



- Board of Directors  
*Engineering and Operations Committee*

3/13/2012 Board Meeting

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**7-5**

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**Subject**

Appropriate \$1.7 million; and authorize design of four hydroelectric plant rehabilitation projects (Approp. 15458)

**Description**

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This action authorizes final design to rehabilitate electrical systems and mechanical equipment at the Foothill and Sepulveda Canyon Hydroelectric Plants, and preliminary design to rehabilitate similar equipment at the San Dimas and Venice Hydroelectric Plants. These facilities have been in continuous use for over 30 years and the equipment has begun to deteriorate.

**Timing and Urgency**

Recent inspections of the Foothill, Sepulveda Canyon, San Dimas, and Venice Hydroelectric Plants have identified that the electrical systems and mechanical equipment at these facilities are exhibiting signs of age-related wear. In order to maintain reliable power generation and revenues, the deteriorated electrical and mechanical equipment must be refurbished. Equipment requiring refurbishment includes electrical protection relays, control relays, and mechanical piping for the generator cooling water systems. The failure of any of these components could cause the plants to unexpectedly shut down. Staff recommends moving forward with these projects to minimize the risk of expensive repairs, enhance operational reliability of the distribution system, and maximize the generation of revenue.

These projects have been reviewed with Metropolitan's updated Capital Investment Plan (CIP) prioritization criteria, and are categorized as Infrastructure Rehabilitation projects. Funds for this action are available within Metropolitan's capital expenditure plan for fiscal year 2011/12.

**Background**

Metropolitan owns and operates 16 small hydroelectric power plants, which have produced an average of \$24 million in revenue annually over the past seven years. This revenue is expected to increase in the future as retail electrical rates continue to rise.

In August 2008, Metropolitan's Board authorized a detailed assessment of the 16 hydroelectric plants. While all of the plants need to be upgraded, the assessment concluded that the Foothill, Sepulveda Canyon, San Dimas, and Venice Hydroelectric Plants have the highest priority for rehabilitation based on their condition and revenue produced. The rehabilitation work will be staged, addressing two hydroelectric plants at a time. In November 2010, Metropolitan's Board authorized preliminary design of mechanical and electrical rehabilitation projects at the Foothill and Sepulveda Canyon Hydroelectric Plants. The preliminary design effort has been completed and staff recommends moving forward with final design of the upgrades at this time. These projects will upgrade the electrical protection relays, control relays, and mechanical piping for the generator cooling water systems at both plants. Staff also recommends proceeding with preliminary design of upgrades for the next two hydroelectric plants at San Dimas and Venice.

Since most of the hydroelectric plants were constructed in the early 1980s as turn-key facilities, there is little documentation of the existing installations. As an initial step in the rehabilitation effort, as-is drawings of the existing facilities will be developed. In addition, reverse engineering of the mechanical equipment and control systems will be performed to establish their operating characteristics and design criteria.

Needed rehabilitation work at the remaining twelve hydroelectric plants has been prioritized, and staff will return to the Board sequentially over the next five years to initiate those projects.

**Project No. 1 – Foothill Hydroelectric Plant Rehabilitation – Final Design Phase (\$610,000)**

The Foothill Hydroelectric Plant was constructed in 1981 and is located adjacent to the Department of Water Resources' Castaic Lake facility, where it receives untreated State Water Project (SWP) flows from that lake. After water passes through the single turbine, it is conveyed to the Joseph Jensen Water Treatment Plant through the Foothill Feeder. When the hydroelectric plant is shut down, flows are diverted through a separate pressure control structure in order to maintain continuous water deliveries to the Jensen plant. The Foothill Hydroelectric Plant can produce up to 9.1 megawatts (MW) of electricity. Depending on pipeline flowrates, daily revenues can range from \$3,000 to \$7,500.

While the facility has received routine preventive maintenance, the electrical and mechanical systems are exhibiting signs of normal wear and tear after 30 years of service. Replacement of deteriorated electrical and mechanical components will help minimize repair costs and unplanned shutdowns. The planned project will upgrade the electrical protection relays and control relays, as they do not always function properly, which leads to overheating or short-circuiting of the electrical system. The electrical upgrade will require documenting and modifying the turbine manufacturer's original proprietary design to accommodate the electrical and control equipment. The copper piping system which supplies cooling water to the generator enclosure will also be replaced, as it has begun to corrode. Due to the close proximity to high voltage equipment, any leakage or spray of water occurring as a result of pipe corrosion could damage the generator and electrical system. The copper piping replacement will require that new piping and supports be routed through very tight spaces, adjacent to the high voltage equipment. This project will also upgrade the cooling water system to eliminate discharge of lubrication water flows into the adjacent storm drain. By eliminating these discharges, the costly and time-consuming tasks of monitoring and testing discharges for compliance with National Pollutant Discharge Elimination System (NPDES) permits will be reduced and discharge fees will no longer be paid.

This action appropriates \$610,000 and authorizes final design phase activities to rehabilitate electrical and mechanical components at Foothill Hydroelectric Plant. The final design will be performed by Metropolitan staff. Planned activities include equipment selection, preparation of drawings and specifications, development of a cost estimate, permitting, and all other activities in advance of award of a construction contract. The requested funds include \$429,000 for final design, \$113,000 for receipt of competitive bids, value engineering, and project management; and \$68,000 for remaining budget. The cost of final design is approximately 14.8 percent of the estimated total construction cost. Engineering Services' goal for design of projects with construction cost less than \$3 million is 9 to 15 percent. The total construction cost for this project is anticipated to range from \$2.5 million to \$2.9 million. Staff will return to the Board at a later date for award of the construction contract.

**Project No. 2 – Sepulveda Canyon Hydroelectric Plant Rehabilitation – Final Design Phase (\$380,000)**

The Sepulveda Canyon Hydroelectric Plant was constructed in 1982. It receives treated water from the Jensen plant via the Sepulveda Feeder, and can produce up to 8.6 MW of electricity with its single turbine. When the hydroelectric plant is shut down, flows are diverted through a separate pressure control structure in order to maintain continuous treated water deliveries into the Central Pool. Depending on pipeline flowrates, daily revenues can range from \$2,000 to \$4,500.

While the facility has received routine preventive maintenance, the electrical and mechanical systems are exhibiting signs of normal wear and tear after 30 years of service. Replacement of deteriorated electrical and mechanical components will help minimize repair costs and unplanned shutdowns. Similar to the Foothill plant, this project will upgrade the electrical protection relays and control relays. The electrical upgrade will require documenting and modifying the turbine manufacturer's original design to accommodate the new electrical and

control equipment. In addition, the transformer ventilation system will be replaced, as it runs hotter than the manufacturer's recommendations due to poor air ventilation in the transformer yard. The bearing cooler will also be upgraded to comply with current cross-connection prevention regulations. This will require a custom double-walled bearing cooler to meet space and thermal characteristics of the existing bearings and bearing housings without compromising the efficiency of the system.

The project will recoat the internal components of the turbine, including the scroll case and tailrace, which have deteriorated over time. The coatings in the tailrace area have large areas with severe corrosion, including blistering, delamination, and rusting of the metal surfaces. Staff recommends moving forward with final design at this time to rehabilitate the hydroelectric plant, which will help minimize repair costs and unplanned shutdowns.

This action appropriates \$380,000 and authorizes final design phase activities to rehabilitate electrical and mechanical components at Sepulveda Canyon Hydroelectric Plant. The final design will be performed by Metropolitan staff. Planned activities include equipment selection, preparation of drawings and specifications, development of a cost estimate, and all other activities in advance of award of a construction contract. The requested funds include \$224,000 for final design; \$101,000 for permitting, receipt of competitive bids, value engineering, and project management; and \$55,000 for remaining budget. The cost of final design is approximately 14.9 percent of the estimated total construction cost. Engineering Services' goal for design of projects with construction cost less than \$3 million is 9 to 15 percent. The total construction cost for this project is anticipated to range from \$1 million to \$1.5 million. Staff will return to the Board at a later date for award of a construction contract.

### **Project No. 3 – San Dimas Hydroelectric Plant Rehabilitation – Preliminary Design Phase (\$350,000)**

The San Dimas Hydroelectric Plant was constructed in 1981. It receives untreated SWP flows from the Department of Water Resources' Devil Canyon facility via the Rialto Pipeline. After water passes through the single turbine, it is conveyed to the F.E. Weymouth Water Treatment Plant through the La Verne Pipeline. When the hydroelectric plant is shut down, flows are diverted through a separate pressure control structure in order to maintain water deliveries to the Weymouth plant. The San Dimas Hydroelectric Plant can produce up to 9.9 MW of electricity. Depending on pipeline flow rates, daily revenues can range from \$2,000 to \$11,000.

While the facility has received routine preventive maintenance, the electrical and mechanical systems are exhibiting signs of normal wear and tear after 30 years of service. The condition assessment identified that the copper piping system which supplies cooling water to the generator enclosure has also begun to corrode. Due to the close proximity to high voltage equipment, any leakage or spray of water occurring as a result of pipe corrosion could damage the generator and electrical system. Staff recommends moving forward at this time with preliminary design to rehabilitate the hydroelectric plant, which will help minimize repair costs and unplanned shutdowns.

This action appropriates \$350,000 and authorizes preliminary design phase activities to rehabilitate electrical and mechanical components of San Dimas Hydroelectric Plant. All work will be performed by Metropolitan staff. Planned activities include: detailed physical inspection which will include partial tear-down of electrical panels; selection of design criteria based on recent technological advances and compatibility with existing equipment; assessment of upgrades needed to comply with current building and safety codes; permitting; preparation of as-is drawings; and development of a preliminary cost estimate. Requested funds include \$219,000 for the preliminary design, \$79,000 for project management, value engineering, and preparation of environmental documentation; and \$52,000 for remaining budget. Staff will return to the Board at a later date to authorize final design.

### **Project No. 4 – Venice Hydroelectric Plant Rehabilitation – Preliminary Design Phase (\$360,000)**

The Venice Hydroelectric Plant was constructed in 1982. It receives treated SWP flows from the Jensen Plant via the Sepulveda Feeder, and can produce up to 10 MW of electricity with its single turbine. When the hydroelectric plant is shut down, flows are diverted through a separate pressure control structure in order to maintain continuous treated water deliveries into the Central Pool. Depending on pipeline flow rates, daily revenues can range from \$3,000 to \$15,000.

While the facility has received routine preventive maintenance, the electrical and mechanical systems are exhibiting signs of normal wear and tear after 30 years of service. The condition assessment identified that the power transformer is approaching the end of its service life and is experiencing high internal oil temperatures, which could lead to failure of the equipment. Electrical components such as protection relays and control relays do not always function properly. In addition, spare parts for some of the electrical equipment are difficult to obtain or are no longer available. Staff recommends moving forward with preliminary design at this time to rehabilitate the hydroelectric plant, which will reduce future repair costs and minimize unplanned shutdowns.

This action appropriates \$360,000 and authorizes preliminary design phase activities to rehabilitate electrical and mechanical components of the Venice Hydroelectric Plant. All work will be performed by Metropolitan staff. Planned activities include: detailed physical inspection which will include partial tear-down of electrical panels; selection of design criteria based on recent technological advances and compatibility with existing equipment; assessment of upgrades needed to comply with current building and safety codes; permitting; preparation of as-is drawings; and development of a preliminary cost estimate. Requested funds include \$235,000 for preliminary design; \$79,000 for project management, value engineering, and preparation of environmental documentation; and \$46,000 for remaining budget. Staff will return to the Board at a later date to authorize final design.

### **Summary**

This action appropriates \$1.7 million and authorizes final design phase activities to rehabilitate electrical and mechanical components at the Foothill and Sepulveda Canyon Hydroelectric Plants, and preliminary design phase activities to rehabilitate the San Dimas and Venice Hydroelectric Plants. See [Attachment 1](#) for the Financial Statement and [Attachment 2](#) for the Location Map.

These projects are included within capital Appropriation No. 15458, the Hydroelectric Power Plant Improvements Program, which was initiated in fiscal year 2008/09. Other projects authorized under Appropriation No. 15458 include the Hydroelectric Power Plant Assessment Survey and the San Dimas Hydroelectric Plant Needle Valve Rehabilitation project. With the present action, the total funding for Appropriation No. 15458 will increase from \$2,017,000 to \$3,717,000.

These projects are consistent with Metropolitan's goals for sustainability by enhancing the reliability of the distribution system and increasing Metropolitan's use of renewable power

### ***Project Milestones***

February 2013 – Completion of final design for the Foothill Hydroelectric Plant, and preliminary design for the San Dimas and Venice Hydroelectric Plants

November 2013 – Completion of final design for the Sepulveda Canyon Hydroelectric Plant

### **Policy**

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Metropolitan Water District Administrative Code Section 5108: Appropriations

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

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CEQA determination for Option #1:

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 determination and

- a. Appropriate \$1.7 million;
- b. Authorize final design to rehabilitate the Foothill and Sepulveda Canyon Hydroelectric Plants; and
- c. Authorize preliminary design to rehabilitate the San Dimas and Venice Hydroelectric Plants.

**Fiscal Impact:** \$1.7 million of budgeted funds (Approp. 15458)

**Business Analysis:** This option will enhance the reliability of the four hydroelectric plants and allow the small hydroelectric program to continue generating approximately \$24 million in annual revenue.

**Option #2**

Do not authorize the four projects at this time.

**Fiscal Impact:** None

**Business Analysis:** This option would forego an opportunity to refurbish the four hydroelectric plants, which could lead to loss of generation revenue, higher repair costs, and unplanned shutdowns.

**Staff Recommendation**

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Option #1

  
 \_\_\_\_\_ 2/21/2012  
 Gordon Johnson Date  
 Manager/Chief Engineer,  
 Engineering Services

  
 \_\_\_\_\_ 2/29/2012  
 Jeffrey Kightlinger Date  
 General Manager

**Attachment 1 – Financial Statement**

**Attachment 2 – Location Map**

Ref# es12615148

**Financial Statement for Hydroelectric Power Plant Improvements Program**

A breakdown of Board Action No. 4 for Appropriation No. 15458 for the Foothill, Sepulveda Canyon, San Dimas and Venice Hydroelectric Plant rehabilitation projects<sup>1</sup> is as follows:

	<b>Previous Total Appropriated Amount (Aug. 2009)</b>	<b>Current Board Action No. 4 (Mar. 2012)</b>	<b>New Total Appropriated Amount</b>
Labor			
Studies & Investigations	\$ 604,000	\$ 453,000	\$ 1,057,000
Owner Costs (Project mgmt, envir. doc.)	142,000	372,000	514,000
Final Design	-	654,000	654,000
Metropolitan Force Construction	917,942	-	917,942
Professional/Technical Services	-	-	-
Materials and Supplies	55,000	-	55,000
Incidental Expenses	7,000	-	7,000
Equipment Use	27,000	-	27,000
Contracts	10,000	-	10,000
Remaining Budget	254,058	221,000	475,058
<b>Total</b>	<b>\$ 2,017,000</b>	<b>\$ 1,700,000</b>	<b>\$ 3,717,000</b>

**Funding Request**

<b>Program Name:</b>	Hydroelectric Power Plant Improvements Program		
<b>Source of Funds:</b>	Revenue Bonds, Replacement and Refurbishment or General Funds		
<b>Appropriation No.:</b>	15458	<b>Board Action No.:</b>	4
<b>Requested Amount:</b>	\$ 1,700,000	<b>Capital Program No.:</b>	15458
<b>Total Appropriated Amount:</b>	\$ 3,717,000	<b>Capital Program Page No.:</b>	303
<b>Total Program Estimate:</b>	\$ 5,258,100	<b>Program Goal:</b>	R-Reliability

<sup>1</sup> The total amounts expended to date on the Foothill, Sepulveda Canyon, and San Dimas Hydroelectric Plants Rehabilitation projects are approximately \$190,000, \$180,000, and \$1,420,000, respectively. This action is the initial appropriation for the Venice Hydroelectric Plant Rehabilitation project.

# Distribution System

