



- Board of Directors  
*Engineering and Operations Committee*

2/12/2013 Board Meeting

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**7-6**

## **Subject**

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Appropriate \$1.58 million; and authorize final design of enhanced bromate control systems for the Henry J. Mills and F. E. Weymouth Water Treatment Plants (Approp. 15472)

## **Executive Summary**

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This action authorizes final design of chemical feed systems which will reduce annual chemical costs for control of bromate formation at the Henry J. Mills and F. E. Weymouth Water Treatment Plants. Bromate can be formed as a disinfection by-product (DBP) when waters containing bromide, such as Metropolitan's State Water Project (SWP) supplies, undergo ozonation.

### **Timing and Urgency**

Metropolitan initiated the Oxidation Retrofit Program (ORP) in the 1990s to add ozone as the primary disinfectant at its five water treatment plants. Since the inception of the ORP, the planned strategy to control the formation of bromate has been to add sulfuric acid and sodium hydroxide before and after the ozone contactors.

Over the last decade, the prices of sulfuric acid and sodium hydroxide have increased by 186 percent and 83 percent, respectively, and are expected to further escalate in the future. Beginning in 2010, Metropolitan has employed an alternate method for bromate control at the Mills plant using a full-scale test system. This alternate control method has reduced the chemical and ozone production costs at Mills by approximately \$400,000 between January and June 2012. Depending on incoming water quality, similar or greater savings may be realized at the Weymouth plant if the alternate bromate control method is adopted at that facility. Staff recommends moving forward with permanent, full-scale chemical feed systems at the Mills and Weymouth plants to reduce operating costs at those two facilities.

This project has been reviewed with Metropolitan's Capital Investment Plan (CIP) prioritization criteria and is categorized as an Infrastructure Reliability project. Funds for this action are available within Metropolitan's capital expenditure plan for fiscal year 2012/13.

## **Details**

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### **Background**

The Mills plant was placed into service in 1978 with an initial capacity of 75 million gallons per day (mgd). The plant was expanded twice and is currently rated to treat 220 mgd, which is the design capacity of the two treatment modules (Modules Nos. 3 and 4) currently in operation. The Mills plant exclusively treats water from the East Branch of the SWP and serves Eastern Municipal Water District and Western Municipal Water District of Riverside County.

In 1941, the Weymouth plant was placed into service with an initial capacity of 100 mgd. The plant was expanded twice to its current capacity of 520 mgd. It delivers a blend of waters from the Colorado River and SWP to serve Metropolitan's Central Pool portion of the distribution system.

Metropolitan initiated the ORP during the 1990s to change the primary disinfectant at its five water treatment plants from chlorine to ozone. The addition of ozone as the primary disinfectant substantially lowers chlorinated DBP levels for compliance with the U.S. Environmental Protection Agency's (EPA's) Disinfectants/Disinfection By-Products Rule. Metropolitan has relied on ozone as the primary disinfectant at the Mills, Jensen, and Skinner plants since 2003, 2005, and 2010, respectively, while the Diemer ozonation system will commence service in 2013. The Weymouth ozonation facilities are planned to be operational by 2016.

While ozone forms fewer DBPs than chlorine with Metropolitan's source waters, bromate is formed as a DBP when waters containing bromide (such as flows from the SWP) are ozonated. Bromate is regulated by the EPA at a maximum contaminant level (MCL) of 10 micrograms per liter ( $\mu\text{g/L}$ ), which is equivalent to 0.01 milligrams per liter ( $\text{mg/L}$ ), based on a running annual average.

At the present time, control of bromate at the Mills, Jensen and Skinner plants can be achieved through use of sulfuric acid to lower the pH of the water during ozonation. This approach reduces the conversion of bromide to bromate. Sulfuric acid is also occasionally used by the plants to enhance the coagulation process if the source water is relatively high in organic material. Following ozonation, the pH of the water is raised with sodium hydroxide to provide a stable, noncorrosive finished water.

With the goal of developing a lower-cost alternative to control bromate formation, staff initiated a three-year demonstration-scale study at the Oxidation Demonstration Plant in La Verne. The study found that, with low levels of chloramines introduced upstream of ozone treatment, the chloramine addition was as effective for bromate control as pH reduction, and performed better under certain conditions. Further, staff concluded that full-scale use of chloramines could potentially reduce chemical costs significantly versus the addition of sulfuric acid and sodium hydroxide.

A full-scale evaluation of this new process was conducted at the Mills plant beginning in July 2010 utilizing spare and short-term testing equipment. This full-scale test was designed to confirm the long-term viability and potential cost savings of adopting the chloramine process. The full-scale test confirmed that chloramines can reliably control bromate formation under current and anticipated water quality conditions while considerably reducing chemical costs. From January 2012 to June 2012, chemical savings of approximately \$400,000 were realized at the Mills plant by implementing this new process on a full-time basis.

### **Enhanced Bromate Control Facilities**

In September 2011, Metropolitan's Board authorized preliminary design activities to evaluate the plant-specific upgrades and costs to adopt the enhanced bromate control strategy at Metropolitan's five water treatment plants. Staff has completed these assessments and has identified the new facilities and upgrades needed for each plant. In addition, construction cost estimates were developed, flow demands were considered to optimize the capacities of equipment needed at each plant, and present-worth cost projections were prepared. These analyses compared the capital construction costs, chemical costs, and operational costs of the new facilities for the chloramine process, versus the costs that would be incurred by retaining the pH reduction process. Staff concluded that adoption of the enhanced bromate control process at the Mills and Weymouth plants would produce substantial cost savings. The anticipated savings in chemical and operational costs for the two plants is approximately \$1.5 million per year. At the Jensen plant, the projected savings would not justify adoption of the enhanced process at this time. At the Skinner and Diemer plants, the ozonation process was either added recently or is in the start-up phase. As a result, staff will continue to assess the viability of adding enhanced bromate control at these plants over the next year.

Preliminary design for the Mills and Weymouth facilities has been completed, and staff recommends proceeding with final design of the bromate control upgrades at this time.

### **Mills and Weymouth Enhanced Bromate Control Facilities – Final Design Phase (\$1,580,000)**

At the Mills plant, enhanced bromate control upgrades will include modification of the existing aqueous ammonia tank farm and ammonia injection system at the plant inlet. A second aqueous ammonia solution pipe will be extended to the inlet structure and both feed lines will be equipped with isolation valves and magnetic flow meters. In addition, two new four-inch diameter chlorine gas lines and diaphragm valves will be added, the

chlorine ejectors will be modified, and the chlorine diffuser at the plant inlet will be relocated. The work will also include modifications to the plant's control systems, instrumentation, chemical trenches, and chemical leak detection systems.

At the Weymouth plant, new bromate control upgrades will include construction of a new aqueous ammonia tank farm with roof structure, unloading facilities, chemical feed system, and secondary containment and ammonia absorber facilities. In addition, two aqueous ammonia feed lines will be extended from the new tank farm to the injection point at the inlet of the ozone contactors. Two four-inch diameter chlorine gas lines will be added from the chlorinators to the new chlorine injection point. The work will also include modifications to the plant's utility piping, control systems, instrumentation, chemical trenches, and chemical leak detection systems.

Final design phase activities for the two plants will include detailed engineering analyses; preparation of drawings and specifications; development of a construction cost estimate; advertisement and receipt of competitive bids; and all other activities in advance of award of construction contracts. All final design activities will be performed by Metropolitan staff.

This action appropriates \$1.58 million and authorizes final design of full-scale enhanced bromate control facilities at the Mills and Weymouth plants. The requested funds include \$930,000 for final design; \$367,000 for permitting, environmental clearances, bidding process for two contracts, and project management; \$60,000 for third-party value engineering review; and \$223,000 for remaining budget. For these projects, the final design cost as a percentage of the estimated construction cost is approximately 12 percent. The construction cost for these two plants is anticipated to range from \$7.7 million to \$10 million. Engineering Services' goal for design of projects with construction cost greater than \$3 million is 9 to 12 percent.

These projects have been evaluated and recommended by Metropolitan's CIP Evaluation Team, and funds are available within the fiscal year 2012/13 capital expenditure plan. See [Attachment 1](#) for the Financial Statement and [Attachment 2](#) for the Location Map.

Both projects are included within capital Appropriation No. 15472, the Enhanced Bromate Control Program. With the present action, the total funding for Appropriation No. 15472 will increase from \$390,000 to \$1.97 million.

#### ***Project Milestones***

February 2014 – Completion of final design for the Mills plant

January 2014 – Completion of final design for the Weymouth plant

#### **Policy**

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Metropolitan Water District Administrative Code Section 5108: Appropriations

#### **California Environmental Quality Act (CEQA)**

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CEQA determinations for Option #1:

#### **Mills Enhanced Bromate Control Facilities – Final Design Phase**

The proposed action is categorically exempt under the provisions of CEQA and the State CEQA Guidelines. The proposed project involves the funding of a study and minor modifications to and replacement of existing public facilities with negligible or no expansion of use and no possibility of significantly impacting the physical environment. In addition, the proposed project will consist of basic data collection, and resource evaluation activities which does not result in a serious or major disturbance to an environmental resource. This may be strictly for information gathering purposes, or as part of a study leading to an action which a public agency has not yet approved, adopted, or funded. Accordingly, the proposed action qualifies for a Class 1, Class 2, and Class 6 Categorical Exemptions (Sections 15301, 15302, and 15306 of the State CEQA Guidelines).

The CEQA determination is: Determine that pursuant to CEQA, the proposed action qualifies under three Categorical Exemptions (Class 1, Section 15301; Class 2, Section 15302; and Class 6, Section 15306 of the State CEQA Guidelines).

**Weymouth Enhanced Bromate Control Facilities – Final Design Phase**

The proposed action is categorically exempt under the provisions of CEQA and the State CEQA Guidelines. The proposed action consists of basic data collection and resource evaluation activities, which do not result in a serious or major disturbance to an environmental resource. This may be strictly for information gathering purposes, or as part of a study leading to an action which a public agency has not yet approved, adopted, or funded. Accordingly, the proposed action qualifies as a Class 6 Categorical Exemption (Section 15306 of the State CEQA Guidelines).

The CEQA determination is: Determine that pursuant to CEQA, the proposed action qualifies under a Categorical Exemption (Class 6, Section 15306 of the State CEQA Guidelines).

CEQA determination for Option #2:

None required

**Board Options**

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**Option #1**

- Adopt the CEQA determinations and
  - a. Appropriate \$1.58 million; and
  - b. Authorize final design of enhanced bromate control systems for the Mills and Weymouth plants.

**Fiscal Impact:** \$1.58 million of capital funds under Approp. 15472

**Business Analysis:** This option will reduce annual operating expenditures at the Mills and Weymouth plants by approximately \$1.5 million in comparison with the previously planned approach to control bromate formation.

**Option #2**

Do not authorize the projects at this time.

**Fiscal Impact:** None

**Business Analysis:** This option would forego an opportunity to reduce annual operating expenditures for chemicals at the Mills and Weymouth plants.

**Staff Recommendation**

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Option #1

  
 \_\_\_\_\_ 1/29/2013  
 Gordon Johnson Date  
 Manager/Chief Engineer  
 Engineering Services

  
 \_\_\_\_\_ 1/30/2013  
 Jeffrey Knightlinger Date  
 General Manager

**Attachment 1 – Financial Statement**

**Attachment 2 – Location Map**

**Financial Statement for Enhanced Bromate Control Program**

A breakdown of Board Action No. 2 for Appropriation No. 15472 for enhanced bromate control<sup>1</sup> at the Mills and Weymouth plants is as follows:

	<b>Previous Total Appropriated Amount (Sept. 2009)</b>	<b>Current Board Action No. 2 (Feb. 2013)</b>	<b>New Total Appropriated Amount</b>
Labor			
Studies & Investigations	\$ 217,000	\$ -	\$ 217,000
Final Design	-	930,000	930,000
Owner Costs (Program mgmt., permitting)	121,000	350,000	471,000
Construction Inspection & Support	-	-	-
Metropolitan Force Construction	-	-	-
Materials & Supplies	1,000	-	1,000
Incidental Expenses	1,000	10,000	11,000
Professional/Technical Services	-	67,000	67,000
Equipment Use	-	-	-
Contracts	-	-	-
Remaining Budget	50,000	223,000	273,000
<b>Total</b>	<b>\$ 390,000</b>	<b>\$ 1,580,000</b>	<b>\$ 1,970,000</b>

**Funding Request**

<b>Program Name:</b>	Enhanced Bromate Control Program		
<b>Source of Funds:</b>	Revenue Bonds, Replacement and Refurbishment or General Funds		
<b>Appropriation No.:</b>	15472	<b>Board Action No.:</b>	2
<b>Requested Amount:</b>	\$ 1,580,000	<b>Capital Program No.:</b>	15472
<b>Total Appropriated Amount:</b>	\$ 1,970,000	<b>Capital Program Page No.:</b>	297
<b>Total Program Estimate:</b>	\$ 24,624,000	<b>Program Goal:</b>	Water Quality

<sup>1</sup> The total amount expended to date on the Enhanced Bromate Control Program is approximately \$269,000.

# Distribution System

