



- Board of Directors
Engineering and Operations Committee

6/10/2014 Board Meeting

8-7

Subject

Appropriate \$2.56 million; and authorize three electrical rehabilitation projects on the Colorado River Aqueduct (Approp. 15384)

Executive Summary

This action authorizes design of three projects that will enhance the reliability, improve performance, and extend the service life of electrical components at Metropolitan's five Colorado River Aqueduct (CRA) pumping plants. The projects will replace power cables and uninterruptable power supplies (UPS) at each plant, and will replace over-current relays at Intake and Gene Pumping Plants.

Timing and Urgency

Metropolitan staff performs regular maintenance of the electrical systems at each CRA pumping plant. Recent inspections have identified that major electrical components are showing signs of deterioration. In addition, the frequency of needed repairs is increasing. While the systems were designed to meet electrical codes in place at the time of their construction in the late 1930s, much of the equipment is underrated by current standards and does not have adequate short-circuit interrupting capability, which may increase the risk of unplanned outages, equipment damage, and fire hazard. In order to maintain reliability of the CRA's electrical systems, staff has established a long-term rehabilitation program. The work has been prioritized, and three initial projects are recommended to proceed at this time.

The first project will replace deteriorated 6.9 kV power cables at each pumping plant. The existing oil-filled power cables are leaking and need to be replaced to maintain pump output capacity.

The second project will replace failing over-current relays at Intake and Gene Pumping Plants. These relays protect a 69 kV transmission line and the pump house equipment from electrical faults. Replacing the relays will reduce the potential for unintended shutdowns and equipment damage.

The third project will replace the UPS systems at all five pumping plants. Each plant has a UPS system to prevent fluctuations in power quality and to serve as a backup supply in case of loss of station power. The existing UPS systems are outdated and are beginning to fail, which could result in loss of critical data.

These three projects will enhance reliability of the CRA, reduce the potential for equipment damage, and reduce the risk of data loss. These projects have been reviewed with Metropolitan's Capital Investment Plan (CIP) prioritization criteria and are categorized as Infrastructure Reliability projects. Funds for this action are available within Metropolitan's capital expenditure plan for fiscal year 2013/14.

Details

Background

The CRA is a 242-mile-long conveyance system that transports water from the Colorado River to Lake Mathews. It consists of five pumping plants; 124 miles of tunnels, siphons, and reservoirs; 63 miles of canals; and 55 miles of conduits. The aqueduct was constructed in the late 1930s and was placed into service in 1941.

The electrical system which provides power to the CRA pumping plants was primarily constructed in the 1930s, and has been in continuous service since that time. The CRA electrical system contains numerous specialized and custom components that transmit power from the hydroelectric turbines at Hoover Dam to the nine primary pumps at each of the five pumping plants. This system includes 305 miles of 230 kV aerial transmission lines, four 230 kV switchyards, and two 69 kV switchyards. At each of the pumping plants, the electrical system includes a main transformer bank, 6.9 kV switch house, motor cables, pump motors, and auxiliary power systems.

Recent inspections have identified that the CRA's major electrical components are showing signs of deterioration, as may be expected after nearly 75 years of continuous operation. In addition, the frequency of needed repairs is increasing. In order to maintain reliability of the CRA's electrical system, staff has established a long-term rehabilitation program. Three of the initial projects are recommended to proceed at this time.

Project No. 1 – CRA Power Cable Replacement – Design Phase (\$1,700,000)

There is a total of 45 primary pumps and motors at the five CRA pumping plants. Power is transmitted to the motors via 3-inch-diameter cables which run through a tunnel that connects each switch house to each pump house. The quantity of cables varies from nine to twenty-seven per plant. These cables were installed in four phases from 1939 through 1959, and consist of a copper core wrapped with oil-soaked paper strips, covered with a lead jacket.

After 55-75 years in continuous service, the power cables have deteriorated and need to be replaced. Oil has begun to leak through cracks in the lead jacket, at the cable connection joints, and at the cable termination points. Frequent repairs are required to address the leaks and maintain the cables' insulating capacity. Continual leaks could result in an outage or reduced pump output. Staff recommends that each of the existing power cables be replaced with a modern, non-lead jacketed cable. The replacement work will take place while the pumping plants remain in service.

Planned preliminary design phase activities include conducting field surveys; asbestos and lead testing; development of final design criteria; preparation of environmental documentation; and development of a construction cost estimate. Planned final design phase activities include evaluation of the structural integrity of the existing cable supports within the tunnels; selection of new power cables; preparation of drawings and specifications; planning for shutdowns and construction sequencing to minimize impacts to water deliveries; value engineering review; preparation of bid packages; and receipt of competitive bids. The hazardous material testing and value engineering will be performed by specialized consultants. All other activities will be performed by Metropolitan staff.

This action appropriates \$1.7 million and authorizes design to replace the power cables at each of the five CRA pumping plants. Requested funds include \$165,000 for preliminary design; \$1,055,000 for final design; \$48,000 for a value engineering assessment; \$45,000 for hazardous material testing; \$277,000 for preparation of environmental documentation, bidding, and project management; and \$110,000 for remaining budget. The final design cost as a percentage of the estimated construction cost is approximately 8.1 percent. Engineering Services' goal for design of projects with construction cost greater than \$3 million is 9 to 12 percent. The estimated construction cost for this project is anticipated to range from \$13 million to \$14 million. Staff will return to the Board at a later date for award of the construction contract.

The total estimated cost to complete the power cable replacement, including current funds requested and future construction and remediation costs, is anticipated to range from \$15 million to \$16 million.

Project No. 2 – CRA Over-Current Relay Replacement – Design Phase and Equipment Procurement (\$450,000)

The electrical power to operate Intake Pumping Plant is transmitted from Gene Pumping Plant via three miles of 69 kV overhead lines. In order to protect the transmission line and pump house equipment from fault currents, over-current relays are located at both of the plants. The purpose of over-current relays is to detect faults which are most often caused by lightning or transmission line damage. The over-current relays send a signal to circuit breakers to open so the faults can be isolated, thereby protecting pump motors and the electrical busses from damage.

The existing over-current relays at Gene and Intake Pumping Plants were installed in the 1940s. Although the relays have performed well, they have begun to fail, which could result in fault current damage to pump house equipment. The manufacturer no longer supports the relays, and replacement parts are difficult to obtain. Staff recommends that the existing electromechanical over-current relays at Gene and Intake Pumping Plants be replaced with modern microprocessor-based units. In addition, differential relays should be provided to protect the 69 kV transmission line between the two pumping plants. At the Hinds, Eagle Mountain, and Iron Mountain Pumping Plants, the original over-current relays were replaced approximately ten years ago. The present units are in good condition and do not need to be replaced at this time.

Planned preliminary design phase activities include conducting field surveys; development of final design criteria; preparation of environmental documentation; and development of a construction cost estimate. Planned final design phase activities include development of procurement specifications and pre-purchase of the relays; preparation of drawings and specifications for the installation contract; preparation of bid packages; and receipt of competitive bids. All activities will be performed by Metropolitan staff.

This action appropriates \$450,000 and authorizes design and procurement to replace over-current relays at Intake and Gene Pumping Plants. Requested funds include \$48,000 for preliminary design; \$148,000 for final design; \$182,000 for procurement of the relays; \$46,000 for preparation of environmental documentation, bidding, and project management; and \$26,000 for remaining budget. The final design cost as a percentage of the estimated construction cost is approximately 14.7 percent. Engineering Services' goal for design of projects with construction cost less than \$3 million is 9 to 15 percent. The estimated construction cost for this project is anticipated to range from \$1 million to \$1.3 million. Staff will return to the Board at a later date for award of the installation contract.

The total estimated cost to complete the over-current relay replacement, including current funds requested and future installation/construction costs, is anticipated to range from \$1.5 million to \$1.8 million.

Project No. 3 – CRA UPS Replacement – Design Phase (\$410,000)

Each CRA pumping plant has a UPS system to prevent fluctuations in power quality and to serve as a backup power supply in case of loss of station power. The UPS systems continuously protect computers, servers, telecommunication equipment, and process equipment from power disruptions which could cause damage to equipment or loss of critical data or process control (e.g., security, the emergency response system, water delivery control and meter information, and water sampling data).

The existing UPS systems at the five pumping plants are 20 years old and are beginning to fail. Typically, UPS systems have a service life of approximately ten years. The existing UPS units are also undersized based on current power demands at the plants, and lack up-to-date features typical of newer systems, such as built-in redundancy. Replacement of the UPS systems is needed to reduce the potential for loss of critical data, and to protect the systems which support emergency response, communications, and water operations.

The planned upgrades include replacement of the UPS units with larger capacity units that are more efficient, reliable, and economical. In addition, UPS panels will be installed to allow flexible control of loads, and to allow for future expansion.

Planned preliminary design phase activities include conducting field surveys; hazardous material investigations; preparation of environmental documentation; and development of a construction cost estimate. Planned final design phase activities include development of procurement specifications; preparation of drawings and specifications; value engineering review; preparation of bid packages; and receipt of competitive bids. Design is recommended to be performed by HDR Engineers, as discussed below. All other work will be performed by Metropolitan staff.

This action appropriates \$410,000 and authorizes design to replace the UPS systems at each CRA pumping plant. Requested funds include \$80,000 for preliminary design; \$222,000 for final design; \$63,000 for preparation of environmental documentation, bidding, value engineering, and project management; and \$45,000 for remaining budget. The final design cost as a percentage of the estimated construction cost is approximately 14.8 percent. Engineering Services' goal for design of projects with construction cost less than \$3 million is 9 to 15 percent.

The construction cost for this project is anticipated to range from \$1.5 million to \$1.9 million. Staff will return to the Board at a later date for award of the construction contract.

The total estimated cost to complete the CRA UPS replacement, including current funds requested and future procurement and construction costs, is anticipated to range from \$1.9 million to \$2.3 million.

Agreement for Engineering Design Services (HDR Engineers) – No Action Required

Final design for the CRA UPS Replacement project is recommended to be performed by HDR Engineers under an existing board-authorized agreement. Based upon the anticipated capital workload over the next two fiscal years, Metropolitan has insufficient technical staff in-house to complete the design within the planned project schedule. HDR Engineers was selected through a competitive process via Request for Qualification No. 927. The planned scope of work for the UPS Replacement project includes detailed design, preparation of drawings and specifications, and provision of technical assistance during bidding. The estimated cost for these services is \$270,000.

No amendment to the existing HDR Engineers agreement is required for this work. For this agreement, Metropolitan has established a Small Business Enterprise (SBE) participation level of 18 percent. HDR Engineers has agreed to provide this level of participation.

Summary

This action appropriates \$2.56 million and authorizes design of three electrical rehabilitation projects on the CRA. These projects have been evaluated and recommended by Metropolitan's CIP Evaluation Team, and funds are available within the fiscal year 2013/14 capital expenditure plan. See [Attachment 1](#) for the Financial Statement and [Attachment 2](#) for the Location Map.

All three projects are included within Appropriation No. 15384, the CRA Electrical Reliability Appropriation, which was initiated in fiscal year 2002/03. With the present action, the total funding for Appropriation No. 15384 will increase from \$19,715,000 to \$22,275,000.

Project Milestones

November 2014 – Completion of design to replace the over-current relays at Intake and Gene Pumping Plants

April 2015 – Completion of design to replace the power cables and UPS systems at each CRA pumping plant

Policy

Metropolitan Water District Administrative Code Section 5108: Appropriations

California Environmental Quality Act (CEQA)

CEQA determination for Option #1:

The proposed action is categorically exempt under the provisions of CEQA and the State CEQA Guidelines. The proposed project involves the funding, preliminary design and final design for minor alterations, reconstruction or replacement of existing public with no expansion of use and no possibility of significantly impacting the physical environment. Accordingly, the proposed action qualifies under Class 1 and Class 2 Categorical Exemptions (Sections 15301 and 15302 of the State CEQA Guidelines).

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

CEQA determination for Option #2:

None required

Board Options

Option #1

Adopt the CEQA determination that the proposed action is categorically exempt, and

- a. Appropriate \$2.56 million;
- b. Authorize design to replace the power cables and uninterruptable power supplies at each CRA pumping plant; and
- c. Authorize design to replace over-current relays at Intake and Gene Pumping Plants.

Fiscal Impact: \$2.56 million of capital funds under Approp. 15384

Business Analysis: This option will maintain reliable power deliveries to critical CRA equipment, will reduce the risk of costly emergency repairs, and will reduce the risk of unscheduled disruption of CRA deliveries.

Option #2

Do not proceed with the three projects at this time.

Fiscal Impact: None

Business Analysis: This option would forgo an opportunity to reduce the risk of unplanned outages of the CRA in the event of electrical component failure.

Staff Recommendation

Option #1


 _____ 5/27/2014
 Gordon Johnson Date
 Manager/Chief Engineer
 Engineering Services


 _____ 5/28/2014
 Jeffrey Nightlinger Date
 General Manager

Attachment 1 – Financial Statement

Attachment 2 – Location Map

Financial Statement for CRA Electrical Reliability Appropriation

A breakdown of Board Action No. 8 for Appropriation No. 15384 for three electrical rehabilitation projects on the CRA¹ is as follows:

	Previous Total Appropriated Amount (Oct. 2012)	Current Board Action No. 8 (June 2014)	New Total Appropriated Amount
Labor			
Studies & Investigations	\$ 378,000	\$ 293,000	\$ 671,000
Final Design	994,700	1,155,000	2,149,700
Owner Costs (Program mgmt., permitting, bidding)	1,360,100	386,000	1,746,100
Submittals Review & Record Drwgs	24,000	-	24,000
Construction Inspection & Support	1,930,500	-	1,930,500
Metropolitan Force Construction	2,030,500	-	2,030,500
Materials & Supplies	500,000	182,000	682,000
Incidental Expenses	109,300	-	109,300
Professional/Technical Services	110,000	-	110,000
Value engineering firm	-	48,000	48,000
Hazardous material testing	-	45,000	45,000
HDR Engineers	-	270,000	270,000
Equipment Use	29,000	-	29,000
Contracts	11,111,000	-	11,111,000
Remaining Budget	1,137,900 ²	181,000	1,318,900
Total	\$ 19,715,000	\$ 2,560,000	\$ 22,275,000

Funding Request

Appropriation Name:	CRA Electrical Reliability Appropriation		
Source of Funds:	Revenue Bonds, Replacement and Refurbishment or General Funds		
Appropriation No.:	15384	Board Action No.:	8
Requested Amount:	\$ 2,560,000	Budget Page No.:	69
Total Appropriated Amount:	\$ 22,275,000	Total Appropriation Estimate:	\$ 44,500,000

¹The is the initial appropriation for the CRA Power Cable Replacement, the CRA Over-Current Relay Replacement, and CRA UPS Replacement projects. The total estimated cost to complete the Power Cable Replacement project is anticipated to range from \$15 million to \$16 million. The total estimated cost to complete the CRA Over-Current Relay Replacement project is anticipated to range from \$1.5 million to \$1.8 million. The total estimated cost to complete the CRA UPS Replacement project is anticipated to range from \$1.9 million to \$2.3 million.

²Includes previous allocation of \$18,000 from remaining budget to the CRA Transformer Rehabilitation study for detailed analysis of replacement alternatives; and \$107,000 from remaining budget to the CRA Danby Tower Rehabilitation for differing site conditions encountered during construction.

Location Map

