, and capacity of cooling water intake structures at these facilities. The rule applies to existing facilities that, as their primary activity, both generate and transmit electric

[29] This discussion uses or closely paraphrases text from Federal Register / Vol. 69, No. 131 / Friday, July 9, 2004 / Rules and Regulations.

power or generate electric power but sell it to another entity for transmission. The national requirements, which will be implemented through National Pollutant Discharge Elimination System (NPDES) permits, are based on the best technology available to minimize the adverse environmental impact associated with the use of cooling water intake structures. EPA's July 2004, final rule establishes performance standards that are projected to reduce impingement mortality by 80 to 95 percent and, if applicable, entrainment by 60 to 90 percent. With the implementation of the July 2004 rule, EPA intends to minimize the adverse environmental impact of cooling water intake structures by reducing the number of aquatic organisms lost as a result of water withdrawals associated with these structures.

The rule's impact to the Moss Landing Power Plant (MLPP) is that they are required to develop a compliance demonstration study which consists of a series of reports to evaluate how past and/or proposed actions will meet with the 316(b) rule requirements. The State of California Regional Water Quality Control Board will review and comment on the study. MLPP has completed some mitigation but the adequacy of previous actions to meet new requirements is not known at this time.

The assumption in this report is that the MLPP has or will meet all the new requirements of EPA's Phase II rules. It is also assumed that the new use occurring with the withdrawal of water from the MLPP discharge for the Coastal Water Project and/or the Monterey Bay Regional Seawater Desalination Project will not constitute a new use or change the MLPP's requirements for withdrawal for cooling related to power generation. Potential changes resulting from Phase II rules or any other new regulations are speculative and not included here. However, the potential application to the Moss Landing Power Plant adds a measure of risk to co-located projects. Assessment of potential impacts related to entrainment or impingement are only assessed related to extant regulations and requirements for operation of the MLPP.

Resolution of the California State Lands Commission[30]

On April 17, 2006 the California State Lands Commission (Commission) adopted of a resolution which expresses its intent not to approve any leases for new power plants using once-through cooling (OTC) systems and imposing certain conditions on lease renewals and extensions for existing facilities. The Commission resolved that intake of large volumes of water for OTC has impacts on coastal organisms by entrainment and impingement. The Commission defined impingement by the occurrence of marine organisms trapped against components of the cooling water system, such as screens, where they die. Entrainment was defined as the induction of smaller marine organisms into and through the cooling water system where most, if not all, of the organisms are destroyed by mechanical damage,

temperature increases or toxic stress. In addition, the Commission resolved that OTC results in biological impacts through thermal discharge. They defined thermal discharge as the release of cooling water at temperatures above ambient conditions resulting in elevation of the temperature of marine waters in the immediate vicinity of the outfall. The Commission found that these effects adversely impact coastal and ocean resources and uses that are within its jurisdiction.

The Commission urged the California Energy Commission and the State Water Resources Control Board to expeditiously develop and implement policies that eliminate the impacts of once-through cooling on the environment, from all new and existing power plants in California.

The Commission stated it shall not approve leases for new power facilities that include once-through cooling technologies.

The Commission stated that it will not approve new leases for power facilities, or leases for re-powering existing facilities, or extensions or amendments of existing leases for existing power facilities, whose operations include once-through cooling, unless the power plant is in full compliance, or engaged in an agency-directed process to achieve full compliance, with requirements imposed to implement both Clean Water Act Section 316(b) and California water quality law as determined by the appropriate agency, and with any additional requirements imposed by state and federal agencies for the purpose of minimizing the impacts of cooling systems on the environment.

The Commission stated that it will include in any extended lease that includes once-through cooling systems, a provision for noticing the intent of the Commission to consider re-opening the lease if the appropriate agency has decided in a permitting proceeding for the leased facility that an alternative, environmentally superior technology exists that can be feasibly installed or if state or federal law or regulations otherwise require modification of the existing once-through cooling system.

The Commission's resolution "calls on public grantees of public trust lands to implement the same policy for facilities within their jurisdiction."

The Commission's Executive Officer stated copies of this resolution would be transmitted to the Chairs of the State Water Resources Control Board, the California Energy Commission, and the California Ocean Protection Council, all grantees, and all current lessees of public trust lands that utilize once-through cooling.

[30]The information about the California State Lands Commission's resolution is reported at the Commission's "meeting and voting records" for April 17, 2006 on http://www.slc.ca.gov/.

There is a belief that since MLPP leases its intake site from the Moss Landing Harbor District it would not affected by the resolution. Whether this is true or not is beyond the scope of this study. However, the impact from this resolution to the MLPP is considered generally the same as those from the Federal rule for the foreseeable future.

This resolution of the California State Lands Commission, if implemented for all cooling water intakes in California, could adversely impact the feasibility of the Coastal Water Project and the Monterey Bay Regional Seawater Desalination Project. While neither project directly uses once through cooling the MLPP relies on once through cooling. The CWP is proposed to draw feed water from the MLPP cooling water discharge and then return the brine via the cooling water outfall.

Environmental Impacts or Environmental Documentation

Both the CWP and the SCDP have prepared environmental documents in the form of the Proponent's Environmental Assessment and a Board Review Draft Environmental Impact Report, respectively. The MBRSDP has not prepared any environmental documents but they indicate that they are in the process of hiring an environmental consultant.

Of significant concern of any of the projects are impingement and entrainment impacts from the conveyance method for seawater source water. The main causes of injury and loss of fish and any other animals or plants at water intakes are entrainment and impingement. The extent of any potential impacts is related to the plant and animal species present at the intake. Some animals are large enough to not be influenced by the flows at the intake will be adversely impacted. The life stage and size of the organisms relates to potential impacts; weakly swimming or immature fish are more likely to be entrained.

The location, design, and operation of the intake structure affects the level of potential impacts at a water intake. Intakes that are located away from plant and animal habitat can decrease or eliminate entrainment and impingement. Intakes that are subsurface (e.g., Ranney wells) will not impinge or entrain animals in the water column. Intakes that are angled so that natural currents sweep by the intake can develop sweeping velocities that prevent or greatly reduce that possibility of fish or other animals from being impinged or entrained.

Monterey Bay Aquatic Environment

The aquatic environment near the proposed projects described in this implementability study is associated with the Monterey Bay National Marine Sanctuary, the Elkhorn Slough and Moss Landing Harbor, the biological habitats, and threatened and endangered species. The projects are located at or near the intersection of three marine geographical areas: Elkhorn Slough, Moss Landing Harbor and Monterey Bay. These areas include open water,

submerged aquatic vegetation, flats, marshes, intertidal zones, and beaches. An assessment[28] of these environs concluded that eight fish larval species made up 95 percent of the larvae entrained during the 12 months of site surveys[28]. Three of the eight species (approximately 5 percent of the larvae) have commercial or recreational value. They were the Pacific herring *Clupea harengus*, white croaker *Genyonemus lineatus*, and Pacific staghorn sculpin *Leptocottus armatus*. Pacific herring in California have been harvested primarily for their roe, with small amounts of whole herring marketed for human consumption, aquarium food, and bait. The white croaker, although not a highly prized species, has been an important constituent of commercial and sport fisheries in California; most of the commercial catch is sold in the fresh fish market with a small amount used for live bait. The Pacific staghorn sculpin is also not highly prized as a food or sport fish, but is a popular bait fish for the San Francisco Bay Delta striped bass sport fishery.[31]

Easements and Agreements Identified and Secured

The PSMCSD has executed an agreement with the owner of the National Refractories site. That agreement is the only agreement or easement for use of land that has been executed for any of the projects.

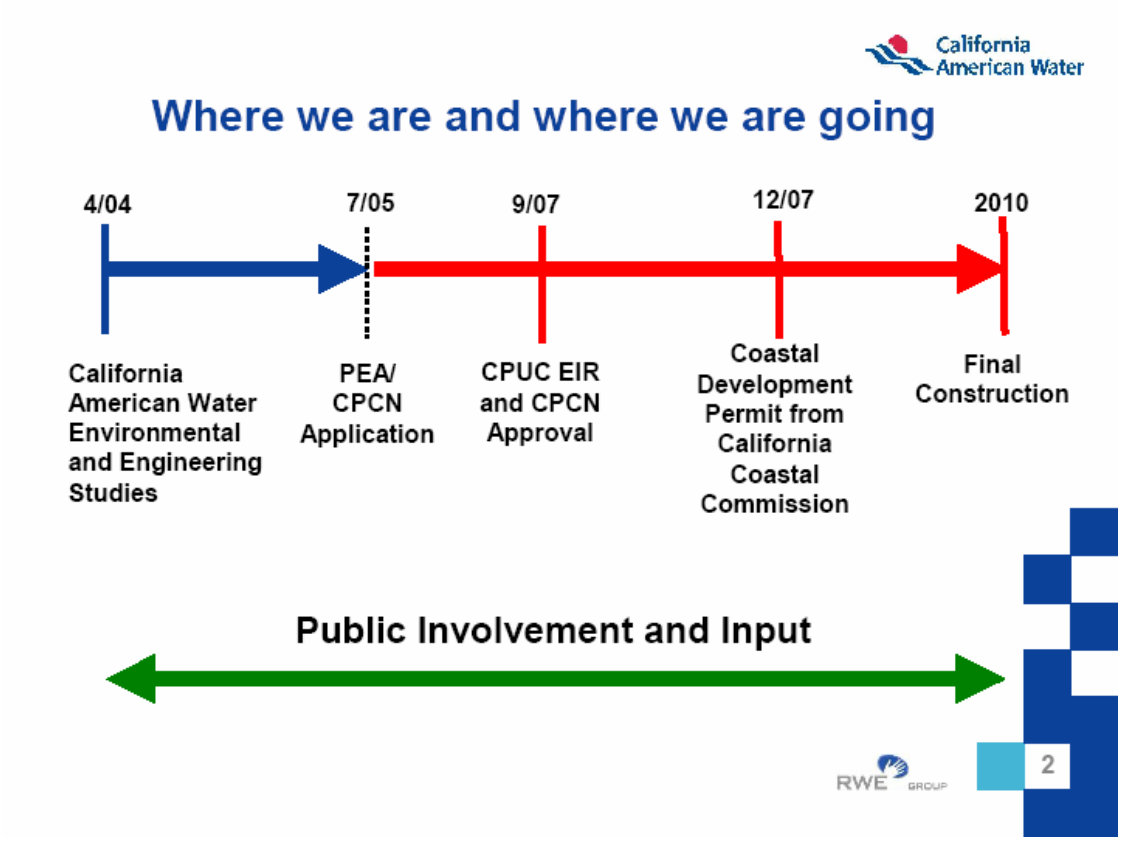
7.1 Coastal Water Project

Schedule Identified

Figure 6 presents the project schedule provided by the project proponents. The proponents also indicated that they are in the process of preparing an updated detailed schedule addressing the current status of the PUC hearings and activities and the permitting for the pilot plant.

[31] This information is from a 2001 California Department of Fish and Game report cited on page 5.7-10 of the Proponent's Environmental Assessment for the Coastal Water Project, PUC Proceeding A.04-09-019

Figure 6 - Coastal Water Project Schedule



Environmental Impacts or Environmental Documentation

The proposed Coastal Water Project (CWP) desalination plant would receive raw seawater from the Moss Landing Power Plant (MLPP) cooling water return system. The MLPP is currently permitted for up to 1.226 billion gallons per day of seawater intake. Units 1 and 2 of MLPP currently utilize a seawater intake within the northern portion of Moss Landing Harbor. The MLPP utilizes modified traveling screens at its intakes. This intake screening system includes vertical screen panels mounted on a continuous belt. The screen mechanism consists of 3/8-inch (0.9 cm) mesh, a drive mechanism, and a spray cleaning system. A key feature of the CWP is that the source water would come through the Units 1 and 2, which has been recently modernized and operates at a more consistent and higher volume. Seawater is collected at the disengaging basin after it has been pumped through Units 1 and 2. A weir within the disengaging basin controls the water depth and cooling water outflow to the discharge pipelines. Source water for the desalination plant would be diverted from the

disengaging basin (which receives water only from Units 1 and 2) prior to discharge into the ocean.[32]

The most recent 316(b) resource assessment of proposed modernization plans for the Moss Landing Power Plant (MLPP) concluded that the long-term impact of impingement and entrainment on the populations of marine and estuarine fish, fish larvae, and cancer crab larvae would be relatively minor.[33]

Duke Energy modified the intake system to reduce entrainment and impingement. In addition to the intake modifications, the Regional Water Quality Control Board, the California Energy Commission, and Duke Energy developed a habitat enhancement program called the Elkhorn Slough Enhancement Program. This program is designed to minimize the adverse environmental effects of the intake system on the Elkhorn Slough watershed resources and allow Duke Energy to comply with the Section 316(b) of the CWA. The objectives of the Elkhorn Slough Enhancement Program are to implement a conservation acquisition program for Elkhorn Slough and restore wetlands.

The CWP desalination facility would not alter the operations of the MLPP. The volume and velocity of water entering the MLPP intakes would remain unchanged. The proposed desalination facility would not have a separate direct ocean water intake and would use only cooling water that is already screened by the MLPP. Although the desalination facility would have its own screening system (three-millimeter screens), the system would convey any screened organisms back to the MLPP outfall. Thus, there would be no impacts due to impingement as a result of Desalination Facility implementation.

A nominal amount of additional entrainment mortality may occur as a result of Proposed Project operation. The majority of organisms entrained by the MLPP are killed or severely distressed by the cooling water process.[34] Additionally, any organisms that survive the once-through cooling water process and enter the desalination facility would be killed.

However, the amount of water diverted for the Proposed Project will represent approximately 1.8 percent of the MLPP's permitted maximum flow of 1.226 billion gallons per day, which is already permitted under the assumption of 100-percent mortality. Due to the relatively

[32] This description is taken from the CWP Conceptual Design Report (Draft) prepared for California American Water, September 2005

[33] This conclusion is taken from the Proponent's Environmental Assessment for the Coastal Water Project, PUC Proceeding A.04-09-019 page 5.7-9

[34] One hundred percent mortality is generally assumed for entrained organisms according to National Pollutant Discharge Elimination System – Final Regulations to Establish Requirements for Cooling Water Intake Structures at Phase II Existing Facilities, U.S. Environmental Protection Agency, July 9, 2004.

small amount of water that would be diverted to the proposed Desalination Facility, impacts from additional entrainment mortality are not anticipated to be significant. In addition, the operation of the MLPP's existing modified intake system (required as part of the 316[b] compliance process) will further minimize entrainment impacts.

Conclusion

The proposed seawater intake for the project is from the cooling water at the Moss Landing Power Plant. The Proposed Project's Desalination Facility would not alter the operations of the MLPP. The operation of the CWP would not alter the potential impacts associated with operations of the MLPP. Thus, as long as the MLPP is permitted to operate the CWP should be able to operate and the proposed levels without adversely impacting the aquatic resources of the associated marine environments.

The PEA includes a summary of environmental impacts and mitigation measures for the proposed project. Many of these environmental impacts are deemed to be significant and would have considerable accompanying mitigation measures.

7.2 Monterey Bay Regional Seawater Desalination Project

Schedule

Table 10 presents the general project implementation schedule that is included in the Monterey Bay Regional Desalination Project Conceptual Design Report.

Table 10 - MBRSDP Schedule

Key Project Implementation Task	Target Completion Date
Environmental Review and Permitting	June 2008
Water Supply Arrangements	January 2007
Design	June 2008
Construction Completion	June 2010
Commercial Operation	July 2010

On March 22, 2006, the Monterey County Director of Planning and Building Inspection approved Coastal Administrative Permit (Resolution #050541) for construction and operation of the MBRSDP Pilot Plant. On April 3, 2006, the Coastal Commission received the County's Notice of Final Action and associated records to start the Coastal Commission's 10-working-day appeal period, appeals were filed during the period. The appellants contend that the project does not conform to the County's Local Coastal Plan.

The Coastal Commission has scheduled a June 15, 2006 hearing on the appeals. The Coastal Commission staff has recommended that the Commission, after public hearing, determine that substantial issues exist with respect to the grounds on which the appeals have been filed. The appellants have raised substantial issues in that project approval and conditioning by the County through issuance of a Coastal Administrative Permit does not conform to the applicable LCP policies.[34a]

Environmental Impacts or Environmental Documentation

The proposed water intake for the Monterey Bay Regional Seawater Desalination Project (MBRSDP) is from two sources 1) direct pumping from the Moss Landing Harbor via the existing National Refractories intake and /or 2) the heated power plant cooling water from the Moss Landing Power Plant. The Moss Landing Power Plant cooling water is the preferred source of water for the desalination plant because of its higher water temperature. The MBRSDP is expected to rely on water from the National Refractories intake when the Moss Landing Power Plant is not operating.

The proposed MBRSDP is described in two stages. The first is a pilot plant test desalination facility. This facility is stated to be exempt from the requirements of the California Environmental Quality Act.[35]

PSMCSD will be the lead agency for evaluating compliance of the proposed full-scale MBRSDP with the requirements of the California Environmental Quality Act (CEQA). The Pajaro-Sunny Mesa Community Services District states in their report of waste discharge, application for renewal, Monterey Bay Regional Desalination Project (NPDES Permit CA0007005)(November 1, 2005) that the evaluation will comply with CEQA requirements. Their report states that an Environmental Impact Report will be prepared.

National Refractories - One of the proposed water intakes for the MBRSDP is the existing National Refractories seawater intake system. For the full-scale MBRSDP facility the heated cooling water from the Moss Landing Power Plant represents a preferred source as reverse osmosis treatment is more efficient when using warm water.[36] There was no detailed description of the National Refractories seawater intake system available for this report and the operational assumptions are uncertain. We were provided with an underwater video

[34a] California Coastal Commission, Staff Report and Recommendation on Appeal Substantial Issue, May 25, 2006
[35] Monterey Bay Regional Desalination Project, Report of Waste Discharge Application for Renewal, NPDES Permit CA0007005, National Refractories Ocean Outfall, November 1, 2005
[36] ibid

survey of the exterior of the National Refractories outfall and diffuser.[37] It appears that the outfall has been damaged by earthquake activities and its condition and repairs are uncertain.

The assumption in this report is that the National Refractories intake operated for the MBRSDP has met or will meet all the new requirements for withdrawal of seawater. It is also assumed that the new use occurring with the withdrawal of water for the MBRSDP will not constitute a new use or change the National Refractories intake's requirements for withdrawal. Potential changes resulting from new rules or any other new regulations are speculative and not included here. Assessment of potential impacts related to entrainment or impingement are only assessed related extant regulations and requirements for operation of the National Refractories intake.

Moss Landing Power Plant - The MLPP is located on the east shore of Moss Landing Harbor. Moss Landing Harbor is on the California coast between Santa Cruz and Monterey, California. The MLPP has two separate water intake structures. The older intake that provided water for Units 1 through 5 of the MLPP is currently unused. The intake for Units 6 and 7 is currently used and is the proposed intake for water for the Monterey Bay Regional Seawater Desalination Project. The intakes are screened with 3/8 inch (0.9 cm) mesh. Water that is pumped into the MLPP and used to cool the thermal units will then be used by the MBRSDP.

The potential impacts of water intake operations have been summarized in the "Moss Landing Power Plant Modernization Project 316(a) Resource Assessment".[38] The results of the field studies indicated that no evidence was found to indicate that cooling water system operations will result an adverse impact on the populations of fish and invertebrates inhabiting Moss Landing Harbor, Elkhorn Slough and Monterey Bay. Most of the organisms entrained and impinged are species that distributed widely by both ocean currents in Monterey Bay and along the Pacific coast. The risk of localized population effects is reduced by the broad extent and movement of these species. The larvae of species that are entrained have very high mortality rates and the percentage of these larvae is small. The report concludes that existing and proposed modernization operations impacts have been and will continue to be undetectable.

Conclusion

The proposed water intake for the MBRSDP is from two sources: 1) direct pumping from the Moss Landing Harbor via the existing National Refractories intake, and /or 2) the heated power plant cooling water from the Moss Landing Power Plant. The availability and

[37] The date of the video is February 2001, provided by Moss Landing Marine Laboratories staff April 2006
[38] The conclusions reported here are from text beginning on page 7-36 of this April 28, 2000 Duke Energy report.

potential impacts of operating the National Refractories outfall are uncertain because of damage to the outfall. The results of the field studies at the Moss Landing Power Plant indicate that cooling water system operations will not result in any adverse impacts on the populations of fish and invertebrates inhabiting Moss Landing Harbor, Elkhorn Slough and Monterey Bay.

7.3 Sand City Desalination Project

Schedule

This project currently has no activity and there are no scheduled activities.

Environmental Impacts or Environmental Documentation

The Board Review Draft EIR for the MPWMD Water Supply Project (December 2003) provides a significant amount of information on the project and its impacts. The Sand City Desalination Project is described in the Board Review Draft EIR and in the report titled "Sand City Desalination Project Feasibility Study" (April 16, 2004). The project is sized at 8,400 Ac-Ft per year (7.5 MGD) of treated water to comply with State Water Resources Control Board Order WR 95-10 under current community water demand. To meet this objective, the project would include either an array of horizontal directionally-drilled (HDD) or radial collector wells for seawater collection (feedwater source) located along the coastal beachfront of Sand City, and a brine disposal system using either HDD wells along the coast in former Ford Ord or a pipeline to the Monterey Regional Water Pollution Control Agency's wastewater treatment plant facility north of Marina (regional outfall).

Figures showing the proposed seawater collection system layouts for HDD wells and radial collector wells are included in the feasibility study. For a project using HDD collector wells, the collector wells would consist of relatively shallow angle (typically, 15 degrees from horizontal) blank well casing extending from the surface entry point, beneath the sand dunes and 200 feet (~70m) west of the mean tide line. West of this point, (i.e. seaward of the shoreline) the wells would consist of near-horizontal perforated screen, at a minimum depth below the sea floor of 15 to 30 feet (~5 to 10 m) in the offshore portion of the aquifer referred to as Older Dune Sand Aquifer or coastal aquifer or in permeable offshore marine sediments.

Because the intake for the seawater is below the sea floor, it is assumed that there are no potential impacts from impingement or entrainment resulting from seawater withdrawal.

Conclusion

The Sand City Desalination Project would include either an array of horizontal directionally-drilled (HDD) or radial collector wells for seawater collection (feedwater source) located along the coastal beachfront of Sand City. Because the intake for the seawater is below the sea floor, it is assumed that there are no potential impacts from impingement or entrainment resulting from seawater withdrawal.

For brine discharge, the project would utilize either HDD wells along the coastal portion of former Fort Ord north of Sand City, or the outfall from the regional wastewater treatment facility north of the Marina. The Board Review Draft EIR stated that the HDD wells option would have less than significant environmental impacts on Monterey Bay aquatic resources. Discharge to the outfall would be subject to the regional facility's NPDES permit.

The Board Review Draft EIR includes a summary of environmental impacts and mitigation measures for the proposed project. Many of these environmental impacts are deemed to be significant and would have considerable accompanying mitigation measures.

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