

- **Board of Directors**
Water Planning, Quality and Resources Committee

July 11, 2006 Board Meeting

9-2

Subject

Report on the Initial Screening of the Mobile Marine Desalination Proposal

Description

Staff has completed an initial screening of the unsolicited Mobile Marine Desalination proposal described in [Attachment 1](#) and recommends that Metropolitan perform no further review at this time. This is the first proposal received involving the concept of an offshore seawater desalination project to be funded by Metropolitan. Although staff found the proposal to be technically feasible, Metropolitan has already committed to its Seawater Desalination Program, which includes five member agency proposed projects that would meet the current Integrated Water Resources Plan target. Further, staff sees potential risks and financial and operational hurdles to offshore desalination. Therefore, further pursuit of the proposed project is not recommended at this time. However, staff will monitor this and other desalination concepts to favorably position Metropolitan for future seawater desalination opportunities.

Metropolitan's role as Regional Facilitator for seawater desalination, adopted in December 2005, includes a process for reviewing unsolicited, third party proposals. The steps include an initial screening, notification to the Board, and a technical evaluation, if directed by the Board of Directors. The purpose of the initial screening is to assess completeness of the proposal and applicability to Metropolitan's needs. During initial screening of the Mobile Marine Desalination proposal, staff contacted twelve agencies to assess permitting and other regulatory requirements, discussed the project with member agencies to gauge their interest, and met with the project proponents to clarify aspects of the proposal. Staff concluded that the proposal contained no fatal flaws for potential regulatory approval. In addition, staff preliminarily judged the project to be technically feasible because the project relies heavily on standard desalination technology; standard energy generation process; a mooring buoy turret system employed in other industries; standard ship maintenance practices; and standard practices for seafloor piping. Further, the proposal does not appear to present an advantage for easier permitting and may actually require more permits than a land-based project.

In discussing the project with the member agencies, none expressed an interest in embracing the proposal as an additional alternative local project. While implementation as a local project was not the intent of the proponent, the discussions helped staff better understand some of the implementation challenges. Potential issues, operational limitations, and other considerations ([Attachment 2](#)) leading to staff's recommendation include:

1. Proposed additional capacity (29,000 to 90,000 AFY) exceeds current IRP target needs,
2. Increased regulatory hurdles, due to the proposed energy generation,
3. Metropolitan's inexperience in developing and operating facilities off the coast,
4. Limited value of the proposal as a transferable emergency supply,
5. System integration costs, not considered in the proposal, and
6. High estimated costs.

Staff also considered Metropolitan's commitment to its Seawater Desalination Program, which is moving toward the IRP target of 150,000 acre-feet per year of seawater desalination by 2025. The program is founded upon the principle of managed risk, with Metropolitan's financial commitment capped at \$250 per acre-foot. This approach supports agencies choosing to develop this new supply. Changes to the IRP goal or how it is met could be addressed in the future, after allowing the member agencies sufficient time to advance their projects. Review of unsolicited proposals, such as this one, combined with knowledge gained from the performance of the member

agency projects strengthens Metropolitan’s ability to consider the best approach to use desalinated seawater in the future to meet regional needs.

Finally, staff considered the financial and legal uncertainty associated with the consortium's proposed sole-source design-build-finance-operate-maintain procurement process. This approach would require a large financial investment for preliminary planning without guarantee of regulatory permitting approval. In addition, legislation may be required to allow this type of procurement process prior to Metropolitan's participation. The proposal’s configuration appears suitable for competitive bidding.

Considering the information contained in the proposal, input from regulatory agencies, and discussions with the member agencies, staff has concluded that further review of the proposal is unwarranted at this time. However, it is recommended that staff monitor development in this field to be prepared if one or more of the current member agency proposals should fail to proceed and/or should the Board reconsider Metropolitan's approach to desalination projects. We believe this conclusion fulfills the Board’s expectations in its December 2005 adoption of the Regional Facilitator role.

Under Metropolitan’s existing program, the member agencies have started or will soon start pilot treatment plants. Removing certain constituents such as bromide, integrating the product water into distribution system without causing corrosion problems, configuring efficient power resources and developing environmentally acceptable intake and brine discharge systems appear to be common challenges. Metropolitan is working closely with the member agencies to understand these factors and to develop a regional research and development plan that would support meeting our regional supply reliability interests. Review of this unsolicited proposal has given staff valuable insight into some ways that project proponents are also trying to address these issues.

Policy

By Minute Item 46491, dated Dec. 13, 2005, Board adoption of Metropolitan facilitator role to address seawater desalination projects

Fiscal Impact

None


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6/23/2006
Date


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6/26/2006
Date

Attachment 1 – Proposal Description

Attachment 2 – Major Potential Risks, Operational Limitations, and Other Considerations

Proposal Description

Background

The Mobile Marine Desalination proposal submitted by Water Standard Company, LLC, Pall Corporation, and PBS&J Inc. consists of a seawater desalination plant built on board a marine vessel, a turret/buoy element to maintain the vessel permanently moored at an unspecified location about three miles offshore, and seabed pipeline to convey water to shore and connect to an existing water system. Needed onshore facilities are not part of the proposal. Power, as presented in the proposal, would be generated on board of the vessel using marine diesel fuel. In a phone interview, the proponents indicated that they had changed the proposed fuel for power generation to biodiesel. They also indicated that the three-mile proposed location was an average of the potential offshore distance from shore from two member agency areas, Orange and Ventura counties. The proposal described the project at the conceptual level:

- Water production on a mobile marine vessel
- Delivery of finished water from ship to shore
- Environmental documentation and project permitting requirements

Ships would be retrofitted to meet project yield and be no older than five years at the time of acquisition. One ship would be equipped to produce between 29,000 and 90,000 acre-feet per year. The ship would be sized according to yield. For a 90,000 acre-feet per year yield, an approximately four-foot diameter pipeline would connect to shore. A ship would require a crew of 20 people. Fuel to run the generators would be delivered through regular ship-to-ship transfers in the open ocean at the mooring site.

Proposal Agreement Structure

Financing of the proposed project is predicated on full disclosure of costs to Metropolitan and includes three procurement options:

- Design, build, finance, operate, maintain (DBFOM)
- Equity Ownership (Metropolitan and/or Partner)
- Traditional project financing

Design, Build, Finance, Operate, Maintain

Metropolitan would keep ownership of the project and transfer the design, construction, and operation of the project to a private sector partner under a single sole-source contract. Financing would be provided by the partner. Typically, sole-source agreements do not fit within Metropolitan's established processes, which call for competitive bidding for projects. Metropolitan is precluded from undertaking this option because the design-build authority in California is given by statute, and Metropolitan has not been given this statutory authority.

Equity Ownership

Metropolitan would share ownership of the project by entering into a long-term lease with equity partner. Metropolitan would contract out services with the partner and share the operational risk.

Traditional Project Financing

As the project owner, Metropolitan would procure the proposed project in the traditional design-bid approach applied to capital improvement projects. Metropolitan would bear all risks associated with the project.

Costs

The proponent provided rough cost estimates for only the DBFOM option, which includes sole-source procurement, and biodiesel-generated power at \$0.0474 per kilowatt-hour. Because this power cost seemed low, staff contacted a California provider of diesel that quoted \$2.40 per gallon, which translates to approximately \$0.20 per kilowatt-hour by staff's best estimate. Some comparisons with the traditional project financing were made by staff and are shown below:

Capital Cost (for 90,000 acre-feet per year project):

| | |
|---------------------------|----------------------|
| Ship | \$ 20 million |
| Generators | \$ 30 million |
| Desal System (w/pipeline) | \$ 95 million |
| Turret/Mooring | \$ 90 million |
| Other Costs | <u>\$ 15 million</u> |

Sub-total Capital Cost **\$250 million**

Offshore:Unit Cost (for 90,000 acre-feet per year project):

| | |
|--|--------------------------------------|
| Capital Unit Cost (90K AFY – 20 yrs @6.5%) | \$250/AF |
| O&M Cost | \$500/AF (based on \$0.0474 per kWh) |
| Proponent's Overhead and management | <u>\$100/AF</u> |
| Sub-total | \$850/AF |

Cost increase due to capital market contingency: \$250/AF

Sub-total offshore: **\$1,100/AF**

Additional system integration costs would be incurred to connect the project to Metropolitan's onshore system. Estimated costs for this alternative have been taken for the Orange County area and adjusted for inflation from Metropolitan's 1994 Desalination System Integration Study:

| <u>Onshore Costs:</u> | <u>Sole-Source MWD Financed</u> | <u>Estimated Proponent Financed Project Cost</u> |
|--|-------------------------------------|--|
| Integration ¹ (pipeline, pumping, operational storage): | \$200/AF | \$200/AF |
| Subtotal Offshore Costs: | <u>\$850/AF</u> | <u>\$1,100/AF</u> |
| Adjustment to reflect more realistic cost of power: ² | <u>\$150/AF</u> | <u>\$150/AF</u> |
| Total Unit Cost: | \$1,200/AF | \$1,450/AF |

¹ This is a mid-range cost and it is sensitive to the actual site chosen.

² Under Metropolitan estimated costs of energy, these estimates would increase by approximately \$150 per acre-foot.

Potential Offshore Sites and Appurtenant Land Based Facilities

No specific location for the proposed project or for the connection to an onshore water system was proposed. Location of offshore facilities would be limited by several factors: navigation ways, depth of ocean floor, access to shore, access to Metropolitan facilities, product water blending capacity, product water storage, and additional pipelines and pumping facilities to deliver water to nearby pressure zones or hydraulic elevations. Onshore system integration costs would depend on the final project location.

Both land-based and sea-based desalination facilities will encounter challenges in integrating the supply into existing distribution systems because of the corrosive nature of the desalinated product. The larger the yields, the greater the integration yields. As a rule of thumb for planning, some agencies are looking for connection points where one acre-foot of desalinated water would be blended with two acre-feet of existing supply. This approach was considered when exploring potential connection points for a 90,000 acre-feet per year project.

Several facilities in Metropolitan's service area were considered for connection to the proposed project:

- The West Basin Feeder, in the vicinity of Manhattan Beach, does not offer blending capacity, or have the demand required for the connection. Estimated three miles of pipeline and pumping would be required to deliver the product water to a 350 feet elevation.
- The West Coast Feeder, in the vicinity of Inglewood, has sufficient demand, but not enough blending capacity. Estimated four miles of pipeline and pumping would be required to deliver water to 660 feet elevation.
- The Palos Verdes Reservoir located on a hill at a hydraulic elevation of 340 feet could be used for blending. However, its demands fluctuate with season and are not large enough to accommodate 90,000 acre-feet per year. Connection would require about 10 miles of pipeline or tunneling through a very expensive right of way.
- Los Angeles Department of Public Works' 22-mile pipeline used by West Basin MWD to serve the Malibu area in Las Virgenes MWD is a small system that would not accept the large amount of project product water. Also, about five miles of pipeline to connect in the Malibu area, and pumping would be required.
- The Allan McCullough Pipeline, in the Irvine area, or to another major pipeline in the Huntington Beach area would serve the Orange County area. About 20 miles of pipeline would be required to connect to the Irvine area, and about six miles to connect to a major pipeline in Huntington Beach. Both cases would require substantial capital and pumping costs.
- San Diego County Water Authority's Second Aqueduct in the vicinity of San Marcos would require about 10 miles of pipeline to convey the water from the Carlsbad area. Pumping would be required to lift the product water about 1,100 feet.

Economies of scale indicate that of the range proposed of 29,000 acre-feet per year (40 cubic feet per second) through 90,000 acre-feet per year (120 cubic feet per second), the most efficient alternative would be to consider a 90,000 acre-feet per year project. A project of this size would have to face the site limitations indicated above.

Major Potential Risks, Operational Limitations, and Other Considerations

Background

Staff contacted twelve agencies¹ to identify challenges and opportunities related to developing a project in the marine environment and to understand the regulatory process and assess permitting and other requirements for the proposed Mobile Marine Desalination project. A meeting was also conducted with member agencies to gauge interest in supporting the proposed project. Finally, proponents of the project were interviewed to clarify aspects of the proposal. At this interview, proponents clarified that the fuel to be used in power generation would be biodiesel, not marine diesel as described in their proposal. Proponents also indicated that the purpose of locating the project three miles offshore was for operational consideration and would not avoid any permitting issues. Three miles was the average distance from potentially eligible onshore sites in Orange and Ventura counties. Costs were also provided by the proponents, which were reflected in Attachment #1.

Staff reviewed the Mobile Marine Desalination proposal starting in March and presented a status report to the Desalination and Reclamation Committee in April. A summary of the major considerations leading to issues, risks or concerns that would hinder the proposed project and its successful implementation at this time are included below:

1. Proposed Capacity (29,000 to 90,000 AFY) exceeds current IRP target needs

Metropolitan's existing Seawater Desalination Program is being implemented as an incentive-agreement process to achieve the IRP target of 150,000 acre-feet per year by 2025. Under the Seawater Desalination Program, five member agencies submitted proposals to receive incentives for about 142,000 acre-feet of annual seawater desalination production. In light of the Board authorizing agreements for all five projects, the program is essentially fully subscribed to meet the IRP goal. Should all five projects be fully successful, development of this project by Metropolitan would exceed current IRP target needs.

2. Increased regulatory hurdles due to proposed energy generation

Regulations for air quality are stringent especially in the Los Angeles and Long Beach basin area where concentrated port and harbor activities are already a major air quality concern. If the emissions produced by a vessel in international waters affect the onshore air quality, regulations would apply up to over 60 miles or more offshore. Because the project vessel would be considered a permanent source of emissions for being moored for more than 12 continuous months, some of these regulations would affect it differently than a cargo or transient ship. The vessel would use biodiesel for power generation. Biodiesel is an alternative diesel fuel produced through a process in which organically derived oils are combined with alcohol (ethanol or methanol) in the presence of a catalyst to form ethyl or methyl ester. Biodiesel can be made from soybean or Canola oils, animal fats, waste vegetable oils, or microalgae oils. Regulations under this regime require emission limits established for the cleanest fuel alternative, in this case, most likely natural gas.

¹ US Coast Guard
California Department of Health Services
South Coast Air Quality Management District
California Air Resources Board
US Corps of Engineers
Long Beach Board of Harbor Commissioners
Los Angeles DWP
California State Land Commission
California Coastal Commission
State Resources Control Board
Los Angeles Regional Water Quality Control
Federal Emergency Management Agency

Proposed proprietary technologies for intake and brine disposal may reduce the impact on the marine life. However, this improvement would not reduce the requirements established for seawater desalination projects as seen by the Coastal Commission.

3. Metropolitan inexperience in conducting business at sea

Ships operate under special regulations and legislation that require direct knowledge of the international maritime organizations. Metropolitan does not have experience conducting business in the marine environment. Metropolitan involvement in the marine environment would call for some adjustment to the business culture, which would require considerable investment of staff and financial resources. This lack of experience in the marine environment may expose Metropolitan to unforeseen risks, such as, vessel operation and safety failures, fuel spills, and underwater pipeline repair. Purchase of vessels, classification, labor relations, maintenance of seabed pipelines and other ocean structures are areas completely outside of Metropolitan's current scope of operation. The marine environment is inherently destructive to machinery and facilities. The combination of salt water, wind and waves creates special maintenance requirements that Metropolitan is unfamiliar with.

4. Limited value of the proposal as a transferable emergency supply

The value of the proposed project as a transferable emergency supply would be limited because Metropolitan would lose core supplies if the project is moved from its proposed location. Additionally, substantial facilities, not included in the proposal, may be required to deliver water to affected locations, which would have to be suitable for connecting to the project. When asked if they would help finance the capital of this project, the Federal Emergency Management Agency responded that it provides coordination of resources at the national level for emergencies and that water supply would typically be a responsibility of State or local governments.

5. System integration costs, not considered in the proposal

Additional onshore facilities required for system integration, such as, post-treatment, operational storage, pipelines, pumping stations and related facilities, and the operation and maintenance costs for those facilities are not included in the proposal. These costs are significant and must be added to the proposed cost of water. In Metropolitan's 1994 Desalination System Integration Study, the integration costs ranged between \$100 and \$400 (updated for inflation) for a variety of options that include project yields from 29,000 acre-feet per year to 100,000 acre-feet per year. The integration costs for an assumed area in Orange County would range between \$170 and \$220 per acre-foot. The above costs may change based on the level of post-treatment required, location of the project, and cost of energy. For purposes of Initial Screening these system integration costs were assumed to be \$200 per acre-foot.

System integration costs would be affected by the location of the project. Location would be limited in response to several controlling factors: navigation channels, depth of ocean floor, access to Metropolitan facilities, product water blending capacity, product water storage, and any additional pipelines and pumping facilities to deliver water to higher

6. High costs

Actual project costs may be higher than those presented by the proponent. Preliminary cost data submitted by the proponents do not reflect the total cost of delivering project water. The proposed unit cost of \$850 per acre-foot is based on energy costs on \$0.0474 per kilowatt-hour (or \$0.50 per gallon of biodiesel by staff's best estimate). Staff contacted a California provider of diesel that quoted \$2.40 per gallon (excludes the cost of offshore delivery), which translates approximately \$0.20 per kilowatt-hour. Additionally, actual costs may vary depending on the design, regulatory requirements and power costs. Currently, Metropolitan buys energy at an average of \$0.08 per kilowatt-hour (rate varies from \$0.16/kWh at peak, to \$0.02/kWh at periods of lower demand). Using this average cost, the cost of proposed desalinated water would increase by \$150 per acre-foot to about \$1,000 per acre-foot.

Onshore system integration costs are not part of the proposal. Currently, proposed onshore projects under Metropolitan's Seawater Desalination Program would include system integration in their costs. In the

proposed project, integration costs of approximately \$200 per acre-foot would have to be added, bringing the total cost of desalinated water delivered by the proposed project to \$1,200 per acre-foot. Additionally, if this project were to be procured under Metropolitan's traditional process, staff has estimated that the total cost would increase to about \$1,450 per acre-foot due to the assurances and protections included in the design and performance of the project.