



● **Board of Directors**  
***Engineering and Operations Committee***

5/11/2010 Board Meeting

**7-3**

**Subject**

Appropriate \$450,000; and authorize initial investigations of control and protection upgrades for the Hiram W. Wadsworth Pumping Plant (Approp. 15467)

**Description**

This action authorizes the initial phase of a rehabilitation project that will upgrade the controls, communications, protection relay system, vibration monitoring system, and pump/generator unit power controls for the Hiram W. Wadsworth Pumping Plant at Diamond Valley Lake (DVL). These components control the operation and protection of the major pumping equipment, the pressure control bypass valves, and the ancillary systems at the Wadsworth pumping plant. This equipment has been in service for ten years and is experiencing end-of-service-life issues. The upgrade work is required for the pumping plant to continue operating. At present equipment failure rates, which appear to be accelerating, the pumping and generating capacity will be progressively reduced commencing in 2013 to 2015, with total loss of capacity anticipated by 2017 to 2023.

This project has been reviewed with Metropolitan's updated Capital Investment Plan (CIP) prioritization criteria, and is categorized as an Infrastructure Upgrade project. The project is budgeted in Metropolitan's CIP for fiscal year 2009/10.

**Timing and Urgency**

In 2009, staff conducted a detailed condition assessment of the Wadsworth pumping plant control system, and identified that a substantial number of components are beginning to fail or have become obsolete. The aging components include: programmable logic controllers (PLCs) that control the pumping plant equipment; the communications system; the protection relay system; the vibration monitoring system; and various motor/drive control elements. These components control the operation and protection of the major pumping equipment, the pressure control and bypass valves, and the ancillary systems at the Wadsworth pumping plant. The control technology used at the Wadsworth pumping plant is approximately 15 years old, which predates modern industry and Metropolitan standards. This equipment has a typical service life of ten years. Further, spare parts are no longer available for many of these components.

Failure of control components may cause single pump/generator units, or entire sections of the pumping plant, to shut down, resulting in reduced pumping plant capacity and reliability. Although staff has made aggressive efforts to secure necessary parts from domestic and international sources, current estimates are that available spare parts will be exhausted within 30 months. When the parts run out, some units or portions of the pumping plant will no longer be operable. While the pumping plant can be run manually in limited circumstances, specific risks include:

1. The inability to automatically control pressures and flows at the pumping plant, and locally on the Inland Feeder and San Diego Canal. The pressure control system controls and protects the pumping plant and its inlet and outlet conduits from over-pressurization, and from prolonged loss or increase of flow. Lack of this automated control would result in:
  - a. Loss of generation due to loss of pressure controls;

- b. Loss of generation bypass flow capability, creating the risk of exceeding the San Diego Canal's drawdown criteria, which could lead to canal damage;
  - c. Loss of flow to the San Diego Canal while generating power via flows from the Inland Feeder, leading to a potential pressure surge in the Inland Feeder;
  - d. Increased flow to the San Diego Canal if the pumps shut down suddenly, as rejected pump flow is diverted to the canal.
2. The limitation or inability to generate energy from DVL. While water could still be withdrawn by gravity from DVL on a short-term basis with generator bypass valves, power generation would cease. Since 2002, energy generation has averaged \$1.3 million per year. Recently, the Wadsworth pumping plant was certified as a renewable energy source, resulting in higher prices (more than double, on average) per megawatt hour. Depending on a range of projected equipment failure rates and subsequent incremental loss of generation units, the limitation or inability to generate power would result in a progressive loss of potential revenue of \$160,000 per year, beginning in 2014 to 2018, and reaching \$1.1 million to \$3.9 million per year by 2020 (resulting in a cumulative \$1.9 million to \$18.6 million loss over ten years, with escalation of 3 percent).
  3. The limitation or inability to pump into DVL. While State project water can be gravity-fed into DVL via the Inland Feeder, Colorado River Aqueduct (CRA) water must be pumped into the lake. Currently, CRA water is not pumped into DVL due to quagga mussel concerns. However, in the event of an emergency, CRA water may need to be pumped into DVL, requiring a functional pumping plant. Depending on equipment failure rates, the progressive loss of pumping capacity could begin in years 2013 to 2015.

### **Background**

Construction of the Wadsworth pumping plant commenced in 1995 and the pumping plant was commissioned in 2000. The Wadsworth pumping plant is the larger of Metropolitan's two hydroelectric facilities that both pump water and generate power (the second is Gregg Avenue). The Wadsworth pumping plant can divert State project water directly into DVL by gravity or can pump CRA water into DVL from the San Diego Canal. The pumping plant can withdraw water from DVL through the generator bypass valves or use this water to generate power; in both cases the water is conveyed south to the Skinner area. Electricity generated at the Wadsworth pumping plant is sold and fed into the regional power grid. The pumping plant's operation is controlled by a complex control system, while the equipment is protected by a variety of electrical components which were also placed into service in 2000. However, due to the length of the construction and commissioning phase, a number of control system and protection components and their technologies are approximately 15 years old.

A recent review of the facility by staff identified the following:

1. The pumping plant's PLCs, which are industrial-grade computers that run software to control pumping plant operations, are obsolete, are no longer supported by the manufacturer, and do not conform to up-to-date Metropolitan equipment standards. The PLCs are experiencing failures, and compatible replacement units are no longer available.
2. The control software is overly complicated and does not include adequate supplier documentation, resulting in difficulties in maintaining the system.
3. A number of additional hardware and software components that control the operation of the pumping plant and equipment are failing and/or obsolete, and are no longer repairable or available for purchase. These components are critical for proper and reliable operation of the pumping plant. They monitor vibration, provide protection for the high-voltage electrical system, and control the pump/generator drives. The use of spares and replacements, where available, has allowed continued operation.
4. Components of the communication system used at the pumping plant are failing and/or obsolete. The use of spares has allowed continued operation. This system, including the communications protocol, is unique and incompatible with modern standard control systems and components.

5. External technical support for the older aspects of the control system, specifically the pumping plant operation control programming, is becoming scarce due to industry attrition.

Staff has taken proactive steps to extend the pumping plant's operational reliability, including acquisition of available spares and reserving redundant systems for future need. While these activities are prudent, they are interim solutions. A failure in one of the components above may compromise the viability of the control system or other equipment, and thus operation of the pumping plant.

Staff recommends that initial investigations be performed to evaluate alternatives ranging from short-term deferral to rehabilitation of the pumping plant for full functionality. The initial investigation of these alternatives would include evaluation of: operational impacts; technical options; risks; solicitation and procurement methods; and project delivery methods; and would include value engineering. At the conclusion of this investigation, staff will return to the Board with conclusions and a recommended approach for moving forward.

#### **Wadsworth Pumping Plant Controls Upgrade – Initial Investigations (\$450,000)**

The Wadsworth Pumping Plant Controls Upgrade project will identify and assess options up to and including replacement of the components described above with modern, supportable, industry-standard, simplified and documented systems. The overall rehabilitation project would be executed in four phases: Initial investigations; preliminary and final design; procurement and installation; and commissioning and training. The initial investigations will take approximately seven months to complete.

For the initial phase of work, planned activities include: identification and evaluation of pumping plant operational alternatives and technical alternatives, including those discussed above; value engineering; risk assessment and minimization of impacts to distribution system and pumping plant operations; evaluation of solicitation and procurement options; development of a conceptual design; preparation of a project execution plan; development of a design and construction schedule and cost estimate; and project management. The products of this effort will be a recommended approach; conceptual design; project execution plan; and detailed scope, schedule, and cost estimates.

The project team for the initial investigation effort will include staff from Water System Operations, Engineering Services, and Information Technology. Technical support will be provided by a specialized consulting firm. The consultant will provide input for the determination and evaluation of pumping plant options, value engineering, risk assessment, solicitation and procurement options, project execution planning, and technical support as needed. The consultant will be selected from a list of firms prequalified under Request for Qualifications (RFQ) No. 927. A total of sixteen firms submitted statements of qualifications in response to the RFQ, while nine were determined to be qualified under a standardized evaluation and scoring process. Final selection of a recommended firm is anticipated by early June. A professional services agreement is planned to be awarded by the General Manager under his authority in Section 8121 of the Administrative Code. The estimated amount of this agreement is \$125,000.

This action appropriates \$450,000 and authorizes the initial phase of a rehabilitation project to upgrade the controls and protection equipment of the Wadsworth pumping plant. Requested funds include: \$245,000 for Metropolitan staff to conduct the activities described above; \$45,000 for project management and owner's costs; \$125,000 for specialized consulting assistance; and \$35,000 for remaining budget. Staff will return to the Board for authorization of preliminary and final design upon completion of the initial investigations. Subsequent board actions will include authorization of procurement and installation; and commissioning and training. The total program estimate for the complete rehabilitation of the items discussed above is estimated to be \$15 million to \$20 million. See [Attachment 1](#) for the Financial Statement and [Attachment 2](#) for the Location Map.

This project is consistent with Metropolitan's goals for sustainability by providing continued operational reliability in water conveyance, storage and distribution, as well as power generation via renewable energy.

#### ***Project Milestone***

November 2010 – Completion of initial investigations

## 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, research 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). In addition, the proposed action is not defined as a project under CEQA because it involves other government fiscal activities, which do not involve any commitment to any specific project which may result in a potentially significant physical impact on the environment (Section 15378(b)(4) 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), and, further, that the proposed action is not subject to CEQA pursuant to Section 15378(b)(4) 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 \$450,000; and
- b. Authorize initial investigations for control and protection upgrades at the Hiram W. Wadsworth Pumping Plant.

**Fiscal Impact:** \$450,000 in budgeted funds under Approp. 15467

**Business Analysis:** This project will protect Metropolitan's assets, increase service reliability to member agencies, and reduce the risk of costly emergency repairs.

### Option #2

Do not authorize the initial investigations at this time.

**Fiscal Impact:** None

**Business Analysis:** This option would forego an opportunity to remediate reliability issues with the Wadsworth pumping plant controls and protection equipment, and could lead to reduced pumping and power generation capacity, more extensive repairs, and unplanned system shutdowns.

**Staff Recommendation**

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Option #1

  
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Roy L. Wolfe  
Manager, Corporate Resources

4/23/2010  
\_\_\_\_\_  
Date

  
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Jeffrey Nightlinger  
General Manager

4/26/2010  
\_\_\_\_\_  
Date

**Attachment 1 – Financial Statement**

**Attachment 2 – Location Map**

Ref# cr12604313

## **Financial Statement for Water Operations Control Program**

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A breakdown of Board Action No. 1 for Appropriation No. 15467 for the Wadsworth Pumping Plant Controls Upgrade\* is as follows:

	<b>Current Board Action No. 1 (May 2010)</b>	
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Labor		
Studies & Investigations	\$	245,000
Owner Costs (Program mgmt., envir. doc.)		40,000
Materials and Supplies		-
Incidental Expenses		5,000
Professional / Technical Services		125,000
Equipment Use		-
Contracts		-
Remaining Budget		35,000
<b>Total</b>	<b>\$</b>	<b>450,000</b>
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### **Funding Request**

<b>Program Name:</b>	Water Operations Control Program		
<b>Source of Funds:</b>	Revenue Bonds, Replacement and Refurbishment or General Funds		
<b>Appropriation No.:</b>	15467	<b>Board Action No.:</b>	1
<b>Requested Amount:</b>	\$ 450,000	<b>Capital Program No.:</b>	15467
<b>Total Appropriated Amount:</b>	\$ 450,000	<b>Capital Program Page No.:</b>	250
<b>Total Program Estimate:</b>	\$ 17,400,000	<b>Program Goal:</b>	Reliability

\* This action is the initial appropriation for the Wadsworth Pumping Plant Controls Upgrade project.

# Diamond Valley Lake

