



- Board of Directors  
*Engineering and Operations Committee*

9/10/2013 Board Meeting

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8-1

## Subject

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Appropriate \$5.1 million; and authorize: (1) preliminary design to rehabilitate prestressed concrete cylinder pipe (PCCP) portions of the Second Lower Feeder; (2) agreement with Black & Veatch for engineering services; (3) agreement with ICF International for preparation of environmental documentation; and (4) agreement with DHI, Inc. for a system-wide hydraulic model (Approp. 15471)

## Executive Summary

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This action initiates a capital program for long-term rehabilitation of the prestressed concrete cylinder pipe (PCCP) portions of the Second Lower Feeder. This program will line approximately 28 miles of that feeder with a steel liner. The work will be staged to minimize water delivery impacts to Metropolitan's member agencies, and will be completed within an 8- to 10-year period. This action also authorizes two professional services agreements for technical support, and an agreement to complete the development of a hydraulic model of Metropolitan's distribution system.

## Timing and Urgency

Over the last several decades, water agencies throughout the United States and several other countries have found that under certain conditions, PCCP lines have an elevated risk of failure versus other types of pipe. PCCP failures can be catastrophic and can occur without warning, compromising system reliability and resulting in significant costs due to interruption of service, unplanned major repairs, and potential third-party damages. In response to this risk, Metropolitan developed a comprehensive program in 1999 to inspect and manage all 163 miles of PCCP within the distribution system. One of the key strategies of this program has been to perform repairs on individual PCCP segments when they are identified as being in distress. While this approach has thus far prevented additional failures of PCCP segments, the repair costs have been relatively high per segment. In addition, there is no guarantee that other failures may not occur in the future, as the remaining PCCP segments continue to deteriorate.

In September 2011, Metropolitan's Board authorized the initial steps of the PCCP Rehabilitation and Replacement Program in order to develop a comprehensive, long-term plan for replacement or relining of Metropolitan's at-risk PCCP lines. Based on trends from 13 years of monitoring and urgent repairs to PCCP lines within the distribution system, staff has concluded that 63 miles of PCCP (22 feeders) appear stable. The remaining 100 miles of PCCP (five feeders) have deteriorated over time and are expected to continue to deteriorate. As a result, staff recommends that a proactive, long-term program to rehabilitate the five feeders be initiated and incorporated into Metropolitan's Capital Investment Plan (CIP). The first pipeline recommended to be addressed is the Second Lower Feeder due to that line's increasing deterioration, corrosive soils, third-party stray currents, high operating pressure, and history of repairs. Initiation of preliminary design at this time to reline the PCCP portions of the Second Lower Feeder will allow an orderly, planned rehabilitation effort to proceed while minimizing delivery impacts to member agencies.

This program has been reviewed with Metropolitan's CIP prioritization criteria, and is categorized as an Infrastructure Reliability project. Funding for this action is available within Metropolitan's capital expenditure plan for fiscal year 2013/14. Detailed reports on the PCCP repair and replacement program have been made to

the Engineering and Operations Committee in July and August 2013. Staff will return to the Board in early 2014 with a detailed plan for phasing the long-term rehabilitation of the remaining four PCCP feeders. See **Attachment 3** for additional information on Metropolitan's experience with PCCP lines.

### **Background**

The Second Lower Feeder delivers treated water from the Robert B. Diemer Water Treatment Plant in Yorba Linda to the Palos Verdes Reservoir in Rolling Hills Estates. The feeder was constructed in 1967 and is 39 miles long. Approximately 30 miles of the line are constructed of PCCP, with diameters ranging from 78 to 84 inches. The remainder of the line is constructed of welded steel pipe with a diameter of 84 inches. The Second Lower Feeder operates at pressures up to 340 pounds per square inch and passes through areas with highly corrosive soils. In addition, there are numerous underground utility lines, natural gas lines, and oil lines within the vicinity, which exposes the feeder to significant stray current interference. Its route follows major public streets as it extends through a highly urbanized area. The feeder crosses several freeways, several flood control channels, and an airport. In addition to supplying water to the Central Pool portion of Metropolitan's distribution system, the Second Lower Feeder has 11 service connections for deliveries to the cities of Long Beach, Los Angeles, and Torrance, the Central Basin Municipal Water District, and the Municipal Water District of Orange County.

The Second Lower Feeder has been inspected three times since 1999 using the electromagnetic inspection technique. To date, over 500 distressed PCCP segments have been identified, or approximately two miles of the 30-mile PCCP portion of the line. These distressed segments are spread throughout the length of the feeder. Between 1999 and 2002, Metropolitan repaired 231 segments or 4,620 feet of PCCP on the Second Lower Feeder. In July 2013, the Board authorized final design of urgent repairs which will line 6,400 feet of the feeder. Final design for these repairs is currently underway, along with fabrication of the liner pipe. The long-term rehabilitation program will address the remaining 28 miles of PCCP in the feeder.

The rehabilitation program for the Second Lower Feeder will be staged to address six reaches of the pipeline in sequence. Construction will take place over an 8- to 10-year period to minimize water delivery impacts to Metropolitan's member agencies. This strategy will improve reliability of the pipeline incrementally with the completion of each reach.

The planned rehabilitation work includes lining the existing PCCP segments with a steel liner designed as a stand-alone pipeline which can accommodate full internal and external pressures on the line. The annular space between the steel liner and the existing PCCP segments will be filled with concrete grout. Open excavations will be required to access the existing pipeline at approximately 2,000-foot intervals. New 40-foot long liner segments will be inserted at these locations, moved into position, and welded together. Approximately 80 access sites are planned along the 28 miles of feeder to be rehabilitated. Most of these access sites will be located in urban areas where tight-sheet shoring is necessary, and close coordination will be required with local agencies and the surrounding communities. Installation of line-sized sectionalizing valves and meters is planned to minimize hydraulic impacts to the feeder's flow capacity due to the reduction of the line's internal diameter. In addition, modifications to several interconnections with other feeders are planned to allow deliveries to continue to member agency service connections while the rehabilitation is underway.

The total cost to complete the rehabilitation of all PCCP portions of the Second Lower Feeder over the next ten years is anticipated to range from \$575 million to \$625 million.

### **Rehabilitation of PCCP Portions of the Second Lower Feeder – Preliminary Design Phase (\$5,100,000)**

Planned engineering activities to initiate the long-term rehabilitation of the Second Lower Feeder include: utilities research for potential repair access locations; assessment of right-of-way needs and temporary construction easements; evaluation of design alternatives; third-party value engineering reviews; hydraulic evaluation of alternate delivery options to service connections while construction is underway; development of a phasing program for construction; and initial permitting and outreach with local agencies. The preliminary design is recommended to be performed by Black & Veatch, as discussed below.

Preparation of environmental documentation will commence at this time in order to integrate that work with the program's preliminary design activities. Staff anticipates that an Environmental Impact Report (EIR) will be

required. A substantial amount of information will need to be compiled in order to identify potential environmental impacts. Preparation of the environmental documentation is recommended to be performed by ICF International, as discussed below.

Lining the existing PCCP segments with a steel liner will result in a reduced internal diameter for conveying water. In addition, the construction will involve isolating and shutting down individual reaches of the pipeline for several months at a time. Identification of alternate means of routing flows through the Central Pool to the member agency service connections, both during and after construction, will require a hydraulic model of the distribution system which allows multiple flow scenarios to be evaluated. Metropolitan's current hydraulic modeling tools provide a technically accurate means to evaluate individual pipelines and small sub-systems, but are not capable of running evaluations of the complex interaction of multiple pipelines within the Central Pool under various flow scenarios and operating conditions. The system-wide hydraulic model will be used to simulate flows through the Central Pool and assess alternate pipeline diameters, evaluate potential modifications to structures such as feeder interconnections and pressure control facilities, and consider the potential addition of pump stations. These assessments will enable staff to develop the most cost-effective means to rehabilitate the feeder while minimizing hydraulic impacts to member agencies. Development of the hydraulic model is recommended to be performed by DHI, Inc., as discussed below.

This action appropriates \$5.1 million and authorizes preliminary design phase activities for rehabilitation of the Second Lower Feeder. Requested funds include \$2.92 million for site investigations, technical development of the preliminary design, and preparation of a preliminary construction cost estimate; \$860,000 for preparation of environmental documentation; \$300,000 for technical oversight by Metropolitan staff, shutdown planning, consultations with resource agencies, and responses to comments received on the draft EIR; \$230,000 for project management and permitting; \$100,000 for third-party value engineering reviews; \$200,000 for hydraulic analyses using the new system-wide model described below; and \$490,000 for remaining budget. No funds are required for development of the hydraulic model. As discussed below, that effort was previously funded by Metropolitan's Board under a separate appropriation.

Staff will return to the Board in mid-2014 to certify the environmental document and authorize final design. Fabrication contracts for steel liner pipe are planned to be awarded in 2015, while the full-scale construction work is planned to commence in mid-2016.

#### **Engineering Services (Black & Veatch) – New Agreement**

Black & Veatch is recommended to perform preliminary design to rehabilitate PCCP portions of the Second Lower Feeder. The planned scope of work for the Black & Veatch agreement includes: conducting field and utility investigations; assessing temporary right-of-way needs; initiating permitting with local agencies; preparing conceptual drawings and a preliminary design report; and developing construction cost estimates. The estimated cost for these services is \$2.78 million. Black & Veatch was selected through a competitive process via Request for Qualifications (RFQ) No. 927. For this agreement, Metropolitan has established a Small Business Enterprise (SBE) participation level of 22 percent.

This action authorizes an agreement with Black & Veatch in an amount not to exceed \$2.78 million to perform preliminary design to rehabilitate PCCP portions of the Second Lower Feeder.

#### **Environmental Documentation (ICF International) – Amendment to Agreement**

ICF International is recommended to prepare environmental documentation for long-term rehabilitation of the Second Lower Feeder. The planned scope of work for the ICF International agreement includes: preparing environmental documents in compliance with the California Environmental Quality Act (CEQA); conducting technical analyses to evaluate potential project impacts associated with air quality, biology, noise, traffic, and cultural resources; and providing technical expertise and guidance on land use, municipal and county regulatory requirements, and state and federal environmental laws and regulations. The estimated cost for these services is \$800,000. ICF International was selected through a competitive process via RFQ No. 956. An agreement with ICF International was initially awarded by the General Manager following the July 2013 action by Metropolitan's Board which authorized urgent repairs on the Second Lower Feeder. Preparation of environmental documentation

for those repairs will be integrated into this scope of work. For this agreement, Metropolitan has established an SBE participation level of 18 percent.

This action authorizes an increase of \$800,000 to the existing agreement with ICF International, for a new not-to-exceed total of \$950,000, to prepare environmental documentation for rehabilitation of the PCCP portions of the Second Lower Feeder.

### **Hydraulic Modeling (DHI, Inc.) – New Agreement**

DHI, Inc. is recommended to develop the hydraulic model of Metropolitan's distribution system. This model will provide staff the capability to evaluate alternatives for maintaining deliveries to member agency service connections during and after rehabilitation of the Second Lower Feeder. Metropolitan previously initiated development of a hydraulic model in 2009 with DHI, Inc. under a pilot project. That pilot effort successfully produced a hydraulic model for a portion of the distribution system. At that time, staff elected to defer completion of the full system-wide model to focus on other high-priority projects. Due to the extensive modeling which will be required for the PCCP Rehabilitation and Replacement Program, staff recommends moving forward at this time to complete the system-wide model.

DHI, Inc. was originally selected to develop the model through a competitive process via Request for Proposals No. 675 under the Simulation and Modeling Assisted Real Time Operations (SMART Ops) capital project. Staff recently commissioned a third-party review of current hydraulic modeling technology and vendors, and concluded that the most cost-effective solution for developing a system-wide model at this time would be to complete the previously developed partial model. Under Metropolitan Administrative Code Section 8140(e), award of an agreement to DHI, Inc. to complete the model is appropriate, because conducting another selection process would not result in a competitive advantage.

The services planned to be provided by DHI, Inc. include completing the system-wide model to include features such as feeders, reservoirs, hydroelectric power plants, pressure control facilities, pressure relief structures, pump stations, and member agency service connections. The model will be tested and verified for accuracy using actual flow measurements recorded under varying operating scenarios. The estimated cost to develop the model is \$975,000. No funds are required to be appropriated for this work, as sufficient funds were previously appropriated under Appropriation No. 15397, the Control System Enhancement Program.

This action authorizes an agreement with DHI, Inc. in an amount not to exceed \$975,000 to develop a system-wide hydraulic model. No additional funds are required for this work.

### **Summary**

This action appropriates \$5.1 million; authorizes preliminary design to rehabilitate PCCP portions of the Second Lower Feeder; authorizes an agreement with Black & Veatch to provide engineering services; authorizes an agreement with ICF International to prepare environmental documentation; and authorizes an agreement with DHI, Inc. to develop a system-wide hydraulic model. This work has been evaluated and recommended by Metropolitan's CIP Evaluation Team, and funds have been included in the fiscal year 2013/14 capital expenditure plan.

This work is included within capital Appropriation No. 15471, the PCCP Rehabilitation and Replacement Program, which was initiated in 2011. With the present action, the total funding for Appropriation No. 15471 will increase from \$19.96 million to \$25.06 million. See [Attachment 1](#) for the Financial Statement and [Attachment 2](#) for the Location Map.

### ***Project Milestone***

November 2014 – Completion of preliminary design to rehabilitate PCCP portions of the Second Lower Feeder

### **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 overall activities involve the funding, studying, carrying out final design, and preparing and processing environmental documentation for the proposed action. These activities consist of basic data collection and resource evaluation activities that 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. In addition, the activities may involve a check for performance of an operation, or quality, health, or safety of a project. Accordingly, the proposed action qualifies for two categorical exemptions (Class 6, Section 15306 and Class 9, Section 15309 of the State CEQA Guidelines). In addition, the proposed action is not subject to CEQA because it involves 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 is categorically exempt (Class 6, Section 15306; and Class 9, Section 15309 of the State CEQA Guidelines). In addition, the fiscal aspect of the proposed action is not subject to CEQA (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 that the proposed action is categorically exempt and

- a. Appropriate \$5.1 million;
- b. Authorize preliminary design to rehabilitate PCCP portions of the Second Lower Feeder;
- c. Authorize agreement with Black & Veatch in an amount not to exceed \$2.78 million to provide engineering services;
- d. Authorize increase of \$800,000 to the agreement with ICF International, for a new not-to-exceed total of \$950,000, to prepare environmental documentation; and
- e. Authorize agreement with DHI, Inc. in an amount not to exceed to \$975,000 to develop a system-wide hydraulic model.

**Fiscal Impact:** \$5.1 million in capital funds under Approp. 15471

**Business Analysis:** This project will protect Metropolitan's assets; enhance delivery reliability to member agencies; complete critical pipeline repairs in a planned, proactive, and cost-effective manner; and reduce the risk of emergency repairs of PCCP lines.

### Option #2

Do not authorize preliminary design for long-term rehabilitation of the Second Lower Feeder.


**Fiscal Impact:** None

**Business Analysis:** This option would forego an opportunity to enhance reliability and extend the service life of PCCP portions of the Second Lower Feeder. This option could lead to higher repair costs, more extensive repairs, and additional unplanned shutdowns.

**Staff Recommendation**

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Option #1

  
\_\_\_\_\_  
Gordon Johnson  
Manager/Chief Engineer,  
Engineering Services

8/19/2013  
Date

  
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Jeffrey Nightlinger  
General Manager

8/22/2013  
Date

**Attachment 1 – Financial Statement**

**Attachment 2 – Location Map**

**Attachment 3 – Background on Metropolitan’s PCCP Rehabilitation and Replacement Program**

Ref# es12625815

## Financial Statement for PCCP Replacement and Rehabilitation Program

A breakdown of Board Action No. 6 for Appropriation No. 15471 for rehabilitation of PCCP portions of the Second Lower Feeder<sup>1</sup> is as follows:

	<b>Previous Total Appropriated Amount (July 2013)</b>	<b>Current Board Action No. 6 (Sep. 2013)</b>	<b>New Total Appropriated Amount</b>
Labor			
Studies & Investigations	\$ 1,282,000	\$ 340,000	\$ 1,622,000
Final Design	1,262,000	-	1,262,000
Owner Costs (Program mgmt., permitting, right-of-way, outreach)	1,354,000	590,000	1,944,000
Submittals Review & Record Drwgs	157,000	-	157,000
Inspection & Support	812,000	-	812,000
Metropolitan Force Construction	3,924,000	-	3,924,000
Materials & Supplies	868,000	-	868,000
Incidental Expenses	142,800	-	142,800
Professional/Technical Services	4,288,000	-	4,288,000
Black & Veatch	-	2,780,000	2,780,000
ICF International	150,000	800,000	950,000
Value engineering firm	-	100,000	100,000
Equipment Use	10,000	-	10,000
Contracts	4,292,803	-	4,292,803
Remaining Budget	1,417,397	490,000	1,907,397
<b>Total</b>	<b>\$ 19,960,000</b>	<b>\$ 5,100,000</b>	<b>25,060,000</b>

### Funding Request

<b>Program Name:</b>	PCCP Replacement and Rehabilitation Program		
<b>Source of Funds:</b>	Revenue Bonds, Replacement and Refurbishment or General Funds		
<b>Appropriation No.:</b>	15471	<b>Board Action No.:</b>	6
<b>Requested Amount:</b>	\$ 5,100,000	<b>Capital Program No.:</b>	15471
<b>Total Appropriated Amount:</b>	\$ 25,060,000	<b>Capital Program Page No.:</b>	314
<b>Total Program Estimate:</b>	\$ 68,529,000	<b>Program Goal:</b>	I-Infrastructure Reliability

<sup>1</sup> This is the initial action for long-term rehabilitation of the Second Lower Feeder. The total cost to complete the rehabilitation of PCCP portions of that feeder is anticipated to range from \$575 million to \$625 million.

# Distribution System





## **BACKGROUND ON METROPOLITAN'S PCCP REHABILITATION AND REPLACEMENT PROGRAM**

Metropolitan's water delivery system includes approximately 830 miles of pipelines, of which 163 miles are comprised of prestressed concrete cylinder pipe (PCCP). There are PCCP reaches within 27 feeders, with diameters ranging from 54 inches to 201 inches. The PCCP lines were installed between 1965 and 1985. A map of the PCCP feeders appears in Figure 1.

PCCP is a composite-walled pipe which consists of a steel cylinder that is spirally wound with high-strength steel prestressing wire. The wire is tightly wrapped around a concrete core in a cement slurry bed and is then coated with cement mortar, which serves as the finished outer surface. The strength of PCCP is provided in large measure by the prestressing wires. PCCP's vulnerability stems from the potential for its prestressing wires to deteriorate under certain conditions over time. Continued deterioration of the wires will lead to their eventual breakage. Broken prestressing wires can significantly reduce the strength of a PCCP line. PCCP pipe failure can be catastrophic, as there is typically little or no warning when failure of a pipe segment is imminent. The sudden failure of a PCCP segment may result in significant costs due to interruption of service, unplanned major repairs, and potential third-party damages.

Beginning in 1999, following a sudden rupture of the Allen-McColloch Pipeline, Metropolitan developed a comprehensive program to inspect and manage all 163 miles of PCCP within the distribution system. The management strategy for PCCP lines has been to aggressively inspect the lines, perform regular corrosion surveys, install cathodic protection where needed, and make repairs to individual PCCP segments when they are identified as being in distress. Since 1999, Metropolitan has inspected all 163 miles of PCCP lines at least three times with a state-of-the-art technique referred to as electromagnetic (or remote eddy current) inspection. This non-destructive inspection technique can identify broken prestressing wires within the pipe wall of a PCCP segment. On numerous occasions over the last decade, urgent repairs of PCCP segments have been performed based on the results of these inspections when they identified individual segments as having an elevated risk of failure. While this approach has thus far prevented additional failures of PCCP lines, the repair costs have been relatively high per segment. In addition, this approach does not address the continued long-term deterioration of the remaining portions of the PCCP lines.

In September 2011, Metropolitan's Board authorized the initial steps of the PCCP Rehabilitation and Replacement Program in order to develop a comprehensive, long-term plan for replacement or relining of Metropolitan's at-risk PCCP lines. During the 2012/13 shutdown season, staff completed the third cycle of electromagnetic testing of all 163 miles of PCCP within the distribution system. Portions of some PCCP feeders which appear to be at risk have been inspected on additional occasions. Based on the data collected over 13 years of these inspections and on the urgent repairs performed on PCCP lines, trends can be detected in the stability of these lines. Of the 27 feeders which contain reaches of PCCP, 22 of the feeders appear to be stable. The length of PCCP in these 22 lines is approximately 63 miles.

A total of 100 miles of PCCP on five feeders (the Second Lower Feeder, Sepulveda Feeder, Rialto Feeder, Calabazas Feeder, and Allen-McColloch Pipeline) have deteriorated over time, are subject to conditions which can degrade PCCP segments, and are expected to continue to deteriorate. As a result, staff recommends that a proactive, long-term program to rehabilitate these five feeders be initiated and incorporated into Metropolitan's CIP. Based on continued monitoring of the remaining 22 PCCP feeders in the distribution system, staff may recommend that portions of those pipelines also be rehabilitated in the future.

Moving forward, staff's revised approach for management of PCCP lines is recommended to be:

- Reline or replace the entire PCCP portions of the feeders instead of individual PCCP segments.
- Continue regular electromagnetic inspections until the long-term rehabilitation work has been completed. New data and trends will allow the priority and sequence of rehabilitation work to be adjusted as necessary.

- Install cathodic protection systems where necessary. These systems are used to protect both PCCP and welded steel pipelines from corrosion due to stray currents.
- Perform urgent repairs of PCCP segments if the repairs are needed prior to the scheduled rehabilitation of an entire feeder. As much as possible, the urgent repairs will be consistent with the long-term rehabilitation effort.

The first PCCP line recommended to be rehabilitated is the Second Lower Feeder. This line is subject to corrosive soils and third-party stray currents, has a high operating pressure, and continues to deteriorate. Several major repairs have been performed on this pipeline since 1999. The present action authorizes preliminary design phase activities, including preparation of environmental documentation, for long-term rehabilitation of the Second Lower Feeder.

Figure 1  
Metropolitan's PCCP Feeders

