

# Waterworks System Improvements



Wachusett Reservoir

# **Integrated Water Supply Improvement Program**

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MWRA's Integrated Water Supply Improvement Program is an initiative consisting of a series of projects to protect reservoir watersheds, build new water treatment and transmission facilities, upgrade distribution storage and MWRA and community pipelines and interim improvements to the Metropolitan Tunnel system redundancy. The program improves each aspect of the water system from the watersheds to the consumer to ensure that high quality water reliably reaches MWRA customers' taps. The program began in 1995 with the initial components which were completed by 2005 and the program remains active as the scope was expanded to continue to improve the water system. The main program components are as follows:

**Watershed Protection** The watershed areas around Quabbin and Wachusett Reservoirs are pristine areas with 85% of the land covered in forest or wetlands and about 75% protected from development by direct ownership or development restrictions. MWRA works in partnership with the Department of Conservation and Recreation (DCR) to manage and protect the watersheds. MWRA also finances all the operating and capital expenses for the watershed activities of DCR and on-going land acquisition activities.

**MetroWest Water Supply Tunnel** The 17-mile-long 14-foot diameter tunnel connects the new Carroll Water Treatment Plant at Walnut Hill in Marlborough to the greater Boston area. It is now working in parallel with the rehabilitated Hultman Aqueduct to move water into the metropolitan Boston area. Construction began on the tunnel in 1996 and the completed tunnel was placed in service in October 2003.

**Carroll Water Treatment Plant** The water treatment plant in Marlborough began operating in July 2005 and it has a maximum day capacity of 405 million gallons per day. This project consolidates all treatment steps into one plant which uses ozone for primary disinfection because ozone is a strong disinfection agent against pathogens such as Giardia and viruses while reducing levels of chlorine disinfection byproducts. Ultraviolet light treatment was added in 2014 as a second primary disinfection process for Cryptosporidium inactivation. The plant also provides corrosion control by adding carbon dioxide and sodium carbonate to raise the water's pH and alkalinity and thus control lead leaching from home plumbing fixtures. The treatment process concludes with fluoridation and residual disinfection with chloramines. A 45 million gallon storage tank on the site allows for daily variation in demand and flexibility in plant operation.

**Water Storage Tanks** As required by Massachusetts Department of Environmental Protection (DEP) rules, MWRA is building covered storage tanks to replace open distribution storage reservoirs near cities and towns to lessen the risk that contaminants will get into the tap water. A 20 million gallon tank in Stoneham replaced the open Fells Reservoir, two 12.5 million gallon circular tanks in Ludlow replaced the Nash Hill Reservoir and the 20 million gallon Loring Road tank replaced the Weston Reservoir. The largest tank, the 115 million gallon Norumbega Covered Storage Facility replaced the open Norumbega Reservoir in Weston and was placed in full service in 2004. In 2009, MWRA completed construction of a 20 million gallon tank to replace the currently off-line Blue Hills Reservoir in Quincy. The 20 million gallon Spot Pond Storage Facility replaced the off-line Spot Pond Reservoir in Stoneham and was put in service in 2015.

**Pipeline Rehabilitation** An important component of the overall Integrated Water Supply Improvement Program is focus on the long-term rehabilitation of older, unlined cast iron and steel water mains in the MWRA and community systems. Water in direct contact with the metal surface corrodes through both biological and chemical processes resulting in tuberculation, thus narrowing the pipes and providing surfaces for bacteria growth. These processes also often result in consumer complaints about rusty water. To reap the full value of the other investments in the water system, MWRA decided to replace or rehabilitate the poor quality pipe particularly given that as of 1993, more than 80 percent of MWRA pipes were unlined. Since then, MWRA has been proceeding with a program of replacing or rehabilitating (normally through cleaning and lining) unlined cast iron and steel mains. Furthermore, in 1998, almost half (47%) of community pipes were unlined. In 1999, MWRA created a \$250 million zero-interest loan program to encourage and facilitate rehabilitation of local mains. An additional \$210 million was added in FY11 for

the Phase 2 program known as Local Water System Assistance Program of which \$10 million is allocated among the Chicopee Valley Aqueduct (CVA) communities. The Local Water System Assistance Program was expanded beginning in FY17 to include \$100 million in interest-free loans to communities solely for efforts to fully replace lead service lines. In FY18 Local Water Assistance Program Phase 3 was added in the amount of \$278 million and Phase 3 CVA for \$14 million. The Local Water System Assistance Program was expanded beginning in FY17 to include \$100 million in interest-free loans to communities solely for efforts to fully replace lead service lines. The Lead Service Line Replacement Loan Program is budgeted over twenty years.

**Metropolitan Tunnel System Redundancy – Interim Improvements** Plans for interim improvements to reduce the risk of failure and improve system operating conditions in the event that an emergency occurs are underway. The projects include the Top of Shafts Interim Improvements, Chestnut Hill Emergency Pump Station improvements, Chestnut Hill Emergency Generator, WASM/SPSM PRV Improvements and rehabilitation of WASM 3. These projects will be completed while the proposed tunnel redundancy project goes through environmental review, design, and construction.

**Metropolitan Tunnel System Redundancy** The Metropolitan Tunnel System includes the City Tunnel (1950), the City Tunnel Extension (1963), and the Dorchester Tunnel (1976). Together, these tunnels carry approximately 60% of the total system daily demand with no redundancy. The tunnels and shafts represent a low risk of failure. However, many of the valves and piping at the surface are in need of repair or replacement. Failure of some valves could cut off a majority of the system's capacity to supply water and have not been exercised for fear of failing in a closed position. These valves should be, but cannot be, replaced because shut down of the City Tunnel would be required. The Metropolitan Tunnel Redundancy program consists of two deep rock tunnels beginning at the same location in Weston near the Massachusetts Turnpike/Route 128 interchange. The 4.5-mile Northern Tunnel generally follows the route of MWRA's existing Weston Aqueduct Supply Main (WASM) 3 transmission main to a point about midway along the pipeline near the Waltham/Belmont border, which will allow flow in WASM 3 in both directions. The 9.5-mile Southern Tunnel runs east to southeast to tie into the surface connections at Shaft 7C of the Dorchester Tunnel. After the tunnels are constructed, the existing tunnels can be removed from service for rehabilitation. The Metropolitan Tunnel Redundancy Program is currently at the very early stages of planning and design. The organizational framework to manage the program within MWRA is in place in the form of the Tunnel Redundancy Department. Program Support Services contract began in April 2019 and the Preliminary Design and MEPA Review contract was awarded in May 2020.

## S. 542 Carroll Water Treatment Plant

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### Project Purpose and Benefits

- Contributes to improved public health*
- Fulfills a regulatory requirement*

*To provide high quality drinking water to MWRA customers and to ensure that the water delivered from the Wachusett Reservoir meets the drinking water quality standards established by the federal Safe Drinking Water Act (SDWA). Part of this objective was met by constructing a 405 million-gallon per day (maximum) water ozonation/chloramination treatment plant primarily in Marlborough with portions of the facility located in Southborough and Northborough. Ultraviolet light disinfection facilities were added in 2014 to comply with new drinking water regulations.*

### Project History and Background

MWRA provides drinking water to 2.3 million people in 42 metropolitan Boston communities. The source water supply comes from the Quabbin and Wachusett reservoirs; two large, high quality water bodies in Central Massachusetts. About 50% of the water flowing from the Wachusett Reservoir comes first from the Quabbin Reservoir, the larger reservoir to the west. MWRA received a waiver from filtration requirements for the Quabbin Reservoir in 1991 from the Massachusetts Department of Environmental Protection (Mass DEP), the agency granted primacy to enforce the Safe Drinking Water Act (SDWA) by the United States Environmental Protection Agency (USEPA) in Massachusetts.

In June 1993, MWRA negotiated an administrative consent order with DEP setting forth the steps needed to comply with the Surface Water Treatment Rule (SWTR). The consent order required MWRA to find a site, design a filtration plant, and build it, unless MWRA along with MDC could demonstrate to Massachusetts DEP no later than 1998 that the system met the criteria for avoiding filtration and therefore that filtration was not required. After an extensive research and decision-making process, the MWRA Board of Directors voted in October 1998 to request a waiver of the filtration requirements from Mass DEP and to build a new water treatment facility using ozonation with chloramination for the water from Wachusett Reservoir as part of the Integrated Water Supply Improvement Program. The decision recognized that an ozonation/chloramination plant would provide appropriate treatment of the MWRA water supply from Wachusett Reservoir and that adding filtration components costing \$180 million to the new plant would not provide as much additional benefit as using funds to rehabilitate old, unlined cast iron pipes in the MWRA and local distribution systems. As part of the treatment technology decision, MWRA's Board also made a commitment to an expanded program of public health surveillance, financial incentives for communities to target rehabilitation of community pipes, and a full review of the need for further treatment including filtration when the plant was complete.

Mass DEP agreed with the MWRA approach in December 1998 and determined that filtration was not required for the MWRA system. Through the Department of Justice, USEPA sued under its SDWA "overfiling" rights, seeking to require MWRA to build a filtration plant and contending that the SDWA allowed no other option. After an extended trial, on May 5, 2000 Judge Stearns issued his decision that MWRA currently complies with all 11 federal criteria for avoiding filtration under the Surface Water Treatment Rule of the Safe Drinking Water Act. He evaluated the current quality of MWRA water and found MWRA's integrated drinking water improvement program including ozonation treatment technology the better approach to "preserving its safety." He found EPA failed to show that filtration of MWRA water was required either as a matter of cost-benefit or scientific necessity. The judge denied EPA's request for injunctive relief but ordered MWRA to give the Court notice of any future violations of the avoidance criteria to allow the consideration of whether the type of relief requested by USEPA might be necessary. No other order was issued. On July 16, 2001, the U.S. Court of Appeals for the First Circuit affirmed Judge Stearns ruling.

The Carroll Water Treatment Plant (formerly Walnut Hill Treatment Plant) was placed in service in July 2005. It provides treatment necessary to fully comply with all current drinking water regulations. EPA issued new regulations in January 2006 for microbial protection (Long Term 2 Enhanced Surface Water Treatment Rule) and disinfection byproduct control (Stage 2 Disinfectants/Disinfection Byproducts Rule). MWRA will not need to make changes to comply with the Stage 2 D/DBP rule. The LT2ESWT rule required a second primary disinfectant and a somewhat more stringent inactivation of cryptosporidium than the plant's current design. This project included the addition of an ultraviolet light disinfection treatment process at the plant to meet requirements of the LT2ESWT rule. The UV system was placed in service in February 2014.

### Scope

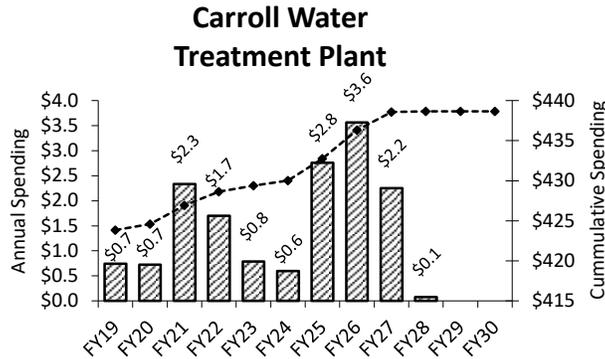
Sub-phase	Scope	Status
Study 1	Investigation of the potential impacts of SDWA amendments on the MWRA system and evaluation of the need, feasibility, and benefits of improved treatment processes.	Completed
Study 2	Evaluation of alternative filtration, disinfection, and corrosion control processes to determine the most appropriate for MWRA source waters. Construction and operation of a pilot plant at the Wachusett Reservoir to allow testing of various treatment technique combinations. Identification of potential locations for treatment facilities.	Completed
AWWARF Red Water Control Strategy Study	Evaluation of treatment options for eliminating discolored water caused by unlined cast-iron pipe. Also investigation of the fundamental aspects of iron chemistry and corrosion using unlined cast-iron pipe from the MWRA community distribution system.	Completed
Emergency Distribution Reservoir Water Management Study	Investigation of potential impacts on the emergency distribution reservoirs resulting from their replacement by new covered distribution reservoirs, and study of ways to maintain their water quality for emergency supply. Norumbega, Weston, Spot Pond, Fells, and Blue Hills Reservoirs have been studied. A pilot study was conducted to evaluate in-reservoir algae treatment for Wachusett Reservoir.	Completed
<i>Cryptosporidium</i> Inactivation Study	Determination of the site-specific efficacy of inactivating <i>Cryptosporidium</i> in Wachusett Reservoir source water using disinfectant alternatives (chlorine/chloramine and ozone/chloramine), and then development of design criteria for the full-scale disinfection contacting system.	Completed
Construction: Cosgrove Disinfection Facility Phases I and II	Construction of the Cosgrove Disinfection Facility. Free chlorine is applied at the Cosgrove Aqueduct to utilize travel time to achieve primary disinfection prior to corrosion control treatment and secondary disinfection.	Completed
Immediate Disinfection-MECo	Massachusetts Electric Co. power line installation to support the disinfection process at the Cosgrove Disinfection Facility.	Completed
Distribution Water Consultant	To provide technical assistance related to distribution system management.	Completed
EIR/Conceptual Design	Environmental reviews, data collection and analyses, and facility designs to support the dual track compliance approach, evaluation of design criteria, site plans, plant hydraulics, and construction of a small-scale demonstration water treatment plant.	Completed

<b>Sub-phase</b>	<b>Scope</b>	<b>Status</b>
Design/CS/RI: Walnut Hill WTP	Design and Engineering Services During Construction for the water treatment plant and associated components.	Completed
WHCP1: Wachusett and Cosgrove Intakes	Upgrade of the Cosgrove Intake and powerhouse to allow automatic, unstaffed operation of the facility. Replacement of the valves and piping in the Wachusett Intake is required to allow this facility to serve as a backup water supply.	Completed
WHCP2: Interim Aqueduct Rehabilitation	Shotcrete lining of the Wachusett Aqueduct to ensure supply of water continues to greater Boston during modifications to Shaft C and to enable it to serve as a backup to the Cosgrove Tunnel.	Completed
WHCP3: Site Work and Storage Tank	Includes clearing and excavation, site access roads, yard piping, and construction of a 45-million gallon storage tank.	Completed
WHCP4: Treatment Facilities	Construction of ozonation, corrosion control, chloramination operations and emergency generator buildings, modifications to Shafts B and C, and installation of system wide instrumentation from Wachusett Reservoir to Norumbega Reservoir.	Completed
WHCP6: Late Site Work	Final grading, landscaping, and paving of treatment facility site.	Completed
Design & Construction WHCP7: Existing Facilities Modifications	Modification to and conversion of the Interim Corrosion Control Facility, Cosgrove Disinfection Facility, Transmission Maintenance Facility. These buildings will be converted from water treatment/quality uses to expanded maintenance shops and SCADA technicians shop facilities for the new water treatment plant. In addition, the project includes demolition of old electrical building, some miscellaneous items at Cosgrove Intake Building, conversion of Cosgrove Disinfection Facility to a Boat Storage Facility and replacement of the roof, lab improvements and HVAC system for Water Quality Lab at Southboro. Also, buildings rehab will incorporate achievable LEED (Leadership on Energy & Environmental Design) goals.	Active
Design Management Support	Professional services and value engineering support to MWRA in review of the water treatment plant design.	Completed
Construction Management/RI	Construction management and resident inspection during construction of the water treatment plant.	Completed
Cosgrove Disinfection Facility Underwater Improvements	Installation of underwater piping needed to apply sodium hypochlorite at Shaft A.	Completed
Community Chlorine Analyzers	Purchase of free chlorine residual analyzers for eight communities to work in association with interim chloramination facilities.	Completed
OCIP	Owner Controlled Insurance Program, providing pollution liability, workers' compensation, general liability, and excess loss coverage during construction of the CWTP.	Completed
Professional Services	As needed legal, insurance, design, and construction specialty services for the Carroll Water Treatment Plant.	Completed
Marlborough MOA	Agreement to mitigate the impacts of the construction of the Carroll Water Treatment Plant on Marlborough.	Completed
WHWTP – MECo	Relocation of electric power lines.	Completed
Site Security Services	Site security services at the Carroll Water Treatment Plant.	Completed

Sub-phase	Scope	Status
CSX Crossing	Railroad track improvements adjacent to CWTP.	Completed
Wachusett Algae Design and Construction	Design and Construction of automated chemical dispensing system for algae control.	Future
Public Health Research	With the assistance of public health agencies and researchers, evaluation of the public health impact of the water treatment changes that occurred in 2004.	Completed
Security Equipment	Design and installation of card access, improved motion and intrusion alarm systems, video surveillance, and monitoring equipment for MWRA facilities.	Completed
WHCP8– Cosgrove Screens Design/CS/RI and Construction	Replace existing manual screens with finer automatically controlled traveling screens.	Completed
AWWARF-Evaluation Ozone and UV	Study of the effects of ozone and ultraviolet treatment on cryptosporidium to ensure inactivation in Wachusett Reservoir.	Completed
Fitout/Construction	Non-construction related items for start-up and operation of the new water treatment plant including furnishings, shop and maintenance equipment, audio/visual supplies, laboratory equipment, and miscellaneous consumable supplies.	Completed
Carroll Ultra Violet Disinfection Design, and Construction	Design and construction programs to add Ultra Violet (UV) to the CWTP. UV system placed into service in February 2014.	Completed
As-Needed Technical Assistance No. 1 and No. 2	As-needed design services to support the start-up of the CWTP including electrical engineering, HVAC engineering, mechanical engineering, civil engineering and a variety of geotechnical, environmental, and architectural technical assistance.	Completed
Ancillary Modifications Construction 1	Follow-up construction from the As-Needed Technical Assistance contracts.	Completed
Ancillary Modifications Construction 2	Address improvements in reliability, optimization of plant performance and/or reduce plant operating costs.	Active
Ancillary Mods Design 3 and 4	Additional As-Needed design services as a follow-up for additional improvements at the Carroll Water Treatment Plant.	Completed
Technical Assistance No. 5 and #6	Continuation of as-needed engineering technical assistance for ancillary modifications design and plant optimization.	Completed
Carroll Water Treatment Plant Storage Tank Roof Drainage System Repair	Design and construct a solution that addresses trench drainage system's poor performance. Poor roof drainage could possibly result in water quality problems.	Future
Technical Assistance No. 7 and No. 8	Continuation of as-needed engineering technical assistance for ancillary modifications design and plant optimization.	Completed
Technical Assistance No. 9 and No. 10	Continuation of as-needed engineering technical assistance for ancillary modifications design and plant optimization.	Active
<b>Technical Assistance No. 11 and No. 12</b>	<b>The next two phases of as-needed engineering technical assistance for ancillary modifications design and plant optimization.</b>	<b>Future</b>

**Expenditure Forecast (in \$000s) and Project Status**

Total Budget	Payments thru FY19	Remaining Balance	FY20	FY21	FY19-23	FY24-28	Beyond FY28
\$438,652	\$423,860	\$14,791	\$725	\$2,331	\$6,285	\$9,250	\$0



Project Status 5/20	96.8%	Status as % is approximate based on project budget and expenditures. Closed Loop Cooling System, a contract of Ancillary Modifications Construction 2 subphase, was substantially complete in April 2010. Second Gaseous Oxygen Line was substantially complete in May 2012. Wachusett Emergency Connection Valves reached substantial completion in August 2013. Carroll Ultraviolet Disinfection Facility Construction reached substantial completion in February 2014. Existing Facilities Modifications CP-7 Southborough Water Quality Laboratory Upgrades was substantially complete in November 2016 and Marlborough Maintenance Facility was substantially complete in July 2018. Technical Assistance 7 was completed in November 2015. Technical Assistance 8 was completed in June 2018 and 9 and 10 commenced in July 2018. Technical Assistance 11 and 12 are expected to commence in January 2021.
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**Changes to Project Scope, Budget, and Schedule**

Project Cost			Scheduled Completion Date			FY19-23 Spending		
FY20	FY21	Chge.	FY20	FY21	Chge.	FY20	FY21	Chge.
\$436,138	\$438,652	\$2,514	Dec-26	Dec-26	None	\$3,772	\$6,285	\$2,513

**Explanation of Changes**

- Project cost and spending changed primarily due to new projects that were added for As-Needed Technical Assistance 11 and 12, and updated cost estimates for Ancillary Modifications Construction 2 and Existing Facilities Modifications Construction 7.

**CEB Impact**

- Expect \$100,000 in FY28 for utilities for the Wachusett Algae Facility.

## S. 555 Carroll Water Treatment Plant Asset Protection

### *Project Purpose and Benefits*

- Contributes to improved public health*
- Extends current asset life*
- Improves system operability and reliability*
- Fulfills a regulatory requirement*

*To protect the investment of MWRA ratepayers by ensuring timely replacement of equipment and systems.*

### **Project History and Background**

The John J. Carroll Water Treatment Plant has been in service since 2005. Some components of the plant are approaching the end of their service lives while others will need replacement in the future. This project was developed to ensure that MWRA maintains ongoing service while optimizing operations in its water facilities. This project in its current form addresses immediate critical facility and equipment issues.

While the current schedule indicates a completion date of 2034 for construction, the CWTP Facility Asset Protection project will be ongoing throughout the useful life of the facilities.

### **Scope**

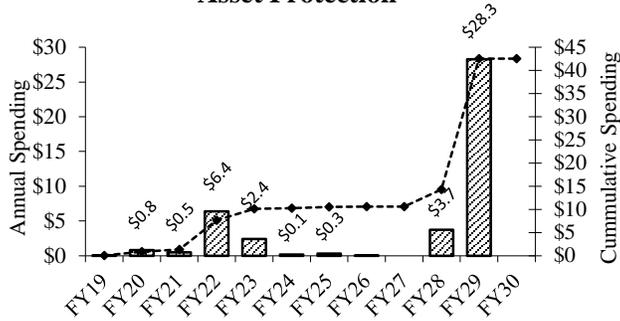
<b>Sub-phase</b>	<b>Scope</b>	<b>Status</b>
Carroll Water Treatment Plant Asset Protection Study (7593)	A consultant's evaluation of CWTP's capital assets and recommendations for upgrades or modifications to ensure operational efficiency of these assets.	Future
LOX Yard Redundancy (7594)	Provide new piping, valves, vaporizer and/or additional liquid oxygen storage to eliminate single points of failure in the CWTP Liquid Oxygen Yard.	Future
Carroll Water Treatment Plant Water Pump Variable Frequency Drives Replacement (7595)	The variable frequency drives on the CWTP Plant Water System are 13 years old and should be replaced in the near future. The normal life of VFDs is shorter than the pumps they control. It is unlikely that the existing VFDs will be operable until 2030 when the plant water pumps are scheduled to be replaced.	Future
Ozone Generator Re-Build (7596)	Periodic re-building of the ozone generators, including cleaning and gasket replacement, is necessary to maintain proper operation.	Future

<b>Sub-phase</b>	<b>Scope</b>	<b>Status</b>
Soda Ash & Ammonia Equipment Replacement (7598)	Replace the existing soda ash feed equipment to maintain operability.	Future
Carroll Water Treatment Plant Chemical System Pipe Pumps, and Tank Replacement (7597)	The condition of the plant chemical system components varies. There have been leaks in the hypochlorite pipes and tanks. The ammonia, bisulfite and fluoride feed systems are aging. This project will rehabilitate these systems as needed.	Future
HVAC Equipment Replacement (7605)	The HVAC equipment at CWTP is over 10 years old. The refrigerant used in this equipment (R-22) is being phased out. The existing equipment will not function with the new refrigerant. Replacement of this equipment will be necessary.	Future
Water Pump Replacement (7606)	The plant water pumps will need to be replaced in the future as they approach the end of their useful life. The current schedule is to replace these pumps by 2030.	Future
Ozone Generator Replacement (7607)	The ozone generators are currently scheduled to be rebuilt in 2022. Eventually spare parts will no longer be available. The current schedule is to replace the ozone generators by 2030.	Future
Ultra Violet Reactor Replacement (7608)	Replacement of the UV reactors will likely be required by 2034 as spare parts for the existing units may no longer be available then.	Future
Carroll Water Treatment Plant Control Room Fire Suppression System (7592)	Replace the existing wet fire sprinkler system in the CWTP Control Room, Communications Room, Electrical Room and Emergency Operations Center with a clean agent type system that does not use water to suppress a fire.	Future
CWTP Emergency Generator No. 1 Replacement (7642)	Replace the generator/alternator on emergency generator No. 1 due to failure.	Active
<b>Corrosion Control Pipe Loop Study (7737)</b>	<b>Conduct a corrosion control study using a pipe loop at the Carroll Water Treatment Plant to evaluate alternatives for Lead and Copper rule compliance.</b>	<b>Future</b>

**Expenditure Forecast (in \$000s) and Project Status**

<b>Total Budget</b>	<b>Payments thru FY19</b>	<b>Remaining Balance</b>	<b>FY20</b>	<b>FY21</b>	<b>FY19-23</b>	<b>FY24-28</b>	<b>Beyond FY28</b>
\$42,563	\$26	\$42,536	\$800	\$487	\$10,092	\$4,200	\$28,271

### Carroll Water Treatment Plant Asset Protection



Project Status 5/20	1.8%	Status as % is approximation based on project budget and expenditures.
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#### Changes to Project Scope, Budget, and Schedule

Project Cost			Scheduled Completion Date			FY19-23 Spending		
FY20	FY21	Chge.	FY20	FY21	Chge.	FY20	FY21	Chge.
\$41,208	\$42,563	\$1,355	Oct-34	Oct-34	None	\$9,062	\$10,092	\$1,030

#### Explanation of Changes

- Project cost changed due to updated cost estimates for Carroll Water Treatment Plant Chemical System Pipe Pumps Replacement, Soda Ash and Ammonia Equipment Replacement and new project added for Corrosion Control Pipe Loop Study.
- Spending changed primarily due to updated cost estimates and new project listed above and accelerated schedule for Carroll Water Treatment Plant Control Room Fire Suppression System.

#### CEB Impacts

- None identified at this time.

## S. 597 Winsor Station/Pipeline Improvements

### Project Purpose and Benefits

Extends current asset life  Results in a net reduction in operating costs

**Master Plan Project  2008 Priority Rating 1 (See Appendix 3)**

*Rehabilitation of the water supply infrastructure at the Winsor Station in Belchertown. Design and construct station piping improvements which would allow water to go to the Swift River without going through the isolation valve. Design and construct means to control flow in the Quabbin Aqueduct. Quabbin Release Pipeline work is also included.*

### Project History and Background

Winsor Dam impounds the Quabbin Reservoir. At the dam, an intake feeds two conduits that are interconnected at a powerhouse below the dam. One conduit discharges to the Chicopee Valley Aqueduct; the other conduit feeds a now inoperative hydroelectric turbine/generator unit. A bypass valve at the Winsor Station house also allows flow to be discharged directly to the Swift River.

The water supply infrastructure within the Winsor Station is in need of major repair and upgrade as much of it is over 75 years old. Several other sub-phases are needed to address the extensive work on the Quabbin Transmission System and the Swift River bypasses. These sub-phases include:

- Winsor Station Chapman Valve Repair & Purchase of Sleeve Valves - Immediate replacement of the existing damaged Chapman Valve with sleeve valves.
- Pipeline Replacement Phase 1 – To repair and upgrade large-diameter piping and valving in the basement of the Winsor Station including the bypasses.
- Quabbin Aqueduct – To replace the antiquated and unreliable shutter system at Shaft 12 with a gate to control flow in the Quabbin Aqueduct and inspect the Quabbin Tunnel and recommend maintenance or repairs. Make repairs to the Shaft 12 building and Shaft 2.
- Winsor Power Station Upgrades -. Rehabilitate Winsor Power Station and the CVA Intake Structure.
- Hatchery Pipeline- To convey cold, well-oxygenated hypolimnetic water from Quabbin Reservoir to the downstream trout hatchery, a hydro turbine is located in a vault near the connection of the pipeline to the CVA that captures some of the hydraulic energy contained in the pipeline as the water is conveyed to the hatchery. The power generated is sold back to the grid.

### Scope

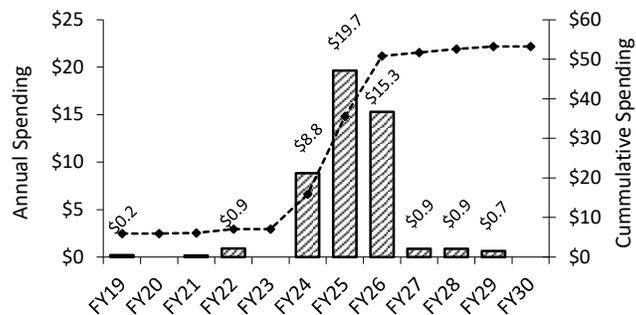
Sub-phase	Scope	Status
Quabbin Aqueduct & Winsor Power Station Preliminary Design (7114)	Preliminary design of improvements at Shafts 1, 2, 9 and 12 of the Quabbin Aqueduct and the Winsor Power Station.	Completed
Shaft 12 Isolation Gate Design CA/RI (7509) and Construction (7197)	Installation of a gate to control flow at Shaft 12, the intake to the Quabbin Aqueduct, thereby improving safety and reliability of the transmission system.	Future

Sub-phase	Scope	Status
Quabbin Aqueduct Inspection (6277)	TV inspection of the Quabbin Aqueduct.	Future
Winsor Power Station Upgrades and Quabbin Buildings Rehabilitation Design CA/RI (7460) and Construction (7115), and Shaft 2 Construction (7198)	Design and Construction to address piping improvements and building rehabilitation for water supply and Swift River discharge. Will also include improvements to the CVA Intake Structure and include Shaft 2 structural improvements, and Shaft 12 intake and service building electrical, plumbing, and building improvements.	Future
Hatchery Pipeline Design (7017) and Construction (7235)	Design and construction of approximately 5,000 feet of pipeline to convey 6 MGD of water from the CVA to the downstream trout hatchery. The project would provide a consistent and reliable source of high quality cold water to the hatchery, as well as supplement flows to the Swift River. The project will also include a hydro turbine that would capture some of the hydraulic energy contained in the pipeline as the water is conveyed to the hatchery which will be sold back to the grid. The hydro turbine portion is funded under the Alternative Energy Initiatives project and Massachusetts Leading by Example Program.	Completed
Winsor Station Chapman Valve Repair (7212)	Construction of replacement valving for the existing 36" Chapman Butterfly Valve (design by Technical Assistance consultant).	Completed
Purchase of Sleeve Valves (7234)	For replacing the damaged Chapman Butterfly Valve.	Completed

**Expenditure Forecast (in \$000s) and Project Status**

Total Budget	Payments thru FY19	Remaining Balance	FY20	FY21	FY19-23	FY24-28	Beyond FY28
\$53,203	\$5,938	\$47,265	\$0	\$183	\$1,304	\$45,513	\$653

**Winsor Station/Pipeline Improvements**



Project Status 5/20	11.2%	Status as % is approximation based on project budget and expenditures. Winsor Station Chapman Valve Repair was completed in November 2009. Shaft 12 isolation gate Design CA/RI notice to proceed was issued in March 2017. Preliminary design was completed and final design was subsequently cancelled. Hatchery Pipeline Design/ESDC/RI commenced in August 2013 and construction was substantially complete in September 2017.
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**Changes to Project Scope, Budget, and Schedule**

Project Cost			Scheduled Completion Date			FY19-23 Spending		
FY20	FY21	Chge.	FY20	FY21	Chge.	FY20	FY21	Chge.
\$49,559	\$53,203	\$3,644	Jan-26	Jan-26	None	\$204	\$1,304	\$1,100

**Explanation of Changes**

- Project cost change primarily due to inflation adjustments for Quabbin Aqueduct and Winsor Power Station Construction, Shaft 12 Isolation Gate Construction and Quabbin Aqueduct TV Inspection contracts, and updated cost estimate for Shaft 2 Construction.
- Project spending change due to updated cost estimate for Shaft 2 Construction.

**CEB Impacts**

- None identified at this time.

# S. 604 MetroWest Water Supply Tunnel

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## Project Purpose and Benefits

- Contributes to improved public health*
- Fulfills a regulatory requirement*
- Extends current asset life*
- Improves system operability and reliability*

*To provide transmission redundancy for the Hultman Aqueduct ensuring reliable water delivery and providing sufficient hydraulic capacity to support the John J. Carroll Water Treatment Plant and covered storage distribution facilities. This project consists of construction of a 17.6-mile deep rock tunnel from Shaft D in Marlborough to Shaft 5 of the City Tunnel in Weston, and to Shaft W in Weston, as well as the construction of a covered storage facility at Loring Road in Weston. Also included construction of shafts and valve chambers for connections of Shaft 4 in Southborough and to the Norumbega Covered Storage facility.*

## Project History and Background

Adequate transmission capacity is a critical component of MWRA's Integrated Water Supply Improvement Program. MWRA's water delivery depends on a system of tunnels and aqueducts that transport water from the Quabbin and Wachusett Reservoirs to the distribution reservoirs in metropolitan Boston. The existing tunnels and aqueducts were deficient in several respects. First, the transmission system was unable to supply sufficient hydraulic capacity during peak flow periods, leading to pressure deficiencies in all high service areas during the summer months. Second, key sections of the transmission system, such as the Hultman Aqueduct and the Southborough Tunnel, relied on a single conduit. In the event of failure of any of the major transmission sections, the remaining waterworks system could not meet the demand for water.

Construction of the MetroWest Water Supply Tunnel and its extension to the Weston Aqueduct Terminal Chamber has provided the critically needed minimum level of transmission redundancy for the Hultman Aqueduct. Enhancements and improvements to the reliability of the City Tunnel and the City Tunnel Extension are being planned as part of the Long-Term Redundancy project. This will also enhance system maintenance by allowing each major supply conduit to be taken out of service for inspection, cleaning, and repair.

In June 1989, MWRA began engineering work on reconstruction of the Sudbury Aqueduct. In May 1990, the Board of Directors directed staff to put minimum effort into further study of the Sudbury Aqueduct reconstruction alternatives and maximum effort into study of the all-tunnel alternative. The advantages of tunneling included a large reduction in surface activities resulting in a reduced environmental impact, and the potential to obtain a large increase in water transmission capacity to enable the tunnel to supplant the Weston Aqueduct as well as provide redundancy to the Hultman Aqueduct. Other advantages included a higher pressure rating by constructing a tunnel deeper into rock, and the ability to construct along a straight line, reducing the overall length of the project by three miles.

In November 1990, the Board of Directors directed staff to eliminate the planned tunnel from Norumbega Reservoir to the Chestnut Hill Reservoir in favor of connecting to Shaft 5 of the City Tunnel and to the eastern end of the Weston Aqueduct. The connection allowed the Weston Aqueduct and Weston Reservoir to be taken off-line and used only for emergency supply as required by the Safe Drinking Water Act.

In December 1995, the Board of Directors authorized solicitation of bids on the first major construction contract of the MetroWest Tunnel project. In June 1996, a notice to proceed was issued on this contract, beginning the transition from design to construction of the project. In November 2003, the tunnel was placed in service.

In September 2005, the Board of Directors authorized an engineering services contract to rehabilitate the existing Hultman Aqueduct and to interconnect the MetroWest Tunnel with the Hultman Aqueduct. In the interim, Valve Chamber E-3 at Southborough was constructed in order to facilitate system operations and the demolition of an existing chlorine building was completed in preparation for construction of the interconnections.

In May 2013 construction was substantially complete on Contract CP6A to interconnect the MetroWest Tunnel with the Hultman Aqueduct and to rehabilitate the Hultman Aqueduct from Shaft 4 in Southborough to Shaft 5 of the City Tunnels and to Shaft W of the MetroWest Tunnel in Weston. A second construction contract (CP6B) was substantially complete to rehabilitate the remainder of the Hultman Aqueduct from Shaft C of the Cosgrove Tunnel to Shaft I of the Southborough Tunnel, and to rehabilitate the top-of-shaft facilities at Shaft 4 of the Southborough Tunnel in Southborough.

**Program Elements**

The MetroWest Tunnel is 17.6 miles long with a 14-foot finished diameter. The first segment of the tunnel extends from the water treatment plant site at Walnut Hill on the Marlborough/Southborough line to Shaft 4 of the Hultman Aqueduct in Southborough. From there, the tunnel continues to a "WYE" connection east of Norumbega Reservoir, and continues east from the "WYE" to Shaft 5 of the City Tunnel and northward to the Weston Aqueduct Terminal Chamber. The tunnel depth varies from 200 to 500 feet below ground surface along the alignment.

After the MetroWest Tunnel and the John Carroll Water Treatment Plant were in service, the Hultman Aqueduct was inspected and rehabilitated. Surface distribution facilities, including piping, valve chambers, and risers connect the tunnel to the Hultman Aqueduct and local community services. Intermediate connections between the MetroWest Tunnel and the Hultman Aqueduct permit operation of segments of either the aqueduct or the tunnel interchangeably, allowing flexibility in the maintenance of the two conduits.

**Scope**

Sub-phase	Scope	Status
Study	Study of the aqueduct/tunnel system to determine the best alternative to improve hydraulic capacity and create redundancy.	Completed
Construction-Sudbury Pipe Bridge	Rehabilitation of the Siphon Pipe Bridge at the Weston Aqueduct which experienced significant leakage.	Completed
Design/EIR-Tunnel-Engineering Services During Construction	Environmental impact report (EIR) process and design of the 17.6-mile long, 14-foot diameter tunnel. Construction support services, including environmental and safety compliance, claims assistance, contract administration, quality assurance testing, and community relations.	Completed
Construction: Western Tunnel Segment – CP1	Construction of the western portion of the tunnel and associated surface facilities. Shaft E was constructed at the Sudbury Dam and a tunnel was excavated 4.9 miles to Shaft D, located adjacent to the clear well of the Walnut Hill Water Treatment Plant (WHWTP). A riser shaft has been excavated to connect the tunnel to Southborough's Hosmer Pump Station and includes the surface piping facilities necessary to bring water from the Wachusett Reservoir.	Completed

Sub-phase	Scope	Status
Construction: Middle Tunnel Segment – CP2	Construction of approximately 11.9 miles of tunnel between Southborough and Weston. Construction was staged from Shaft L, located at a sand and gravel pit in Framingham, where a permanent connection to the Hultman will be constructed. Along the alignment, four small-diameter shafts have been constructed for community connections to Framingham and Weston. The western reach of the Middle Tunnel Segment portion of the tunnel terminates at Shaft E. The eastern reach terminates at the "WYE" where it meets the East Tunnel Segment. Shafts NE and NW will be constructed on the northwest side of Norumbega Reservoir where surface work included construction of valve chambers and surface piping to allow connections to the Hultman Aqueduct and Norumbega Reservoir. The design at Shaft N included provisions for connections to the Norumbega Covered Storage Facility and the proposed Metropolitan Tunnel Loop.	Completed
Construction: Shaft 5A-CP3	Shaft 5A was excavated near the intersection of Route 128 and the Massachusetts Turnpike.	Completed
Construction: Eastern Tunnel Segment – CP3A	Construction of the eastern portion of the tunnel. An approximately 4,400-foot long, 12-foot finished diameter tunnel was constructed from the Shaft 5A bottom through the "WYE" where it meets the Middle Tunnel Segment and on to Shaft W where a shaft connection to the Loring Road storage tanks was made.	Completed
Construction: MHD Salt Sheds – CP5	Massachusetts Highway Department (MHD) salt storage operations were relocated from the Shaft 5A site to a new, nearby location on MHD property on Recreation Road in Weston. This allowed demolition of the MHD salt sheds at the Shaft 5A site.	Completed
Testing and Disinfection – CP7	Pressure testing of the MWWST from Shaft E (west) to Shaft W and 5A, and disinfection and dechlorination of the entire tunnel from Shaft D to Shafts W and 5A, and final disinfection of the Norumbega Covered Storage tanks. Also included the disinfection and dechlorination of the Wachusett Aqueduct and the piping connections through Walnut Hill to MetroWest Shaft D.	Completed
Construction: Loring Road Covered Storage-CP8	Construction of surface facilities at the Shaft W site included a 20 million-gallon storage facility that replaced the function of the existing Weston Aqueduct/Weston Reservoir system, allowing the system to be taken off-line and placed on emergency stand-by status. The storage facility has been constructed as two concrete tanks partially buried in a hillside adjacent to Shaft W. Connections were made under this contract at Shaft W to two WASM (1 and 2) low service mains and the WASM 4 high service main, as well as to the 7-foot diameter branch of the Hultman Aqueduct. Also included rehabilitation of 4,100 linear feet of 60-inch diameter pipe and four master meters.	Completed
Construction Management/RI	Full inspection of all construction activity, as well as provision of construction support services including environmental and safety compliance, claims assistance, contract administration, quality assurance testing, community relations, labor relations, engineering services during construction, and provision of technical assistance.	Completed

<b>Sub-phase</b>	<b>Scope</b>	<b>Status</b>
Hultman Study	Risk analyses to determine which leaks should be repaired now and a monitoring plan for leaks which presently do not threaten the integrity of the aqueduct.	Completed
Hultman Leak Repair	Test pit excavation and leak repair on the Hultman Aqueduct.	Completed
Hultman Repair Bands	Purchase of external repair bands to be installed as part of Hultman investigation and repair.	Completed
Hultman Investigation and Repair	Evaluation of various segments of the Hultman Aqueduct and installation of repair bands at major leak sites.	Completed
Land Acquisition	Easements along the 17.6-mile tunnel construction route, as well as land at the Shaft W and Shaft L sites.	Completed
Professional Services	Services such as construction safety, contractor audit, legal services, risk management consulting services, and other miscellaneous services.	Completed
Framingham MOU	Agreement to mitigate the impacts of the construction on the Town of Framingham.	Completed
Weston MOU	Agreement to mitigate the impacts of the construction on the Town of Weston.	Completed
Southborough MOU	Agreement to mitigate the impacts of the construction on the Town of Southborough.	Completed
Local Water Supply Contingency Design/CA/RI and Construction	Design and implementation of a Water Supply Contingency Plan including the installation of new local mains where residential well supplies could be affected by tunnel construction.	Completed
Community Technical Assistance	Funds to assist communities with the redesign of utility plans.	Completed
Owner Controlled Insurance	Owner controlled insurance program providing workers' compensation, general liability, and pollution liability insurance for MetroWest Water Supply Tunnel construction.	Completed
Design CA/RI Hultman Interconnect CP6	Design CA/RI of the interconnections between the MetroWest Water Supply Tunnel and the Hultman Aqueduct as well as inspection of the Southboro Tunnel and rehabilitation of the Hultman Aqueduct.	Completed
Construction: Hultman CP9	Construction of Valve Chamber E-3.	Completed
Interim Disinfection	Temporary disinfection related to CP-7 sub-phase.	Completed
Equipment Prepurchase	Pre-purchased one 10-foot diameter butterfly valve for installation in Valve Chamber E3.	Completed
Construction CP6A Lower Hultman Rehab. and 6B Upper Hultman Rehab.	Construction of interconnections between Metrowest Tunnel and the Hultman Aqueduct, and rehabilitation of Hultman Aqueduct including replacement or repair of air relief structures, blow off valves, culverts beneath the aqueduct; replacement of existing valves; and additional items to restore the aqueduct to safe and efficient operation after more than 70 years of service without an overhaul.	Completed
Construction 6A Demolition	Demolition of existing chlorine storage building to allow for construction of a new valve chamber on the Hultman Aqueduct.	Completed

Sub-phase	Scope	Status
CP6 Easements	Easements for CP-6 Contract.	Completed
Valve Chamber and Storage Tank Access Improvements Design (7283) and Construction (7476)	Design and construction to provide better and safer access to valve chambers for Water Quality and Maintenance personnel. Provide secure hatches at Loring Road Tanks.	Future
Shafts 5A/5 Surface Piping Cathodic Protection Construction (7477)	Construction to replace cathodic protection systems.	Completed
Hultman Shaft 5A Leak	Repair Hultman Leak at Shaft 5A.	Completed

#### Expenditure Forecast (in \$000s) and Project Status

Total Budget	Payments thru FY19	Remaining Balance	FY20	FY21	FY19-23	FY24-28	Beyond FY28
\$700,184	\$697,182	\$3,002	\$0	\$0	\$0	\$3,002	\$0

Project Status 5/20	99.6%	Status as % is approximation based on project budget and expenditures. CP6A Lower Hultman Rehab was substantially complete in May 2013. Upper Hultman CP6B contract was substantially complete in June 2013. Shaft 5A/5 Surface Pipe Cathodic Protection was substantially complete in June 2017.
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#### Changes to Project Scope, Budget, and Schedule

Project Cost			Scheduled Completion Date			FY19-23 Spending		
FY20	FY21	Chge.	FY20	FY21	Chge.	FY20	FY21	Chge.
\$700,184	\$700,184	\$0	Mar-27	Mar-27	None	\$0	\$0	\$0

#### Explanation of Changes

- N/A.

#### CEB Impact

- None identified at this time.

## S. 616 Quabbin Transmission Rehabilitation

### Project Purpose and Benefits

- ☑ Provides environmental benefits
- ☑ Extends current asset life
- ☑ Improves system operability and reliability

*To ensure continued reliable delivery of high quality water to MWRA customer communities through inspection, evaluations, and rehabilitation of the aging transmission system. Many of the transmission facilities and structures were constructed in the 1930s and 1940s and are in need of repair, routine maintenance, updating, and modifications for code compliance, health and safety, and security. Based on the findings and recommendations of this inspection phase, MWRA has and will continue to add design and construction phases to the CIP.*

### Project History and Background

This project provided an engineering assessment of key water transmission facilities, structures, and operations. Many of the 44 facilities were constructed in the 1930s and 1940s and are in need of repairs, routine maintenance, and modifications for code compliance, health and safety, and security. The facilities and structures include dams and spillways, structures on tops of shafts, hydraulic diversion facilities, gatehouses, intake buildings, service buildings, and garages. The facilities are spread over a large geographic area ranging from Quabbin Reservoir eastward to the Boston Metropolitan area.

The engineering assessment utilized existing information and site visits to inventory the condition of each facility. The work yielded a facility report that identifies existing conditions and provides recommendations for needed improvements, rehabilitation, and repairs. The project resulted in the development of a conceptual design for each facility including alternatives, basic design criteria, cost estimates, required permits, and schedules. MWRA uses the final conceptual design reports to develop a detailed scope of work for the future procurement of engineering services for subsequent design, construction administration, and resident inspection services. Staff will integrate and coordinate project findings with MWRA's current master planning efforts.

One critical component of the Quabbin Tunnel, the pressure-reducing valves at the Oakdale Power Station, was targeted for immediate replacement. These valves were in poor condition. Due to their important function of reducing hydraulic head to allow water from the Quabbin Reservoir to flow into Wachusett Reservoir, replacement of the Oakdale Valves was a high priority.

### Scope

Sub-phase	Scope	Status
Facilities Inspection	Assessment of existing conditions; update of infrastructure rehabilitation evaluation; identification of improvements/repairs/upgrades, establishment of priorities for repairs, and preparation of cost estimates.	Completed
Oakdale Valves Phase 1	Study, design, and construction for the rehabilitation/replacement of two valves and miscellaneous support equipment at the Oakdale facility.	Completed
Equipment Pre-Purchase	The two large butterfly valves (84 inch and 72 inch) and the fixed orifice valve (48 inch) that were needed in Phase I Valve Rehabilitation, required 6 to 10 months to fabricate and had to be pre-purchased so the valves were available for installation.	Completed

Sub-phase	Scope	Status
Oakdale Phase 1A Design & Construction	Upgrade the 60-year old Oakdale facility and electrical control systems and the switchyard which are antiquated and unsafe to personnel. Will lower the station service voltage from 2,200 to 480.	Completed
Ware River Intake Valve Replacement Design and Construction	Replace oil-actuated valves currently underwater and inaccessible for maintenance with electric actuated valves. Also, replace siphons with hard piped intakes and automate equipment with remote control capabilities.	Future
CVA Intake Motorized Screen Replacement Construction	Replace current motorized screens on the CVA Intake. One screen has failed. Both have reached the end of their useful life. The screens keep debris from entering CVA.	Completed
Rehabilitation of Oakdale Turbine Design and Construction	Rehabilitate turbine. Turbine was last rehabilitated in 1986 and we will be approaching thirty years which is the expected life of an overhaul.	Future
Rehabilitate Wachusett Bastion Design (7333), Construction (7697) and REI (7716)	Make structural improvements to the Bastion including a new roof, repairs of the concrete walls, and drainage and ventilation systems.	Active
Wachusett Lower Gatehouse Pipe Replacement Construction (7380) and REI (7727)	Replace the oldest piping in the Lower Gatehouse. Existing piping and valves have failed or are of poor condition. Other piping and valves of the same age in this facility have already been replaced.	Future
Wachusett Lower Gatehouse Interim Pipe Repair (7379)	Install blind flanges on the three 48-inch pipes in the Lower Gatehouse to isolate the pipes from the broken Equalizer pipe.	Active
Wachusett Lower Gatehouse Building Rehab Constr. (7698) and REI (7726)	Replace the leaking roof, gutters, and repair/seal masonry and degraded windows and doors. Sealing of the building will allow more efficient heating of building space to prevent further deterioration. Replace the existing propane fueled boilers. The existing heating isn't sufficient to keep building warm enough and therefore remaining moisture contributes to accelerated deterioration	Future
Oakdale High Line Replacement	Replacement of 70 year old 69kv overhead transmission line and ground operated switch that supplies power and delivers power from the Oakdale Power Station.	Future

Wachusett Dam Bridge Crane Removal (7780)	Demolition of old bridge crane that must be removed from the Wachusett Dam Lower Gatehouse as it represents a safety hazard.	
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#### Expenditure Forecast (in \$000s) and Project Status

Total Budget	Payments thru FY19	Remaining Balance	FY20	FY21	FY19-23	FY24-28	Beyond FY28
\$22,246	\$8,670	13,576	\$410	\$2,046	\$11,099	\$2,455	\$25

Project Status 5/20	41.1%	Status as % is approximation based on project budget and expenditures. Valves were received in February 2006 and Phase I Design was substantially complete in June 2007. Phase 1A Construction was substantially complete in July 2013. CVA Motorized Screens Replacement Construction was substantially complete in August 2017. Wachusett Dam Lower Gate House Interim Pipe Repair commenced in October 2019.
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**Changes to Project Scope, Budget, and Schedule**

Project Cost			Scheduled Completion Date			FY19-23 Spending		
FY20	FY21	Chge.	FY20	FY21	Chge.	FY20	FY21	Chge.
\$19,032	\$22,246	\$3,214	Jan-27	Jan-27	None	\$8,168	\$11,099	\$2,931

**Explanation of Changes**

- Project cost and spending changed due to updated cost estimates for Wachusett Lower Gatehouse Pipe Replacement Construction and Resident Engineering/Inspection (REI), Wachusett Bastion Rehabilitation REI, Wachusett Lower Gatehouse Building Rehabilitation REI, and Wachusett Dam Bridge Crane Removal. Also, award of Wachusett Dam Lower Gate House Interim Pipe Repair was greater than budgeted.

**CEB Impacts**

- None identified at this time.

## S. 617 Sudbury/Weston Aqueduct Repairs

### Project Purpose and Benefits

- Contributes to improved public health*
- Extends current asset life*
- Improves system operability and reliability*

*To ensure continued reliable delivery of high quality water to MWRA customer communities through study, design, and implementation of repairs to the Sudbury and Weston Aqueducts. These backup systems are both more than 100 years old, and need to be ready for emergency use.*

### Project History and Background

This project includes the inspection of the Sudbury Aqueduct in preparation for future repairs. This aqueduct constructed in 1878 is almost 140 years old and is in need of renewal and upgrade. This is a critical back-up facility for the City Tunnel and the Sudbury Reservoir emergency supply. The inspection phase of the Sudbury Aqueduct was conducted in 2006. The Inspection Report identified several short-term repairs required to better prepare the aqueduct for short-term use. This project will also fund inspections of the Weston Aqueduct which is more than 110 years old. The results of the inspection will allow MWRA to evaluate and prioritize future construction and repair work for this aqueduct.

### Scope

Sub-phase	Scope	Status
Hazardous Materials	Remove contaminated sediment from aqueduct.	Completed
Sudbury Aqueduct Inspection	Inspection of the Sudbury Aqueduct to identify need for future repair work.	Completed
Weston Aqueduct Sluice Gates Construction	Construct a means to isolate the Weston Reservoir from a break west of Ash Street that could detrimentally affect the elevation in the Weston Reservoir. The construction contract will replace antiquated stop-plank gates in Siphon Chambers 3 and 4 blow-off valves along the Weston Aqueduct and an air valve on the Sudbury River Pipe Bridge. Design is being performed by Task Order under the Technical Assistance Contract.	Future
Weston Aqueduct Gatehouse Rehabilitation	Evaluation of the structural integrity of the gatehouse and design of modifications necessary to rehabilitate the structure. Design for replacement of stop logs and stop log guides.	Future
Sudbury Short-Term Repairs Phase 1 and 2 Construction	Repairs needed in order to better prepare the Sudbury Aqueduct for short-term use (flow test and emergency activation).	Future
Rosemary Brook Siphon Building Repairs	Repairs to stabilize structures for functional use as emergency water supply facility. Repairs include re-pointing and rebuilding of brick structures and roof replacement. Rosemary Brook Siphon in conjunction with the Sudbury Aqueduct supplies raw water to the Chestnut Hill Reservoir in the event of an emergency.	Completed
Evaluation of Farm Pond Buildings-Waban Arches (7473)	Assessment of historic structures to determine measures to repair and stabilize facilities. Will include Massachusetts Historical Commission review of proposed alternative.	Completed

Sub-phase	Scope	Status
Waban Arches Rehabilitation Design (7616) and Construction (7617)	Design and construction of repairs to the Waban Arches of the Sudbury Aqueduct.	Future
Farm Pond Inlet Chamber & Gatehouse Design (7618) and Construction (7619)	Design and repairs to the Farm Pond Inlet Chamber and Gatehouse of the Sudbury Aqueduct.	Future

#### Expenditure Forecast (in \$000s) and Project Status

Total Budget	Payments thru FY19	Remaining Balance	FY20	FY21	FY19-23	FY24-28	Beyond FY28
\$12,496	\$2,627	\$9,869	\$0	\$1,514	\$2,341	\$7,257	\$667

Project Status 5/20	21.0%	Status as % is approximation based on project budget and expenditures. Inspection of Sudbury Aqueduct was completed in October 2006. Rosemary Brook Building Repair and Evaluation of Farm Pond Buildings-Waban Arches reached substantial completion in FY18. Weston Aqueduct Sluice Gates Construction is expected to commence in FY21.
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#### Changes to Project Scope, Budget, and Schedule

Project Cost			Scheduled Completion Date			FY19-23 Spending		
FY20	FY21	Chge.	FY20	FY21	Chge.	FY20	FY21	Chge.
\$11,507	\$12,496	\$989	Oct-28	Oct-28	None	\$1,464	\$2,341	\$877

#### Explanation of Changes

- Project cost and spending changed due to updated cost estimate for Weston Aqueduct Gatehouse Rehabilitation, and Weston Aqueduct Sluice Gates Construction, as well as inflation adjustment for Sudbury Short-term Repairs contract.
- Project spending changed due to updated cost estimate listed above.

#### CEB Impacts

- None identified at this time.

## S. 621 Watershed Land

### Project Purpose and Benefit

- Fulfills regulatory requirement.*
- Provides water quality benefits.*
- Continues to improve public health.*

*Acquire, in the name of the Commonwealth, parcels of real estate or interests in real estate that are important or critical to the maintenance of water quality in MWRA water supply sources and the advancement of watershed protection.*

### Project History and Background

The Watershed Protection Act (WsPA) regulates land use and activities within critical areas of the Quabbin Reservoir, Ware River, and Wachusett Reservoir watersheds for the purpose of protecting the quality of drinking water. Since the passage of the WsPA in 1992, watershed lands had been purchased by the Commonwealth through its bond proceeds. The MWRA was then billed for and, over the years, paid increasing percentages of the debt service on those bonds, eventually reaching 100% of the debt service. MWRA also makes Payments in Lieu of Taxes (PILOT) to each watershed community for the land owned for water supply protection.

Since 1992, land acquisition has evolved into program-status and is a significant component of the Watershed Protection Plans for Quabbin Reservoir/Ware River and Wachusett Reservoir. Land in the watersheds undergoes analysis by the Land Acquisition Panel (LAP), which is comprised of Department of Conservation and Recreation (DCR) and MWRA staff. The LAP analyzes critical criteria for protection of the source water resources, including presence of streams and aquifers, steep slopes, forest cover, and proximity to the reservoirs. Parcels are ranked as to their value to the water supply system and, when the desirable parcels become available, are pursued through the LAP for acquisition through a “friendly taking” in fee or conservation restriction. LAP maintains an active list of parcels to pursue as seller and LAP interest, and funding availability, exist to support acquisition.

Under the revised Memorandum of Understanding between MWRA and DCR, executed April 2004, MWRA will utilize its own bond issuances for the purpose of acquiring, in the name of the Commonwealth, parcels of real estate or interests in real estate for the purpose of watershed protection. At its December 2004 meeting, the MWRA Board of Directors approved the use of MWRA bond proceeds for such purpose.

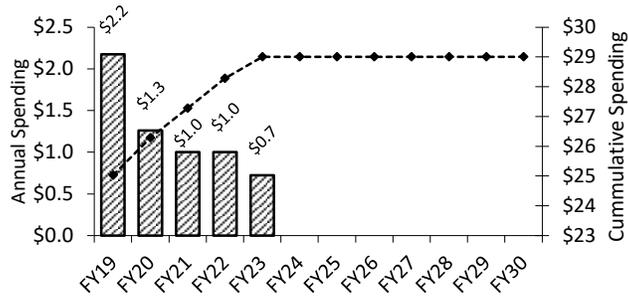
### Scope

Sub-phase	Scope	Status
Land Acquisition	Acquire parcels of real estate or interests in real estate critical to protection of the watershed and source water quality.	Active

### Expenditure Forecast (in \$000s) and Project Status

Total Budget	Payments thru FY19	Remaining Balance	FY20	FY21	FY19-23	FY24-28	Beyond FY28
\$29,000	\$25,020	\$3,980	\$1,259	\$1,000	\$6,154	\$0	\$0

### Watershed Land



Project Status 5/20	89.8%	Status as % is approximation based on project budget and expenditures. MWRA began purchasing land in FY07.
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#### Changes to Project Scope, Budget, and Schedule

Project Cost			Scheduled Completion Date			FY19-23 Spending		
FY20	FY21	Chge.	FY20	FY21	Chge.	FY20	FY21	Chge.
\$29,000	\$29,000	\$0	Jun-23	Jun-23	None	\$5,600	\$6,154	\$554

#### Explanation of Changes

- Project spending changed due to updated cash flow.

#### CEB Impacts

- None identified at this time.

## S. 622 Cosgrove Tunnel Redundancy

### Project Purpose and Benefits

- Contributes to improved public health*
- Provides environmental benefits*
- Extends current asset life*
- Results in a net reduction in operating costs*
- Improves system operability and reliability*

**Master Plan Project  2008 Priority Rating 1 (See Appendix 3)**

*To plan, design and construct the recommended redundancy improvements the Cosgrove Tunnel.*

### Project History and Background

This project evaluated alternatives and developed conceptual designs and cost estimates to provide redundancy for the metropolitan tunnel system and the Cosgrove Tunnel.

For the western system, the Board of Directors approved the construction of a new pump station to provide redundancy for water supply to the John J. Carroll Water Treatment Plant and to support the shutdown and repair of the Cosgrove Tunnel.

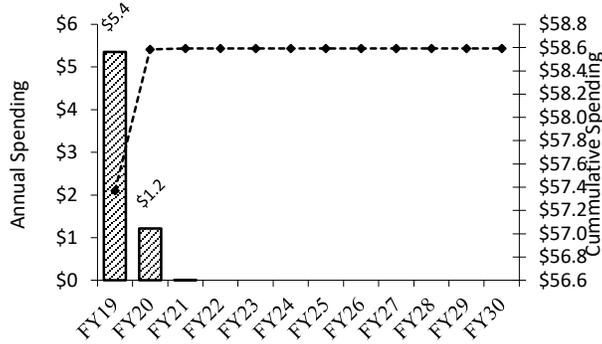
### Scope

Sub-phase	Scope	Status
Wachusett Aqueduct Pump Station Design/ESDC/RI and Construction (7156/7517)	Design and construction of an emergency pump station to pump water from the Wachusett Aqueduct to the Carroll Water Treatment Plant. Pump station will provide redundancy in the event of a failure at the Cosgrove Tunnel or Intake and for the inspection/rehabilitation of the Cosgrove Tunnel. During a planned or emergency shutdown of the Cosgrove Tunnel, the existing gravity Wachusett Aqueduct with the proposed emergency pump station could deliver approximately 240 million gallons per day (mgd) of raw water to the CWTP for full treatment. The 240-mgd capacity would allow for unrestricted supply for at least eight months during the lower-demand fall/winter/spring period. This project, along with the completed Hultman Aqueduct rehabilitation and interconnections project, provide fully treated water transmission redundancy from the Wachusett Reservoir to the beginning of the metropolitan distribution system in Weston.	Completed

### Expenditure Forecast (in \$000s) and Project Status

Total Budget	Payments thru FY19	Remaining Balance	FY20	FY21	FY19-23	FY24-28	Beyond FY28
\$58,592	\$57,369	\$1,223	\$1,216	\$7	\$6,574	\$0	\$0

### Cosgrove Tunnel Redundancy



Project Status 5/20	100.0%	Status as % is approximation based on project budget and expenditures. Wachusett Aqueduct Redundancy Pump Station Design/ESDC/RI contract was awarded in January 2012. Wachusett Aqueduct Pump Station Construction was substantially complete in February 2019.
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#### Changes to Project Scope, Budget, and Schedule

Project Cost			Scheduled Completion Date			FY19-23 Spending		
FY20	FY21	Chge.	FY20	FY21	Chge.	FY20	FY21	Chge.
\$59,146	\$58,592	(\$554)	Feb-19	Feb-19	None	\$7,128	\$6,574	(\$554)

#### Explanation of Changes

- Project cost and spending changed due to Wachusett Aqueduct Pump Station change orders and amendment.

#### CEB Impacts

- None identified at this time.

## S. 623 Dam Projects

### Project Purpose and Benefits

- Contributes to improved public health*
- Provides environmental benefits*
- Extends current asset life*
- Results in a net reduction in operating costs*
- Improves system operability and reliability*

**Master Plan Project  2008 Priority Rating 2 (See Appendix 3)**

*To evaluate, design, and make necessary safety modifications and repairs to dams for proper operation as a result of the 2004 MOU between MWRA and DCR.*

### Project History and Background

Massachusetts Dam Safety Regulations, 302 CMR 10.00, require modifications to the Framingham Reservoir No. 3 (Foss) Dam to provide a spillway system capable of passing the applicable Spillway Design Flood (SDF) or safely storing this same flood within the reservoir without a spillway or other emergency overflow structure. Based on existing Hydraulics and Hydrology studies for Foss Dam, needed improvements include dam embankment armoring and turf improvements to protect against wind-induced overtopping at the Spillway Design Flood (SDF).

All earthen dams and masonry dams under MWRA responsibility were built in the late 1800s to early 1900s and are in periodic need of maintenance. Based on completed internal inspections, repairs are needed including rip rap re-setting and replacement, mitigation of erosion features, and addressing mortar loss and consequent minor leakage at gatehouses are necessary at Foss, Weston, Chestnut Hill, Sudbury and Wachusett Open Channel Lower dams.

### Scope

Sub-phase	Scope	Status
Dam Safety Modifications and Repairs	Provide Design and ESDC for required Dam Safety Modifications and Repairs. Construct parapet wave walls on dam crests to safely contain the SDF at the Weston Reservoir Dam. At present, alternatives are being evaluated at Foss.	Completed
Quinapoxet Dam Removal Design/ESDC, Construction, and REI	Provide final design, ESDC/RI, and construction for the removal of the Quinapoxet Dam adjacent to the Oakdale Pump Station. The removal of the dam will help landlocked fish in the Wachusett Reservoir to reach spawning grounds in the Quinapoxet River.	Active

Sub-phase	Scope	Status
Sudbury/Foss Dam Improvements/Wachusett North Dike Overtopping Protection Design CA/RI and Construction	Regulatory requirement for dam safety compliance for the Sudbury/Foss Dams to ensure spillway will properly function and regulatory requirement for dam safety compliance for the Wachusett North Dike to ensure earthen dam structure will withstand overtopping. Dike requires reconnection of earthen berm around Leominster Pump Station to protect against wave run-up/overtopping at the spillway design flood. Area of dike was removed in mid 1960s to build the P.S. instrumentation (piezometers) is required to monitor internal conditions at all High Hazard class earthen dams. Wachusett North and South Dikes will be the first of the remaining dams to have this installed.	Active

#### Expenditure Forecast (in \$000s) and Project Status

Total Budget	Payments thru FY19	Remaining Balance	FY20	FY21	FY19-23	FY24-28	Beyond FY23
\$7,023	\$3,139	\$3,884	\$215	\$643	\$3,861	\$46	\$0

Project Status 5/20	45.9%	Status as % is approximation based on project budget and expenditures. Design phase for Dam Safety Modifications and Repairs began in September 2009. Dam Safety Modifications and Repairs Construction reached substantial completion in September 2012. Sudbury/Foss Dam Design CA/RI commenced in March 2019. Quinapoxet Dam Removal Design/ESDC commenced in November 2019.
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#### Changes to Project Scope, Budget, and Schedule

Project Cost			Scheduled Completion Date			FY19-23 Spending		
FY20	FY21	Chge.	FY20	FY21	Chge.	FY20	FY21	Chge.
\$6,048	\$7,023	\$975	Dec-22	Mar-23	3 mos.	2,890	\$3,861	\$971

#### Explanation of Changes

- Project cost and spending increased due to award of Quinapoxet Dam Removal Design/Engineering Services During Construction was greater than budgeted amount, and updated cost estimate for Quinapoxet Dam Removal – Construction contract. Also, amendment for Sudbury Foss Dam Design/Construction Administration/Resident Inspection contract.

#### CEB Impacts

- None identified at this time.

## S. 625 Metropolitan Tunnel Redundancy

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### Project Purpose and Benefits

- ☑ *Contributes to improved public health*
- ☑ *Provides environmental benefits*
- ☑ *Extends current asset life*
- ☑ *Improves system operability and reliability*

**Master Plan Project ☑ 2008 Priority Rating 1 (See Appendix 3)**

*To plan, design and construct the recommended redundancy improvements to the City Tunnel, the City Tunnel Extension, the Dorchester Tunnel and the Cosgrove Tunnel.*

### Project History and Background

This project includes the study, permitting, design, and construction of redundancy improvements to critical elements of the water transmission system. The study phase evaluated alternatives and developed conceptual designs and cost estimates to provide redundancy for the metropolitan tunnel system.

The metropolitan tunnel system was evaluated first with emphasis on providing redundancy for Shaft 7 of the City Tunnel. Historically, the plan for providing redundancy for the metropolitan tunnel system was based on one or more proposed parallel deep rock tunnel loops from the terminus of the Hultman Aqueduct and MetroWest Tunnel in Weston into the metropolitan area. The focus of this study was to develop and evaluate alternative surface pipe improvements, in addition to revisiting previously proposed tunnel loops, to achieve an acceptable level of redundancy at a lower cost.

The tunnels in the Metropolitan Boston area, i.e. the City Tunnel, City Tunnel Extension, and Dorchester Tunnel remain a weak link in the water transmission system. While the integrity of the underground tunnel sections is believed to be good based on very low unaccounted-for-water in the MWRA transmission system, there is still risk of failure mainly due to pipe and valve failures at the surface connections to the distribution system or due to major subsurface failures as a result of earthquakes or movement along geological faults. A rupture of piping or a valve failure at critical surface connections points on the metropolitan area tunnel shafts would cause an immediate loss of pressure throughout the entire High Service area and would require difficult emergency valve closures, activation of emergency supplies with a boil-water order and lengthy system repairs. The assumption is that tunnels have a useful life of 100 years, but these subsurface structures have not been inspected and their actual condition is unknown because they cannot be shut down for inspection. Facilities at the top of tunnel shafts have been examined and a number of hardening measures are needed for risk reduction at these sites. Completion of distribution system storage projects at Blue Hills and the Spot Pond Storage Facility have assisted in mitigating the effects of local pipe ruptures.

In the event of a failure of the City Tunnel, a limited amount of water could be transferred through the WASM 3 (scheduled for major rehabilitation) and WASM 4 (rehabilitation completed) pipelines and the Sudbury Aqueduct would need to be brought on-line. Extensive use of the Sudbury Aqueduct/Chestnut Hill Emergency Pump Station and open distribution storage at Spot Pond and Chestnut Hill would be required. Supply would be limited and a boil order would be put in place. Failure of the City Tunnel Extension would be similar with reliance on WASM 3 and open storage at Spot Pond.

The redundancy study was undertaken to recommend a phased program which could be implemented over a period of years. The study reviewed currently proposed MWRA pipeline improvement projects and recommendations as to changes in size and/or alignment to contribute to the objective of transmission redundancy within the metropolitan system.

Additional study of the Metropolitan system has focused on the evaluation of new tunnels for providing redundancy. Several tunnel alternatives have been considered and staff presented a recommended plan to the Board of Directors in the fall of 2016. Staff also presented recommended plan to the MWRA water communities in December 2016. The recommended plan which was approved by the Board in February 2017 includes a deep rock tunnel option for both northern and southern components. The northern and southern components are identified below in the Planning, Design and Construction phases.

Subsequent Design, Permitting and Construction phases will follow-up on the recommendations of the study. The Design and Construction costs have been updated based on the recommendations of the study. Long-Term Redundancy is one of the MWRA's largest undertakings in the next decade, and a variety of options are still being evaluated.

### Scope

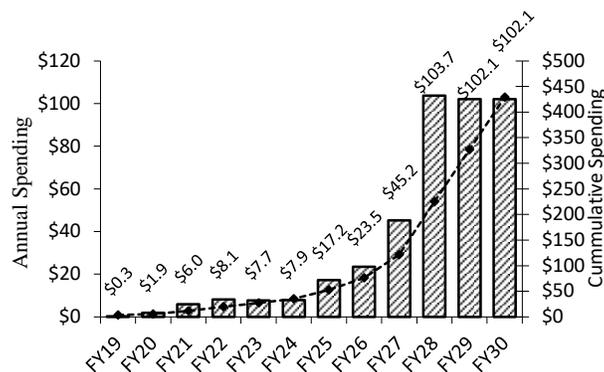
Sub-phase	Scope	Status
Water Transmission Redundancy Plan (6273)	Evaluation and recommendations of alternatives for long term redundancy.	Completed
Sudbury Aqueduct Pre-MEPA Review & Preliminary Design/EIR (7352)	Study and Pre-MEPA review of the Sudbury Aqueduct as a potential element for providing redundancy in the southern portions of the metropolitan tunnel system. Evaluate alternatives and conduct MEPA review for Sudbury pressurization. Also, includes final design and CA/RI for Rosemary Brook Siphon Buildings repair/stabilization.	Completed
Preliminary Design and MEPA Review (7159)	Preliminary design, geotechnical investigation, permitting and MEPA environmental review of the Northern and Southern Tunnels.	Active
Construction Management (7356)	Constructability review of final documents. Full inspection of all construction activity, as well as provision of construction support services including environmental and safety compliance, claims assistance, contract administration and quality assurance testing.	Future
Final Design/Engineering Services During Construction (7556)	Final Design and Engineering Services During Construction of the Northern and Southern Tunnels, including connecting mains.	Future
Tunnel Construction (7291)	Construction of the Northern and Southern Tunnel Loops.	Future
Tops of Shafts Connecting Mains Surface Construction (7357)	Construction of Connecting Mains between existing facilities and the various tunnel shafts along the Northern and Southern Tunnels.	Future
Tops of Shafts Rehabilitation Design CA/RI (7521) and Construction (7522)	Design CA/RI and Construction to rehabilitate the Tops of Shafts of the existing tunnel system.	Future
Shaft 7 Buildings Design CA/RI and Construction (7558/7559)	Design and construction of a new access building above the Shaft 7 Top of Shaft structure including new electrical service, HVAC equipment, piping corrosion protection, PRV replacement, new flow meters, and structural and access improvements to the facility.	Future
Administration Legal and Public Outreach	Community agreements, land acquisition and possible Owner Controlled Insurance Program for the Northern and Southern Tunnels.	Future

Sub-phase	Scope	Status
Program Support Services (7655)	The Program Support Services consultant firm will provide technical professional resources to the Tunnel Redundancy Department to support program-wide management, risk management, quality management, standardization, contract delivery and contract packaging. The PSS will include independent technical reviews, constructability reviews, critical path schedule evaluations, and cost estimating/opinions.	Active
Technical Assistance	The Technical Assistance contract will provide technical analysis, real estate support, fieldwork and other support to the Tunnel Program to address technical needs in a timely fashion as they arise.	Future

#### Expenditure Forecast (in \$000s) and Project Status

Total Budget	Payments thru FY19	Remaining Balance	FY20	FY21	FY19-23	FY24-28	Beyond FY28
\$1,506,963	\$3,716	\$1,503,246	\$1,900	\$5,985	\$23,945	\$197,424	\$1,282,137

#### Metropolitan Tunnel Redundancy



Project Status 5/20	0.4%	Status as % is approximation based on project budget and expenditures. Program Support Services commenced in April 2019. Preliminary Design and MEPA Review was awarded in May 2020.
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#### Changes to Project Scope, Budget, and Schedule

Project Cost			Scheduled Completion Date			FY19-23 Spending		
FY20	FY21	Chge.	FY20	FY21	Chge.	FY20	FY21	Chge.
\$1,421,750	\$1,506,963	\$85,213	Apr-42	Apr-42	None	\$24,313	\$23,945	(\$368)

**Explanation of Changes.**

- Project cost change primarily due to inflation adjustments on unawarded contracts.
- Spending changed primarily due to restructuring and scheduling separate phase for Technical Assistance which was broken out from Administration, Legal and Public Outreach phase, and award less than budget for Preliminary Design & MEPA Review.

**CEB Impacts**

- \$400,000 in FY22 for salaries, benefits, and other expenses associated with the project management of the Metro Tunnel Redundancy and \$250,000 in FY25 for rock storage shed.

## S. 628 Metropolitan Redundancy Interim Improvements

### Project Purpose and Benefits

- ☑ *Contributes to improved public health*
- ☑ *Provides environmental benefits*
- ☑ *Extends current asset life*
- ☑ *Results in a net reduction in operating costs*
- ☑ *Improves system operability and reliability*

**Master Plan Project ☑ 2008 Priority Rating 1 (See Appendix 3)**

*To plan, design and construct the recommended interim redundancy improvements to the existing tunnel system, to protect or needed as back-up in case of failure.*

### Project History and Background

Design and Engineering Services during construction for four construction contracts that will be completed in the near term while the proposed tunnel redundancy project goes through environmental review, design and construction. These construction projects are needed to protect and improve critical facilities related to the existing tunnel system, or are needed as back-up means of supply in the event that one or more elements of the existing tunnel system fail. The construction projects include the Top of Shafts Interim Improvements, Chestnut Hill Emergency Pump Station improvements, Chestnut Hill Emergency Generator, WASM/Spot Pond Supply Mains PRV Improvements and rehabilitation of WASM 3. The Waltham Water Pipeline Project will provide water to Waltham during shutdown of WASM 3 CP-3.

### Scope

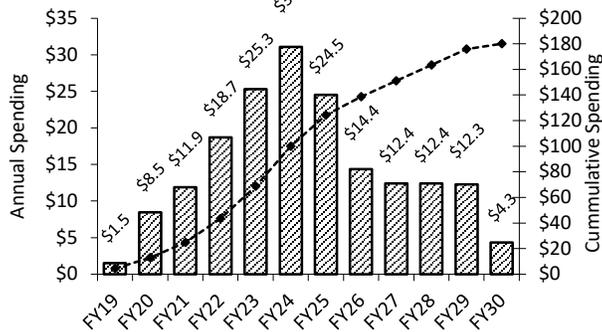
Sub-phase	Scope	Status
CP1 Shafts 6,8,9A (7561), CP2 Shaft 5 (7671) and REI (7702), CP3 Shafts 7,7B,7C,7D (7670) and REI (7703)	This project will provide strengthening of pipe directly connected to the tunnel system, cathodic protection for pipe connections to prevent further corrosion, replacement of nuts on valve connections if found to be at risk .	Future
Chestnut Hill Emergency Pump Station Improvements Design CA/RI (7574), Construction (7562), and REI (7669)	The Chestnut Hill Emergency Pump Station is in need of improvement to piping and pumping systems to reduce surge loads on the suction and discharge piping during emergency operation when the Dorchester Tunnel is out of service. Discharge pressures from the pump station would exceed normal pressures in community pipelines increasing risk of failure during emergency operation. Also, coordination of pump station operation between Chestnut Hill and Newton Street and Hyde Park pump stations is of concern. With CHEPS not operating, grade lines in the Southern High system fall below acceptable levels at high points in the system and Blue Hills tank is unable to be filled. Improvements under this contract include potential pump and motor replacement, pipe reconfiguration, surge controls, possible installation of variable frequency drives on motors to regulate discharge pressures and installation of additional valves to allow isolation of the tunnel without operating old valves that are directly connected to the tunnel.	Active

Sub-phase	Scope	Status
WASM 3 Rehabilitation MEPA/Design CA/RI (6539) and WASM 3 Rehab CP- 1(6544), CP-2 (6543) and CP-3 (6545)	MEPA/Design CA/RI and construction of the WASM 3 rehabilitation from the Hultman Aqueduct Branch in Weston to the existing PRV chamber near Section W16 at Medford Square. Construction will include cleaning and cement mortar lining, some sliplining and some pipe replacement.	Active
Low Service PRV Improvements Design & ESDC (7575), Construction Improvements (7563), REI (7674)	The project will allow the Low Service system to be utilized to increase the supply to the Gillis Pump Station in Stoneham to avoid the need to pump out of the Spot Pond Reservoir in an emergency. The Low Service pipelines would be operated at grade lines consistent with WASM 3 grade line to push additional flow to the Gillis Pump Station in an emergency. Some Low Service revenue meters may require pressure reducing valves to lower pressures to communities along the way. In addition, PRV's on WASM 3/4 would also require replacement to maximize the supply to the north.	Active
Shafts 5 Building Improvements Design/CA (7599), Construction (7600), and REI (7673)	Electrical and architectural improvements at Shafts 5 & 9 buildings in Weston and Somerville. Including improvements to dewatering systems inside shafts, Building Code and Hazardous Material Evaluations at each of these sites are being completed under Technical Assistance Task Order prior to design.	Future
Waltham Water Pipeline Design CA (7547), Construction (7457), and REI (7672)	Design/Construction Administration and Construction/Resident Inspection of 36" diameter pipeline of a length to be determined of a new connection to Waltham from the Northern Extra High Service Area.	Future
Commonwealth Avenue Pump Station Improvements Design CA/RI (7523) and Construction (7524)	Design, engineering services during construction, resident engineering/inspection services and construction to provide improvements to the Commonwealth Avenue Pump Station. The project includes new pipe connections to the Low Service Pipes and two new pumps (one replacement and one additional) for redundancy. Also, includes Supervisory Control and Data Acquisition (SCADA) controls, and heating, ventilation and air conditioning equipment to replace older equipment.	Active

**Expenditure Forecast (in \$000s) and Project Status**

Total Budget	Payments thru FY19	Remaining Balance	FY20	FY21	FY19-23	FY24-28	Beyond FY28
\$180,056	\$4,340	\$175,716	\$8,460	\$11,865	\$65,860	94,787	\$16,572

### Metro Redundancy Interim Improvements



Project Status 5/20	6.8%	Status as % is approximation based on project budget and expenditures. WASM 3 MEPA/Design CA/RI commenced in July 2013. Commonwealth Avenue Pump Station Improvements Design CA/RI was awarded in November 2016 and construction commenced in February 2019. WASM SPSM/PRV Design/CA commenced in July 2018. Chestnut Hill Emergency Pump Station Design/CA commenced in May 2019.
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#### Changes to Project Scope, Budget, and Schedule

Project Cost			Scheduled Completion Date			FY19-23 Spending		
FY20	FY21	Chge.	FY20	FY21	Chge.	FY20	FY21	Chge.
\$177,348	\$180,056	\$2,708	Jun-26	Jul-29	37 mos.	\$92,636	\$65,860	(\$26,776)

#### Explanation of Changes

- Project cost changed primarily due to inflation adjustments on unawarded contracts, updated cost estimates for WASM 3 CP-1 and CP1 Shafts 6,8, 9A contracts, and change orders for Commonwealth Avenue Pump Station Redundancy Design/CA/RI and Commonwealth Avenue Pump Station Improvements-Construction.
- Project schedule changed due to updated Weston Aqueduct Supply Mains CP-3 schedule.
- Project spending changed due to updated projects costs listed above, updated schedules for WASM 3 Rehab CP-1, 2, and 3, Waltham Water Pipeline, Shafts 5 & 9 Improvements, and CP3 Shafts 7, 7B, 7C, and 7D contracts. Also, updated cash flow for WASM 3 MEPA/Design/CA/RI.

#### CEB Impacts

- None identified at this time.

## S. 630 Watershed Division Capital Improvements

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### Project Purpose and Benefit

- Extends current asset life*
- Fulfills regulatory requirement*
- Improves system operability and reliability*
- Continues to improve public health*

*To renovate an aging Quabbin Administration Building complex to address existing code or operational deficiencies, energy efficiency, employee and public access. Also, to comply with regulatory requirements by Massachusetts Department of Environmental Protection related to Quabbin Administration Buildings water and wastewater systems.*

### Project History and Background

DWSP Quabbin/Ware Region facilities support a staff of approximately 80 employees, and provide recreational opportunities and services to more than 500,000 visitors annually to the reservoir.

Construction of the QAB was completed in 1938 and it is not uncommon to find original system controls still operational today (77 years). One of the more pressing needs is the rehabilitation of critically important utilities and support systems that both distribute power and water throughout the facility. Most of these system components are exhibiting signs of deterioration (e.g. wiring, plumbing, heating) and preemptive actions are necessary to avoid catastrophic failures.

The significant investment of capital into the restoration of the facility will also trigger necessary upgrades to satisfy today's more stringent standards for Universal Access, public safety and occupational standards. Example of possible Code induced upgrades may include added environmental safeguards for occupational safety (e.g. ventilation and hazard abatements), installation of fire alarms and expanded fire protection systems, universally accessible access routes to and from the building and special accommodations (e.g. elevator, public restrooms).

Mechanical control systems for the distribution of steam throughout the Complex are very old, antiquated systems that need modernization to ensure continued reliable operation. Many components also fail to satisfy current building code requirements and would require upgrading.

As discussed above in the Quabbin Administration Building Complex: Major Renovations Project, there are many building components that need work. Two issues that need immediate attention are the boiler room wastewater discharges and the leaking water system. In 2013, the Quabbin Administrative Building (QAB) water supply system came under scrutiny by the MA Department of Environmental Protection and the State Plumbing Inspector. DEP is requiring that floor drains located inside of the buildings boiler room be abandoned and that daily well withdrawal levels be brought down to acceptable levels. Also, in 2014 wastewater discharges from the MWRA laboratory inside of the QAB facility were authorized by the DEP under the condition that daily wastewater flows be verified and shown to be within approved limits. The DWSP has initiated monitoring of wastewater flows from the QAB facility and anticipates that future upgrades to the septic system will be needed. In order to satisfy these mandates, significant investments are needed to retrofit existing mechanicals and make significant improvements to the distribution of water and handling of wastewater throughout the building immediately.

These improvements will be needed no matter what form of Quabbin Administration Building renovations are determined to be needed under the larger capital project. These two issues are essentially "fast-track" components on the larger project needed for regulatory compliance. DCR will use professional engineering consultants to complete repair designs.

**Scope**

Sub-phase	Scope	Status
Quabbin Administration Building Rehabilitation Conceptual Design Report, Design/Construction Administration and Construction	Design and Construction for improvements at the Quabbin Administration Building.	Future
River Road Improvements - Wachusett	Improvements to River Road at Wachusett including paving and drainage.	Future
<b>Quabbin Water Supply Construction</b>	<b>Project to supply water to the Quabbin Reservoir buildings.</b>	<b>Future</b>
Quabbin Maintenance Garage/Wash Bay/Storage Building Design CA/RI and Construction	Design and installation of a modular building in stockroom area off Blue Meadow Road for large vehicle maintenance, washing, and equipment storage. Includes demolition of old sheds, conversion of underground storage tank to above ground storage tank, paving and security.	Future

**Expenditure Forecast (in \$000s) and Project Status**

Total Budget	Payments thru FY19	Remaining Balance	FY20	FY21	FY19-23	FY24-28	Beyond FY28
\$24,083	\$0	\$24,083	\$0	\$1,825	\$9,254	\$14,829	\$0

Project Status 5/20	0%	Status as % is approximation based on project budget and expenditures.
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**Changes to Project Scope, Budget, and Schedule**

Project Cost			Scheduled Completion Date			FY19-23 Spending		
FY20	FY21	Chge.	FY20	FY21	Chge.	FY20	FY21	Chge.
\$21,900	\$24,083	\$2,183	Mar-26	Mar-26	None	\$7,840	\$9,254	\$1,414

**Explanation of Changes**

- Project cost changed primarily due to new project that was added for Quabbin Water Supply and updated cost estimate for River Road Improvements at Wachusett.
- Project spending changed due to project cost changes listed above as well as updated schedule for the Maintenance Garage/Wash Bay/Storage Building Construction contract.

**CEB Impacts**

- \$100,000 for lab work in FY24 during the Quabbin Administration Building Rehabilitation.

# S. 618 Peabody Pipeline Project

## Project Purpose and Benefits

- Contributes to improved public health*
- Extends current asset life*
- Improves system operability and reliability*

*The proposed new pipeline and meter will serve the western side of town that is currently served by the Winona WTP and also provide a redundant connection to the city's water distribution system. The City estimates that their MWRA water supply would increase from 1.1 MGD to 2.5 MGD.*

## Project History and Background

Peabody is a partially supplied MWRA water community. Peabody's drinking water is mainly supplied by the Coolidge and Winona Water Treatment Plants. Raw water from the Ipswich River is pumped to Suntaug Lake and Winona Pond. Water from Winona Pond is treated at the Winona Water Treatment Plant (Winona WTP) and water from Suntaug Lake and Spring pond are treated at the Coolidge Water Treatment Plant (Coolidge WTP). Peabody supplements its drinking water through an existing MWRA connection, Meter 168.

Peabody's Winona WTP, constructed in 1974, has reached the end of its useful life. The city considered an option to purchase more water from the MWRA, however, this option has been cancelled.

## Scope

Sub-phase	Scope	Status
Peabody Pipeline Design/ESDC/REI (6895)	This phase includes the design of an 11,450-linear foot, 24-inch diameter water pipeline that will extend MWRA's Section 109 from the Lynnfield/Saugus town line to the Peabody/Lynnfield line on Route 1.	Completed

## Expenditure Forecast (in \$000s) and Project Status

Total Budget	Payments thru FY19	Remaining Balance	FY20	FY21	FY19-23	FY24-28	Beyond FY28
\$1,448	\$1,430	\$18	\$18	\$0	\$389	\$0	\$0

Project Status 5/20	100%	Status as % is approximation based on project budget and expenditures. Design/ESDC/REI was awarded in May 2017 and was cancelled in September 2019.
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**Changes to Project Scope, Budget, and Schedule**

Project Cost			Scheduled Completion Date			FY19-23 Spending		
FY20	FY21	Chge.	FY20	FY21	Chge.	FY20	FY21	Chge.
\$1,509	\$1,448	(\$61)	Aug-20	Sep-19	(11) mos.	\$450	\$389	(\$61)

**Explanation of Changes**

- Project cost, schedule and spending changed due to Peabody Pipeline Design/ESDC/REI contract was cancelled.

**CEB Impacts**

- None identified at this time.

## S. 677 Valve Replacement

### Project Purpose and Benefits

- ☑ *Contributes to improved public health*
- ☑ *Provides environmental benefits*
- ☑ *Fulfills a regulatory requirement*
- ☑ *Extends current asset life*
- ☑ *Improves system operability and reliability*

*To replace, repair or retrofit approximately 500 blow-off valves and several hundred main line valves within the pipeline distribution system. Blow-off valve retrofits eliminate cross-connections into sewers or drainage piping. Main line valve replacements improve MWRA's ability to respond to emergency situations such as pipe breaks and provide tight shutdown for pipeline construction projects. Faster response reduces negative impacts on customers. Combining the two valve replacement efforts reduces the need for repeat construction at sites and alleviates traffic impacts, re-paving needs, and other site-specific issues.*

### Project History and Background

MWRA owns and operates nearly 300 miles of distribution pipeline which contain approximately 1,578 blow-off valves and 1,713 main line valves. Some blow-off valves are cross-connected into sewers or drainage piping. To ensure there is no chance of contamination, DEP requires retrofitting of the blow-off valves to provide air gaps to ensure that non-potable water cannot reach the potable water lines. In addition, many of the main line valves in the system are significantly beyond their original design life. Many of these are either inoperable or inadequate and require replacement, repair, or retrofitting.

However, significant progress has been made in the last several years in correcting the cross connections at the blow-offs and in replacing defective main line valves and adding new valves to improve operations throughout the system. The valve replacement program continues this process. MWRA utilizes in-house crews and outside contractors to replace several blow-off and main line valves every year, both as part of the Valve Replacement Program and pipeline rehabilitation contracts.

### Scope

Sub-phase	Scope	Status
Design/Phase 1	Design of valve replacements, setting priorities based on the level of urgency or risk associated with each valve and scheduling work on valves that would not otherwise be replaced during upcoming pipeline rehabilitation projects.	Completed
Construction - Phase 1 (5126)	Purchase and installation of 27 blow-off valve retrofits.	Completed
Construction - Phase 2 (6105)	Purchase and installation of 10 blow-off valve retrofits and 10 main line valve replacements.	Completed
Construction - Phase 3 (6278)	Purchase and installation of 10 blow-off valve retrofits and 12 main line valve replacements as well as rehabilitation of two meters.	Completed

Sub-phase	Scope	Status
Construction - Phases 4, 5 & 6 (6345, 6346, 6435)	For each phase, purchase and install blow-off valve retrofits and main line valve replacements and rehabilitation of miscellaneous meters. Phase 4 Contract included 12 main line valves, 10 blow-off retrofits, 2 check valves and the rehabilitation of 2 meters. Phase 5 Contract included 10 blow-off valve retrofits and 13 main line valve replacements. Phase 6 included 4 blow-off valve retrofits, 8 main line valve replacements and 9 globe valves (tank isolation).	Completed
Construction Phases 7, 8 & 9 (6436, 7195, 7236)	For each phase, purchase and install blow-off valve retrofits and main line valve replacements and rehabilitation of miscellaneous meters. Each phase includes approximately 10 blow-off valve retrofits and 10 main line valve replacements.	Completed/Future
Design CA/RI Phases 8 & 9 (7417, 7418)	Design/Contract Administration/Resident Inspection for construction Phases 8 and 9.	Future
Equipment Purchase (6088)	Purchase of approximately 20 main line valves per phase for ten phases for replacement work to be done by in-house staff. Also includes the cost of line stops associated with this work.	Completed

#### Expenditure Forecast (in \$000s) and Project Status

Total Budget	Payments thru FY19	Remaining Balance	FY20	FY21	FY19-23	FY24-28	Beyond FY28
\$22,279	\$12,016	\$10,263	\$0	\$0	\$0	\$6,747	\$3,515

Project Status 5/20	53.9%	Status as % is approximation based on project budget and expenditures. Phases 1-7 are complete.
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#### Changes to Project Scope, Budget, and Schedule

Project Cost			Scheduled Completion Date			FY19-23 Spending		
FY20	FY21	Chge.	FY20	FY21	Chge.	FY19	FY20	Chge.
\$21,655	\$22,279	\$624	Jun-29	Jun-29	None	\$0	\$0	\$0

#### Explanation of Changes

- Project cost changed due to inflation adjustments on unawarded contracts.

#### CEB Impacts

- None identified at this time.

## S. 692 Northern High Service – Section 27 Improvements

### Project Purpose and Benefits

- Contributes to improved public health*
- Extends current asset life*
- Improves system operability and reliability*

To rehabilitate/replace a segment of pipe originally installed in 1898 in Lynn which suffers from poor hydraulic performance and frequent leakage. Rehabilitate/replacement of approximately 7,200 linear feet of pipeline will improve service to the communities north of Lynn.

### Project History and Background

Section 27 is a 12–20 inch diameter cast iron main installed in 1898 that serves the communities north of Lynn. The main has become severely corroded. As a result of this deterioration, various major leaks have occurred since 1966. Because the main runs under major thoroughfares in Lynn, repair of leaks is disruptive and costly. Appropriate corrosion control methods will be employed on the pipeline to minimize corrosion potential in Section 27. During preliminary design, an evaluation determined MWRA should abandon the portion of Section 27 that parallels Section 91 and an adjacent pipeline, Section 35.

### Scope

Sub-phase	Scope	Status
Section 27 Design/CA, Construction and REI (7721, 6333, 7722)	Rehabilitation/replacement of 7,200 linear feet of pipeline to replace severely corroded pipe.	Future

### Expenditure Forecast (in \$000s) and Project Status

Total Budget	Payments thru FY19	Remaining Balance	FY20	FY21	FY19-23	FY24-28	Beyond FY23
\$1,668	\$124	\$1,545	\$0	\$2	\$28	\$1,517	\$0

Project Status 5/20	7.4%	Status as % is approximation based on project budget and expenditures.
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### Changes to Project Scope, Budget, and Schedule

Project Cost			Scheduled Completion Date			FY19-23 Spending		
FY20	FY21	Chge.	FY20	FY21	Chge.	FY20	FY21	Chge.
\$1,326	\$1,668	\$342	Nov-25	Nov-25	None	\$27	\$28	\$1

### Explanation of Changes

- Project cost change due to separate phases added for Section 27 Rehab Design/CA and REI. Also, inflation

adjustment on Section 27 Rehab Construction contract.

**CEB Impacts**

- None identified at this time.

## S. 693 Northern High Service - Revere and Malden Pipeline Improvements

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### Project Purpose and Benefits

- Contributes to improved public health*
- Extends current asset life*
- Improves system operability and reliability*

*To improve the delivery capabilities of major distribution lines serving the Northern High System. The existing pipelines are inadequate and suffer from extensive corrosion and leakage. Replacement, rehabilitation, and/or reinforcement will provide a strong and reliable means to convey water from the City Tunnel Extension to communities in the northern and eastern portions of the Northern High Service Area.*

### Project History and Background

The southeast corner of the Northern High Service Area has experienced pressure deficiencies because of undersized pipes and extensive pipeline corrosion. The corrosion problems have led to numerous leaks and pressure deficiencies which can cause fire-fighting difficulties. These deficiencies particularly affect Malden, Revere, Lynn, Winthrop, Deer Island, East Boston, Saugus, Nahant, Peabody, Marblehead, and Swampscott. To correct these problems, MWRA is implementing a series of pipeline improvements.

This project includes installation of pipeline on Sections 97, 97A and 68 in Revere and Sections 49, 53, 53A and Shaft9A-D in Malden; rehabilitation of Sections 53 and 55 in Revere; and installation of control valves to improve water pressure. All the work for this project, with the exception of the design and construction of Section 53 connections and Section 53A, Section 68 and the Shaft 9A-D Extension is complete. Completion of this construction will improve the pressure and flow of water conveyed to the Northern High Service Area.

A hydraulic study of the distribution system recommended that MWRA install a new pipeline in Revere, beginning at the Everett/Chelsea/Revere border and extending through Revere to the East Boston border. This new pipeline runs parallel with existing pipelines and carries a large portion of the flow formerly carried by the existing system, thereby increasing water pressure and flow to Revere, East Boston, Winthrop, and Deer Island, particularly during periods of high demand. Installation of new control valves was required to regulate water pressure and fill the Winthrop standpipe. The original control valves between Winthrop pipelines and MWRA transmission mains were inadequate. Fluctuations in pressure threatened to rupture the town's pipelines. More efficient valves were required to eliminate the danger. Flow tests performed on Sections 32 and 55 of the existing Revere and Winthrop pipelines revealed that these sections had severe flow problems. The pipelines were only able to carry a fraction of the designed capacity because of internal corrosion. Cleaning and lining the pipelines restored flow capacity.

Section 53 in Malden and Revere was an 18,900-foot long, 30-inch diameter steel pipeline, exceeding 60 years of age. Workers dug four test pits to determine the condition of this pipeline and uncovered 18 holes in the pipe. Investigations into recent failures revealed severe corrosion through the pipe wall in several locations. Replacement of the Malden portion of Section 53 with a new 48-inch diameter pipe has been completed. The Revere portion of Section 53 has been sliplined with 24-inch diameter steel pipe. In addition to feeding into the new 48-inch Saugus/Lynn pipeline, this pipe plays an important role in the supply network for Deer Island. Sections 49 and 49A, old 24-inch pipelines, are used to connect Section 53 to Shaft 9A of the City Tunnel. They are undersized for this purpose and are a severe restriction. A new 3,500-lf, 48-inch diameter pipe (proposed Section 53A) is needed to reinforce Sections 49 and 49A. A 1,000-lf, 20-inch diameter pipe, portion of Section 68, interconnects Section 53 with the new Saugus/Lynn pipeline. This section is undersized and needs to be reinforced with 1,000 lf of new 48-inch diameter pipe to improve hydraulic capacity. Approximately 4,000 lf of Section 14, an existing 30-inch diameter cast-iron pipe installed in 1916, will be cleaned and cement mortar lined to improve

redundancy for Section 84. The Shaft 9A-D Extension will provide a more reliable connector from Shaft 9A of the City Tunnel Extension to the Section 99 pipe that serves as the suction line to the Gillis Pump Station.

### Scope

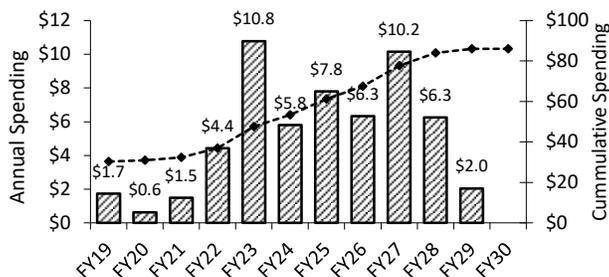
Sub-phase	Scope	Status
Design/CS/RI – Revere/Malden	Design, construction services, and resident inspection for Section 53 in Malden and Sections 97 and 97A in Revere.	Completed
Construction Revere Beach (5186)	Installation of 5,491 linear feet of 36-inch pipeline and 10,111 linear feet of 30-inch pipeline on Section 97, as well as 3,872 linear feet of 24-inch pipeline, and 1,350 linear feet of 20-inch pipeline on Section 97A in the vicinity of Revere Beach Parkway.	Completed
Construction Malden Section 53 (5176)	Installation of 11,907 feet of 48-inch diameter pipeline in Malden on Section 53.	Completed
Construction Linden Square (5238)	Construction and construction administration of a 1,000 linear feet segment of Section 53 in the Linden Square area of Malden. The Massachusetts Highway Dept constructed this section as part of its roadway reconstruction project around Linden Square.	Completed
Construction Revere Section 53 (5177)	Rehabilitation of 4,900 linear feet of 30-inch pipe in Revere on Section 53 and replacement of 1,500 linear feet under Route 1 in Revere.	Completed
Construction Road Restoration	Design, construction administration, and construction of the full road restoration to ensure a stable road surface without cracking on Eastern Avenue in Malden in compliance with the requirements of the Massachusetts Architectural Access Board. The City of Malden will do this work.	Completed
Construction Control Valves (5191)	Installation of control valves needed to regulate water pressure and fill the Winthrop standpipe.	Completed
Construction DI Pipeline Cleaning & Lining (5179)	Design and cleaning and lining of the 2,000 linear feet, 8-inch diameter water supply main to Deer Island.	Completed
Construction – Winthrop C&L (5178)	Rehabilitation of 7,900 linear feet of 16-inch diameter pipe on Section 32 and 20-inch diameter pipe on Section 55 in Revere and Winthrop.	Completed
Section 53 and 99 Improvements Design CA (7485), and REI (7682)	Design /Construction Administration and Resident Inspection for Sections 53 and 99 Improvements.	Active/Future
CP-1 Construction Section 53 Connections (6335)	Construction of 4,500 linear feet of new 48-inch pipe in Malden. These proposed pipelines will eliminate hydraulic restrictions and better integrate Section 53 into the Northern High distribution system.	Future
CP-3 Section 99 Connections Construction (6958)	Construction of approximately 3,000 linear feet of new 60-inch diameter pipeline in Malden connecting the Shaft 9A-D line (60-inch dia.) to Section 99 (72-inch dia.).	Future

Sub-phase	Scope	Status
Section 56 Repl./Saugus River Feasibility Study (7500), Design CA (7454) and Construction (7486), and REI (7681)	Feasibility Study, Design CA and REI, and Construction to replace failed 20/30-inch diameter steel water main crossing of the Saugus River by trenchless methods. Main was installed in 1934 and is out of service. This main provides redundancy to Section 26 which is currently also out of service.	Completed/Active/Future
Section 56 Demolition Construction (7536)	Section 56 Construction Pipe Demolition at General Edwards Bridge.	Completed
Section 14 Pipe Relocation (Malden) (6957)	Abandon 540 lf of existing Section 14 water main in Malden Center and replace with 400 feet of new 36-inch ductile iron water pipe in a new alignment. A 36-inch gate valve will also be installed as well as a blow-off setup.	Completed
CP-2 Section 14 Construction (7699)	Rehabilitation of 4,000 lf of Section 14.	Future
Sections 13 & 48 Rehabilitation Design CA/RI and Construction (7602/7603)	Design and construction of the rehabilitation of Section 13 (7,300 lf of 36-inch cast-iron 1896 vintage pipe) and Section 48 (7,300 lf of 38-inch diameter and 1,400 lf of 30-inch diameter riveted steel 1929 vintage pipe) in Stoneham, Malden and Melrose from the Gate House at Fells Reservoir partially along Highland Avenue to Pleasant Street and Charles Street will improve hydraulics and water quality.	Future

#### Expenditure Forecast (in \$000s) and Project Status

Total Budget	Payments thru FY19	Remaining Balance	FY20	FY21	FY19-23	FY24-28	Beyond FY28
\$86,011	\$30,301	\$55,710	\$628	\$1,500	\$19,062	\$36,349	\$2,039

#### NHS - Revere & Malden Pipeline Improvements



Project Status 5/20	35.9%	Status as % is approximation based on project budget and expenditures. Revere Beach, Malden Section 53, Revere Section 53 Construction and Linden Square construction are complete. Section 56 Feasibility Study was substantially complete in June 2017. Section 14 Pipe Relocation – Malden was completed in May 2018. Section 56 Pipe Demolition on General Edwards Bridge was substantially completed in May 2019. Section 56 Replacement/Saugus Design/CA commenced in November 2019.
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**Changes to Project Scope, Budget, and Schedule**

Project Cost			Scheduled Completion Date			FY19-23 Spending		
FY20	FY21	Chge.	FY20	FY21	Chge.	FY20	FY21	Chge.
\$82,804	\$86,011	3,207	Jul-28	Jul-28	None	\$10,344	\$19,062	\$8,718

**Explanation of Changes**

- Project cost changed primarily due to updated cost estimates for Sections 14, 53 and 99 REI and Sections 53 and 99 Connections Design/ Construction Administration contracts. Also, Section 56 Replacement/Saugus Design/CA award was greater than budgeted.
- Spending changed due to updated schedules for Section 56 Replacement Construction and REI, Section 56 Replacement award was greater than budgeted, and schedule shifts for CP-3 Section 99 Construction, Sections 14, 53, and 99 REI, and CP-2 Section 14 Construction contracts.

**CEB Impacts**

- None identified at this time.

## S. 702 New Connecting Mains - Shaft 7 to WASM 3

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### Project Purpose and Benefits

- Contributes to improved public health*
- Extends current asset life*
- Improves system operability and reliability*

*To provide redundancy and improve the reliability of WASM 3 (Weston Aqueduct Supply Main); provide hydraulic looping and redundancy, enable Intermediate High Sections 59 and 60 to be taken off-line for rehabilitation, and improve water quality by reducing the length of unlined cast iron water mains in the MWRA system. Completion of this project will help provide the basis for a strong hydraulic network of piping among WASM 3, WASM 4, and the City Tunnel. The future conversion of Sections 23 and 24 in an emergency to provide a redundant supply to the Intermediate High Service system Section 25 and 59 that serve Belmont and Watertown via the WASM Commonwealth Avenue Pump Station.*

### Project History and Background

WASM 3 is a 56-inch to 60-inch diameter lock-bar steel pipe installed in 1926 and 1927. It is connected to the MetroWest Tunnel and Hultman Branch at the west end and the City Tunnel Extension at its east end. It extends from Weston through Waltham, Belmont, Arlington and Somerville to Medford. Most of its flow comes from the MetroWest Tunnel Shaft W, with peak flow of 57 million gallons per day. A lesser amount enters the main from the City Tunnel Extension Shaft 9. Upon completion of the Hultman Aqueduct and its interconnection to the Weston Aqueduct Terminal Chamber in 1941, WASM 3 became part of the High Service system. There are no connecting mains along the length of this 11-mile pipeline, and no other means available to adequately supply the nine communities it serves. WASM 3 serves communities northwest of Boston and is the sole source of supply to the Northern Extra High Service Area (Bedford, Lexington, Waltham, Arlington, and Winchester) and the Intermediate High Service Area (Belmont, Arlington, and Watertown). It also supplies a portion of the Northern High Service Area (Waltham, Watertown, Belmont, Arlington, Medford, and Somerville), and is a means of supplying the Spot Pond Supply Mains and Reservoir. WASM 3 serves a population of more than 250,000.

A break almost anywhere on this pipeline would result in severe service disruptions in Waltham, Watertown, Belmont, Arlington, Lexington, Bedford, and Winchester. Virtually no water would reach Waltham if a break were to occur at the west end of the pipeline; water normally supplied through the Shaft W connection would be forced through the Shaft 9 connection, increasing flows and reducing hydraulic grade lines in WASM 3, the City Tunnel, and City Tunnel Extension. The lack of redundancy also makes routine cleaning and lining of the 90± year old pipeline impossible. The need for maintenance is indicated by a significant number of leaks, particularly on the most vulnerable west end, which are the result of corrosion pitting through the pipe wall, as well as by the reduced carrying capacity of the line.

Completion of this project will facilitate conveyance of high service water from Shaft 9 of the City Tunnel Extension to WASM 3. This will be accomplished by rehabilitating existing mains between the City Tunnel Extension and WASM 3.

Previously proposed portions of this project have been eliminated or placed on hold until the Long-Term Redundancy study is completed. Specifically, the proposed new 48-inch diameter pipe through Newton and Waltham has been eliminated. The rehabilitation of Sections 23, 24, and 47 will proceed. Also, extension of Section 75 and replacement of Section 25 with a new 20-inch pipe will allow a redundant supply connection to Sections 25 and 59 serving Belmont and Watertown by way of the Commonwealth Avenue Pump Station.

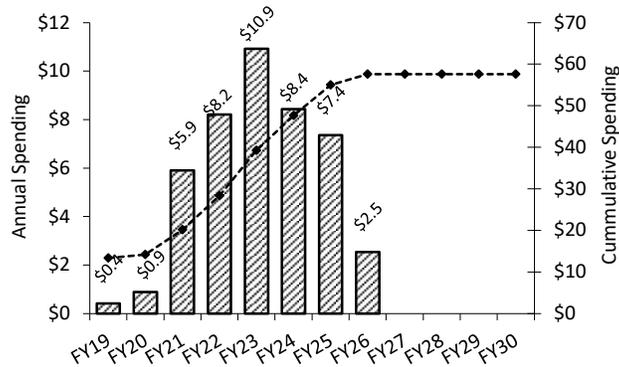
**Scope**

<b>Sub-phase</b>	<b>Scope</b>	<b>Status</b>
Watertown MOU	Payment to the City of Watertown to fund a portion of its Galen Street project to replace an existing 10-inch diameter pipeline with a new 12-inch diameter water main.	Completed
Routing Study (5163)	Identification of alternatives to determine the optimum approach for providing additional strong connections to WASM 3.	Completed
Design/CA/RI-DP1 (6383)	Design, construction administration and resident inspection services for a new 48-inch pipeline to interconnect WASM 3 with WASM 4 (CP-1). This design work was terminated based on the recommendation of the Long Term Redundancy Study.	Completed
Design DP2/4 Meter 120 (6384)	Design services for Section 47 from Meter 120 to WASM4. Construction Administration and Resident Inspection services to be performed by in-house staff.	Completed
CP3 C&L Sections 59 & 60 Construction (6548)	Cleaning and lining of 16,400 linear feet of 20-inch diameter pipe on Sections 59 and 60 (Intermediate High) from Section 25 in Watertown to Meter 121 in Arlington.	Future
Design/CA/RI and Construction Section 23, 24, 47 (6385/6392)	Cleaning and cement mortar lining of 4,500 feet of 36-inch diameter Section 23 and 11,000 feet of 20-inch Section 24 and Section 47; Replacing 3,600 feet of Section 23 water main, and 6,200 feet of Section 24 water main; Replacement of the check valve assembly at existing Revenue Meter 120 to Boston; and Replacement of 2,325 feet of Newton's 20-inch diameter water main in Ward Street, parallel to Sections 23 and 24.	Active/Future
NE Segment CP5 (6394)	Rehabilitation of 15,000 linear feet of 20 and 48-inch diameter pipe for Sections 18, 50, and 51 for the Northeast Segment plus Meter 32 replacement.	Completed
Design/CA for Sections 25, 75, 59 & 60 (6955) and REI (7680)	Design/Construction Administration and Resident Inspection services for replacement of Sections 25, extension of Section 75, and rehabilitation of Sections 59 & 60 pipelines.	Active/Future
Section 25 Replacement Construction CP-2 (6956)	Replacement of existing Section 25 (approximately 4,800 linear feet of existing 16" pipe) with a new 20 or 24-inch diameter pipeline.	Future
Section 75 Extension Construction CP-1 (7484)	Addition of approximately 4,000 feet of new 30-inch diameter pipe to extend Section 75 easterly to Section 24 in Newton, to provide a redundant feed to the Intermediate High Service area supplying Arlington, Belmont and Watertown which also requires replacement of Section 25 under construction Contract 6956, above.	Future

**Expenditure Forecast (in \$000s) and Project Status**

<b>Total Budget</b>	<b>Payments thru FY19</b>	<b>Remaining Balance</b>	<b>FY20</b>	<b>FY21</b>	<b>FY19-23</b>	<b>FY24-28</b>	<b>Beyond FY28</b>
\$57,572	\$13,332	\$44,239	\$885	\$5,900	\$26,320	\$18,327	\$0

### New Connecting Mains



Project Status 5/20	24.2%	Status as % is approximation based on project budget and expenditures. Northeast Segment CP-5 construction contract was completed in November 2011. Design of CP3 (Sections 23, 24 & 47) commenced in August 2016. Replacement Section 25, 75, 59 & 60 Design/CA was awarded in December 2018.
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#### Changes to Project Scope, Budget, and Schedule

Project Cost			Scheduled Completion Date			FY19-23 Spending		
FY20	FY21	Chge.	FY20	FY21	Chge.	FY20	FY21	Chge.
\$56,376	\$57,572	\$1,196	Dec-25	Dec-25	None	\$25,839	\$26,320	\$481

#### Explanation of Changes

- Project cost changed primarily due to updated cost estimate for Section 23, 24,47 Rehab, as well as inflation on unawarded contracts.
- Spending changed due to updated cost estimate listed above as well as inflation adjustment for Replacement of Section 25 Construction CP-2.

#### CEB Impacts

- None identified at this time.

## S. 704 Rehabilitation of Other Pump Stations

### Project Purpose and Benefits

- ☑ *Contributes to improved public health*
- ☑ *Extends current asset life*
- ☑ *Results in a net reduction in operating costs*
- ☑ *Improves system operability and reliability*

*To rehabilitate five active pump stations (Brattle Court, Reservoir Road, Hyde Park, Belmont, and Spring Street) - each of which is more than 40 years old and is overdue for renewal for safety, reliability, and efficiency reasons. Project includes a future phase to rehabilitate Gillis, Newton Street, Lexington Street, and Commonwealth Ave pump stations.*

### Project History and Background

MWRA's waterworks distribution system includes ten active pump stations. Extensive rehabilitation of the James L. Gillis, Newton Street, Lexington Street, and Commonwealth Avenue pump stations was completed 20 years ago.

The Brattle Court, Reservoir Road, Hyde Park, Belmont, and Spring Street pump stations were built in 1907, 1936, 1937 and 1958, respectively and were overdue for major rehabilitation. The Brattle Court Pump Station serves the towns of Arlington, Lexington, Waltham, and Winchester. The Reservoir Road Pump Station serves Brookline. The Hyde Park Pump Station serves Boston, Milton, Norwood, Canton, Dedham, Westwood and Stoughton. The Belmont Pump Station serves Belmont, Arlington, and Watertown. The Spring Street Pump Station serves Lexington, Bedford, part of Waltham, Belmont, Arlington, and Winchester. Some equipment at each pump station were inoperable, and system demand patterns had shifted during the life of the stations, requiring adjustments to pumping capacity. In addition, station improvements have not kept pace with changes in building and safety codes.

MWRA has divided construction for these five pump stations into two contracts. The first contract (Construction - Interim Automation), based on a fast-track design was completed in February 2001, involved installation of Supervisory Control and Data Acquisition (SCADA) systems at each station. Under the second construction contract, MWRA completed rehabilitation of the five pump stations (Brattle Court, Reservoir Road, Hyde Park, Belmont, and Spring Street). The second construction contract was awarded in October 2006 and was substantially complete in June 2010.

The next phase will be to rehabilitate the Gillis, Newton Street, and Lexington Street pump stations. The Commonwealth Avenue Pump Station rehabilitation is included in Metropolitan Redundancy Interim Improvements project.

### Scope

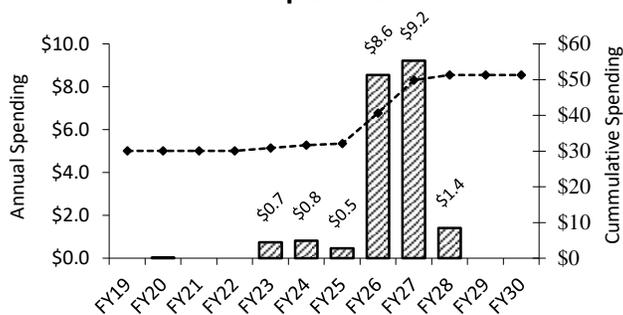
Sub-phase	Scope	Status
Preliminary Design (5153)	Planning and conceptual design including inspection and evaluation of the HVAC systems, buildings, pipes, valves, and other systems at the pump stations; determination of the need for improvements; and preparation of a conceptual design report.	Completed
Design 1/CA/RI (6110)	Design, Construction Administration and Resident Inspection for rehabilitation of five pump stations, including installation of SCADA systems.	Completed
Construction II and C (6304)	Installation of instrumentation at five pump stations to enable remote operation and monitoring.	Completed

Sub-phase	Scope	Status
Rehabilitation of 5 Pump Stations (6375)	Rehabilitation of Brattle Court, Reservoir Road, Hyde Park, Belmont, and Spring Street pump stations, including installation of new mechanical, electrical, instrumentation, and security systems, and building and site refurbishment, and SCADA installation.	Completed
Proprietary Equipment Purchases (6676)	Purchase of proprietary materials for SCADA system for Interim Instrumentation and Control.	Completed
Design 2 CS/RI (6980)	Final Design, construction services, and resident inspection for rehabilitation of five pump stations.	Completed
Technical Assistance	As-Needed Technical Assistance work needed.	Active
Pump Station Rehabilitation Design CA (7526), Construction (7527), and REI (7720)	Rehabilitation of the Gillis, Newton Street, and Lexington Street pump stations. The pumps in these stations are over 20 years old and maintenance of the existing units will be an issue mostly due to availability of replacement parts. More efficient units will be installed based upon age and life of the equipment. Lexington Street is the only pump stations for its respective service area.	Future

#### Expenditure Forecast (in \$000s) and Project Status

Total Budget	Payments thru FY19	Remaining Balance	FY20	FY21	FY19-23	FY24-28	Beyond FY28
\$51,290	\$30,058	\$21,233	\$33	\$0	\$780	\$20,453	\$0

#### Rehab of Other Pump Stations



Project Status 5/20	58.7%	Status as % is approximation based on project budget and expenditures. Construction rehabilitation of 5 pump stations (Brattle Court, Reservoir Road, Hyde Park, Belmont, and Spring Street) was substantially complete in June 2010.
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**Changes to Project Scope, Budget, and Schedule**

Project Cost			Scheduled Completion Date			FY19-23 Spending		
FY20	FY21	Chge.	FY20	FY21	Chge.	FY20	FY21	Chge.
\$50,258	\$51,290	\$1,032	May-27	May-27	None	\$1,247	\$780	(\$467)

**Explanation of Changes**

- Project cost changes due to adding contract for Pumping Station Resident Engineering/Inspection and deleting Pumping Station Rehabilitation Evaluation phase.
- Project spending changed due to Pumping Station Rehabilitation Evaluation phase being deleted.

**CEB Impacts**

- None identified at this time.

# S.708 Northern Extra High Service - New Pipelines

## Project Purpose and Benefits

- Contributes to improved public health*
- Extends current asset life*
- Improves system operability and reliability*

*To provide redundancy in the Northern Extra High (NEH) system and improve hydraulic service and reliability for major portions of the NEH system. Existing lines are undersized and frequently experience pressure problems. Improvements will include construction of two new pipe segments and rehabilitation of existing mains.*

## Project History and Background

The Northern Extra High (NEH) Pressure Zone serves the communities of Waltham, Lexington, Bedford (via Lexington), Belmont, Winchester, and Arlington. The existing pipelines are old and many are not large enough to meet maximum day plus fire flow service goals. Construction of new pipelines as well as replacement and rehabilitation of existing pipelines will improve system reliability and redundancy as well as system pressures, and will result in better fire protection and reduced pumping costs. Improvements will include new pipelines to interconnect Section 45 (in the vicinity of Meter 47) to Section 63 (in the vicinity of Meter 136) and interconnect Section 83 (in the vicinity of Meter 183) to Section 45 (in the vicinity of Meter 47). The improvements will also include replacement of Section 63, Section 34, and Section 45, as well as rehabilitation and replacement of Section 61. These pipe sections are key components of the NEH Service System, are undersized, and are past their useful life. The improvements will also include a new meter for Lexington and Belmont as well as various improvements to existing meters in the NEH pressure zone, which will improve service reliability and redundancy as well as improve flows to communities.

## Scope

Sub-phase	Scope	Status
NEH Improvements Design/ESDC (7404) and REI (7724)	Design and engineering services during construction and REI Services for CP-1 and CP-2.	Future
CP-1 NEH Improvements (6522)	Construction to include new pipe section interconnecting Meters 47 and 136 as well as Replacement of Section 63.	Future
CP-2 NEH Improvements (7725)	Construction to include new pipe section interconnecting Meters 183 and 47 as well as replacement of Sections 34 and 45 and replacement of Section 61. Replacement of 1,532 linear feet of 12-inch diameter cast-iron pipe (Section 34) with new 20-inch diameter pipe and rehabilitation of 3,374 linear feet of 16-inch diameter cast iron main (Section 45) and 4,771 lf of 24-inch diameter steel pipe (Section 61).	Future
Design/CA/RI and Construction Sections 45, 63, and 83 (5242/6340)	Replacement of approximately 2,600 linear feet of Section 45 with 24-inch diameter pipe extending from the connection point at Meter 47 to Section 82 on Park Street at the Intersection of Paul Revere Road in Arlington; installation of about 2,100 linear feet of new 24-inch pipeline (Section 101), parallel to a portion of Section 83, starting from Meter 182 and proceeding to the intersection of Waltham Street (in Lexington and part of Waltham) and Concord Ave (in Lexington). Also, Rehabilitation of Section 63, consisting of about 3,400 linear feet of 20-inch pipeline connecting Section 63 to Meter 136.	Completed

**Expenditure Forecast (in \$000s) and Project Status**

Total Budget	Payments thru FY19	Remaining Balance	FY20	FY21	FY19-23	FY24-28	Beyond FY28
\$40,180	\$3,632	\$36,548	\$6	\$518	\$2,525	\$33,850	\$173

Project Status 5/20	9.0%	Status as % is approximation based on project budget and expenditures. Construction of a portion of Section 45 was completed in September 2001. NEH Improvements Design/ESDC is scheduled to begin in November 2020.
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**Changes to Project Scope, Budget, and Schedule**

Project Cost			Scheduled Completion Date			FY19-23 Spending		
FY20	FY21	Chge.	FY20	FY21	Chge.	FY20	FY21	Chge.
\$10,874	\$40,180	\$29,306	Jul-26	Nov-27	16 mos.	\$447	\$2,525	\$2,078

**Explanation of Changes**

- Project cost, schedule and spending changed due to project repackaged and rescheduled with updated cost estimates for two construction contracts.

**CEB Impacts**

- None identified at this time.

## S. 712 Cathodic Protection of Distribution Mains

### Project Purpose and Benefits

- ☑ *Contributes to improved public health*
- ☑ *Extends current asset life*
- ☑ *Improves system operability and reliability*

*To evaluate the condition of existing cathodic protection systems and determine the feasibility of upgrading or installing cathodic protection systems to protect the system from corrosion.*

### Project History and Background

Within the MWRA water system there are approximately 300 miles of distribution pipe, 10 active pump stations, and 12 distribution storage facilities. A majority of the pipes are made of steel, cast iron and ductile iron and as a result are subject to corrosion due to the environmental conditions in which they reside. In order to maintain pipe integrity, cathodic protection is utilized within the system. Proper cathodic protection decreases the number of pipeline leaks and failures and ensures the integrity of the water distribution system is maintained.

Approximately 68 miles or 24% of MWRA's waterworks pipelines ranging from 24 inches to 60 inches in diameter are made of steel and are particularly subject to corrosion from acidic soils, fluctuating groundwater levels (especially where the groundwater is saline), and stray electrical currents. These steel pipelines are located in 26 of MWRA's 50 water communities.

Cathodic protection reduces deterioration of structural material, thereby increasing pipeline and storage tank life and deferring the need for replacement. Without proper cathodic protection, pipeline leaks and premature pipeline and storage tank failures increase, causing potentially costly property damage and possible loss of service to customers.

Some sections of MWRA's existing steel pipes were originally equipped with cathodic protection systems intended to reduce the effects of corrosion. Other steel pipelines had cathodic protection systems installed sometime after the original pipe installation. Other steel pipelines have been rehabilitated and still other sections of steel pipeline have never received cathodic protection.

### Scope

Sub-phase	Scope	Status
Planning	Evaluation of the condition of the steel pipelines, identification of areas of rapid corrosion due to stray currents, and design and installation of corrosion test stations.	Completed
Cathodic Protection Testing and Evaluation Program (6438)	Test and evaluate 1,019 cathodic protection test stations and 16 rectifiers including: level of protection; functionality of insulation joints; perform repairs; and identify, recommend and test replacement electrodes.	Completed
Cathodic Protection Shafts E & L Construction (6440)	Construction of new cathodic protection systems at Shafts E & L to replace the old systems.	Completed
Cathodic Protection (Shafts N and W) Construction (7610)	Construction to replace the existing cathodic protection systems in order to maintain pipe and steel storage tanks integrity for Shafts N and W.	Future

Sub-phase	Scope	Status
CP-1 Cathodic Protection (Metro System) Design/CA and Construction (7611/7612), and REI (7679) and CP-2 Construction (7715)	Design CA/RI and Construction to replace the existing cathodic protection systems in order to maintain pipe and steel storage tanks integrity for the Metropolitan System.	Future

#### Expenditure Forecast (in \$000s) and Project Status

Total Budget	Payments thru FY19	Remaining Balance	FY20	FY21	FY19-23	FY24-28	Beyond FY20
\$63,483	\$979	\$62,504	\$181	\$308	\$12,066	\$51,148	\$0

Project Status 5/20	1.8%	Status as % is approximation based on project budget and expenditures. Project Planning phase is complete. Cathodic Protection Testing and Evaluation Program was completed in August 2017. Cathodic Protection Shafts E&L was substantially complete in August 2019.
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#### Changes to Project Scope, Budget, and Schedule

Project Cost			Scheduled Completion Date			FY19-23 Spending		
FY20	FY21	Chge.	FY20	FY21	Chge.	FY20	FY21	Chge.
\$66,704	\$63,483	(\$3,221)	Jan-27	Jan-27	None	\$9,740	\$12,066	\$2,326

#### Explanation of Changes

- Project cost changed primarily due to Cathodic Protection West Design/Construction Administration and REI phases were deleted since work will be done through As-Needed Design and REI contracts.
- Spending changed due to Cathodic Protection Metropolitan System project repackaged and rescheduled with updated cost estimates for two construction contracts partially offset by deleted contracts listed above.

#### CEB Impacts

- None identified at this time.

## S. 713 Spot Pond Supply Mains - Rehabilitation

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### Project Purpose and Benefits

- Contributes to improved public health*
- Extends current asset life*
- Improves system operability and reliability*

*To improve the condition, carrying capacity, and valve operability of the two long supply mains which extend north from Chestnut Hill to Spot Pond. These cast-iron mains, originally installed in 1899, deliver water to the Northern Low Service System. Improvements involve a combination of replacement, cleaning and lining, and valve replacement depending on specific site conditions and needs. Improving these supply lines will reduce the need to take water from the City Tunnel to augment the Low Service System and improve the quality of water delivered to eight user communities.*

### Project History and Background

The East and West Spot Pond Supply Mains (SPSMs) serve the Northern Low Service Area, including portions of Brighton, East Boston, Charlestown, Chelsea, Malden, Medford, Somerville, and Everett. The lines are also designed to fully supply Cambridge during drought or emergency. The mains have historically supplied Spot Pond and subsequently the James L. Gillis Pump Station (formerly the Spot Pond Pump Station). With the closure of Spot Pond as a water supply source and the construction of the Spot Pond Suction Main (Section 99) as the primary supply to the Gillis Pump Station, the Spot Pond Supply Mains serve as distribution mains to the eight communities and provide emergency backup supply to the Gillis Pump Station. In the event Section 99 is out of service, the station would take suction directly from these mains, rather than from Spot Pond. These mains interconnect with the new Spot Pond Covered Storage and pump station.

The East Spot Pond Supply Main consists of 61,000 linear feet of mostly 48-inch diameter pipe which passes through Brookline, Boston, Cambridge, Somerville, Medford, Malden, Melrose, and Stoneham. The West Spot Pond Supply Main consists of 53,000 linear feet of 48-inch and 60-inch diameter pipe that passes through Brookline, Boston, Cambridge, Somerville, Medford, and Stoneham. Portions of the SPSMs in Brookline, primarily on Beacon Street, were rehabilitated under the Boston Low Service Pipe and Valve Rehabilitation project.

The carrying capacities of the pipes had been significantly reduced as a result of the build-up of rust deposits (tubercules) and other matter along the pipe walls, which also contributed to water quality deterioration in the Low Service System. The ability of the mains to withstand service pressures was drastically reduced in some areas due to exterior corrosion of pipes. In addition, inoperable or poorly operating valves along the mains made isolation and re-routing of flow difficult to implement.

Section 67 is included in this project because it provides a connection between the East and the West SPSM from Section 11 at Porter Square in Cambridge to Section 4 at Union Square in Somerville. Section 67 consists of 6,900 linear feet of 48-inch diameter steel pipe constructed in 1949. Rehabilitation of this main was needed because of the age of the pipe and the critical role of the main in providing flow to the East and West mains during shut downs for maintenance and construction.

Internal lining of these mains to restore capacity and improve structural integrity, will ensure adequate peak and emergency flow to user communities, alleviate water quality deterioration, and provide emergency back-up capacity for the Northern High System and Northern Intermediate High via the Gillis Pump Station. MWRA's reconfiguration of the water distribution system provides for the Spot Pond Supply Mains to be fed from the City Tunnel Extension only during periods of peak demand, thus conserving tunnel supply for High Service use. Supply to the Low Service System will be provided by Weston Aqueduct Supply Mains 1 and 2, which are connected to the new Loring Road covered storage tanks in Weston that have been constructed as part of MWRA's MetroWest Water Supply Tunnel project. A portion of the supply is from WASM 4, which connects to the East and West Spot

Pond Supply Mains at Western Avenue and North Harvard Avenue and on Memorial Drive at Magazine Beach in Cambridge.

Completion of this project will improve pressures to the far reaches of the Northern High Service Area by reducing the demand burden on the City Tunnel Extension. The quality of water delivered to eight communities will improve as a result of the upgrade of 18 miles of deteriorated pipe.

### Scope

Sub-phase	Scope	Status
Preliminary Design and Design/CA/RI (6223)	Preliminary design, design, construction administration, and resident inspection of the rehabilitation or replacement of Sections 3, 4, 5, 6, 7, 9, 10, 11, 12, 67, and portions of Sections 2, 16W, and 57.	Completed
North (Medford/Melrose) Construction-CP1 (6317)	Cleaning and lining of 20,300 feet of 48-inch and 60-inch pipe in Medford, Malden, Melrose, and Stoneham (Sections 7 and 12). Replacement of valves and reconfiguration of blow-off valves to eliminate cross-connections with storm drains or sewers. Elimination of connection with Spot Pond (considered a cross connection with a non-potable water source), and configuration to allow emergency reconnection if needed.	Completed
Middle (Medford/Somerville) Construction – CP2 (6381)	Cleaning and lining of 24,100 feet of the East Spot Pond Main (48-inch pipe) in Somerville and Malden (Sections 4, 5, 6, and 7) including reinforcement at rail and MBTA crossings; cleaning and lining of 14,000 feet of the West Spot Pond Main (48-inch pipe) in Medford and Somerville; and some steel pipe replacement on the Mystic Valley Parkway (800 feet, 60-inch, Section 16W), and Middlesex Fells Parkway (700 feet, 48-inch, Section 5 on land). Cleaning and lining on Somerville Avenue (Section 67, 6,500 feet of 48-inch steel). Replacement of valves throughout the pipelines, including in Medford Square at the interconnections of Sections 12, 16W, and 57.	Completed
South (Cambridge/Boston) CA/RI Construction – CP3 (6382)	Cleaning and lining of 11,700 linear feet of the East Spot Pond Main in Charles River Crossing and Cambridge (48-inch, Sections 3 and 4) including valve replacement, and cleaning and lining of 16,800 linear feet of the West Spot Pond Main in Harvard St., Franklin St., No. Harvard Avenue, and Massachusetts Avenue (48-inch, Sections 9 and 11, Brighton and Cambridge).	Completed
Early Valve Replacement Contract (6475)	Installation of nine main line valves and associated blow-off valves, as well as permanent by-pass piping to meters and air valves. Also includes removal of pipe at three locations for materials strength testing.	Completed
Walnut Street Bridge Truss Design and Construction (6697/7483)	Section 4 Bridge Truss at Walnut Street spans New Hampshire-Maine Railroad Line is in need of repair, painting and possible replacement. Bridge inspection needs to be done before scope of repairs/painting can be developed. (A portion of CIP 7483 to be used for replacement of rods and inspection of bridge.)	Future
Early Valve Equipment Purchase (6483)	Purchase Order for 12 valves that were installed from 1998-2001 as a precursor to the cleaning and lining contracts.	Completed

Sub-phase	Scope	Status
Section 4 Webster Ave Bridge Pipe Rehabilitation Design and Construction (7334/7335)	Section 4 is a 48-inch diameter cast iron main crossing the Webster Ave Bridge in Somerville that needed to be rehabilitated and was currently out of service due to pipe deflection and leakage. This project returned an isolated pipeline to service to provide redundancy.	Completed

**Expenditure Forecast (in \$000s) and Project Status**

Total Budget	Payments thru FY19	Remaining Balance	FY20	FY21	FY19-23	FY24-28	Beyond FY28
\$66,289	\$65,489	\$800	\$0	\$0	\$800	\$0	\$0

Project Status 5/20	98.8%	Status as % is approximation based on project budget and expenditures. Construction of CP1 (North), CP2 (Middle), CP3 (South), the Early Valve Replacement Contract and Section 4 Webster Ave Bridge Pipe Replacement are complete.
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**Changes to Project Scope, Budget, and Schedule**

Project Cost			Scheduled Completion Date			FY19-23 Spending		
FY20	FY21	Chge.	FY20	FY21	Chge.	FY20	FY21	Chge.
\$66,289	\$66,289	\$0	May-23	May-23	None	\$800	\$800	\$0

**Explanation of Changes**

- N/A.

**CEB Impacts**

- None identified at this time.

## S. 719 Chestnut Hill Connecting Mains

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### Project Purpose and Benefits

- Contributes to improved public health*
- Extends current asset life*
- Improves system operability and reliability*

*To simplify the complex arrangement of old pipes near the former Chestnut Hill pump stations for safety and operability. Also, create a connection between Shaft 7 of the City Tunnel and the Southern Distribution surface mains to provide redundancy along the Dorchester Tunnel. MWRA is restructuring the piping arrangement through a combination of constructing new pipelines, rehabilitating older pipelines, sliplining, abandoning aqueducts, replacing pressure regulating valves, replacing the emergency pumps at Chestnut Hill, and abandoning pipes and valves which are no longer needed for service.*

### Project History and Background

The City Tunnel divides into two branches at Chestnut Hill: The City Tunnel Extension going north to supply the Northern High, Northern Intermediate High and Northern Extra High Systems, and the Dorchester Tunnel, which goes south to supply the Southern High and Southern Extra High Systems. There are two shafts in the Chestnut Hill area: Shaft 7 on the City Tunnel, located immediately west of the Chestnut Hill Reservoir, and Shaft 7B on the Dorchester Tunnel, located immediately east of the reservoir. At each of these shafts two newer pipes extend to connect to the older pipelines of the Boston Low, Northern Low and Southern High Systems.

Previously, the Southern High System could only be supplied from Shaft 7B. If the Dorchester Tunnel were to be out of service, it would be necessary to activate the Sudbury Reservoir System, transport water from there via the Sudbury Aqueduct (currently on standby) to the Chestnut Hill Reservoir (currently on standby) and utilize the emergency pump station at Chestnut Hill to pump water from the reservoir to the Southern High System. This water would not be of acceptable quality and its use would require a boil order. A new potable water connection has been constructed from the low service pipes to the new emergency pump station.

The older pipes in the area were originally designed to be supplied from the Cochituate and Sudbury Aqueducts, the Chestnut Hill Reservoir, or the Chestnut Hill High Service and Low Service pump stations. None of these facilities are presently in normal use, and a new underground pump station has replaced the Chestnut Hill pump stations. The pipe network is not only old and inordinately complex, but it is not designed to take water from the two tunnel shafts that are the present sources of potable supply. Portions of this pipe network have been rehabilitated and integrated into the present operation of the system. Considerable lengths of pipe with minimal or stagnant flow, which are a source of discolored water, have been abandoned. Some new pipe was added to better connect the two tunnel shafts with the surface pipe network. The interconnections between the potable water system and standby facilities, which are considered non-potable, have been rebuilt to eliminate the possibility of cross-connections during normal operation.

The High and Low Service pump station buildings at Chestnut Hill housed facilities which served four functions: emergency pumping, surge relief for the Boston Low System, level control for the Chestnut Hill Reservoir, and remote hydraulic operation of large valves on and near the site of the High Service pump station. Construction of a new underground pump station provides more reliable emergency pumping capacity and has enabled MWRA to abandon the pump station buildings and return them to the Commonwealth. Surge relief was provided in a new Shaft 7B pressure reduction chamber that also interconnects restructured piping. Gate House No. 2 has also been refurbished to provide supply to the new pump station. New valves have been constructed to replace the old hydraulic valves.

**Scope**

<b>Sub-phase</b>	<b>Scope</b>	<b>Status</b>
Design/CA/RI and Construction – Pump Station Potable Connection (6141/6651)	Construction of potable suction and discharge piping to the emergency pump station, restructuring piping to permit surplusing of Chestnut Hill pump station site, elimination of potential cross connections with non-potable suction and discharge lines, reconstruction of the Shaft 7B PRV Station, upgrade of the Shaft 9A PRV station, rehabilitation of valves at Waban Hill Reservoir, and abandonment of the Ward Street Pumping Station and associated piping. Construction to provide potable low service suction to the new pump station and to restructure piping to permit surplusing of the historic pumping stations site. Completion of upgrades of facilities that also may be used during the Walnut Hill Water Treatment Plant startup at Shaft 7B, Shaft 9, and Ward Street.	Completed
Preliminary Engineering (6301)	Provide preliminary design services for the rehabilitation and upgrade of facilities so that MWRA is able to operate the water system during normal conditions and specific emergency scenarios.	Completed
Design/CA/RI and Construction – Emergency Pump Relocation (6503/6501)	Relocation of the emergency pumping function and other minor facilities from the existing High and Low Service pump station buildings to a new 90-mgd underground pump station constructed adjacent to the Low Service building. The relocation enables MWRA to surplus these historic buildings. The new pump station has the capacity to pump 90-mgd from the Sudbury Aqueduct/Chestnut Hill Reservoir to the Southern High Distribution System.	Completed
Boston Paving (6558)	Payment(s) to the City of Boston for paving work provided.	Completed
BECo Emergency Pump Connection (6623)	Payment to Boston Edison Company for installation of electrical service to meet special requirements.	Completed
Chestnut Hill Final Connections Design ESDC, Construction (6995/6982/7705)	Chapter 30 and Chapter 149 final pipe connections.	Future
Equipment Pre-Purchase (6814)	Valve pre-purchase to support potable connection construction so that the Chestnut Hill Pump Station site could be returned to the Commonwealth of Massachusetts as surplus property.	Completed
Demolition of Garages (6820)	Demolition of garages prior to transfer of property to the Commonwealth, at request of state Department of Capital Asset Management.	Completed
Chestnut Hill Gatehouse No. 1 Repairs (7382)	This project provided structural stability of sub-structure of gatehouse which involved flowable fill and structural support walls.	Completed

**Expenditure Forecast (in \$000s) and Project Status**

<b>Total Budget</b>	<b>Payments thru FY19</b>	<b>Remaining Balance</b>	<b>FY20</b>	<b>FY21</b>	<b>FY19-23</b>	<b>FY24-28</b>	<b>Beyond FY28</b>
\$38,945	\$18,287	\$20,659	\$0	\$0	\$0	\$20,648	\$11

Project Status 5/20	47.0%	Status as % is approximation based on project budget and expenditures. Chestnut Hill Gatehouse Repairs was substantially complete in April 2018.
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**Changes to Project Scope, Budget, and Schedule**

Project Cost			Scheduled Completion Date			FY19-23 Spending		
FY20	FY21	Chge.	FY20	FY21	Chge.	FY20	FY21	Chge.
\$33,827	\$38,945	\$5,118	Dec-27	Dec-27	None	\$0	\$0	\$0

**Explanation of Changes**

- Project increased due to inflation adjustments for Chestnut Hill Final Connections work.

**CEB Impacts**

- None identified at this time.

## S. 721 Southern Spine Distribution Mains

### Project Purpose and Benefits

- Contributes to improved public health*
- Extends current asset life*
- Improves system operability and reliability*

*To increase carrying capacity and improve valve operability along the large surface mains that run parallel to the Dorchester Tunnel and provide service to the Southern High and Southern Extra High systems. These mains have serious hydraulic deficiencies and many inoperable valves. Hydraulic performance improvements are needed to provide redundancy for the Dorchester Tunnel. Work will include rehabilitation of more than 12 miles of large diameter pipeline.*

### Project History and Background

The Southern Spine Distribution Mains comprise the surface piping which parallels the Dorchester Tunnel. The mains begin in the vicinity of Shaft 7B in Brookline and end at the Blue Hills Reservoir in Quincy. The mains serve the Southern High and Southern Extra High System communities of Boston, Brookline, Milton, Quincy, Norwood, Canton, Stoughton and Dedham-Westwood.

Because of the poor conditions of the valves, MWRA operations staff must frequently close several valves in order to shut down a line. This practice often results in closing more of the system than is otherwise necessary. Several of these pipelines are currently functioning at approximately 50% of their original carrying capacity due to the build-up of rust deposits and other matter along the pipeline walls. In their present condition, these mains could not provide adequate service to users if the Dorchester Tunnel was taken off-line.

Construction of the first two contracts for Section 22 South was completed by June 2005. The contracts for Section 107 Phase 1 and Phase 2 were completed in January 2009 and January 2012, respectively.

### Scope

Sub-phase	Scope	Status
Sections 21,43, 22 Design/CA/RI	Design, construction administration, and resident inspection for five construction contracts in Phase 1, including rehab of 32,000 linear feet of 24- to 48-inch diameter pipes, and installation of 17,000 linear feet of 36- to 48-inch pipes. Rehabilitation to consist of cleaning and cement mortar lining, and replacement of the main line valves, blow-off valves, and appurtenances.	Completed
Section 22 South Construction	Rehabilitation of approximately 10,000 linear feet of 48-inch diameter Section 22 South, and installation of 1,700 linear feet of new pipe.	Completed
Adams Street Bridge	Relocation of a pipeline made necessary by the reconstruction of this bridge by the MBTA.	Completed
Southern High Ext Study (6602)	Study to determine the feasibility of expanding water services to additional communities in the Southern High Service Area. Cost of the study and public participation was fully funded by the Commonwealth of Massachusetts. Completed in May-1999.	Completed
Section 22 Rehab Alternative Analysis/Environmental Permitting (7155)	Section 22 rehabilitation alternatives analysis and environmental permitting.	Active

Sub-phase	Scope	Status
Section 22 Design/ESDC (7120)	Design/ESDC for Section 22 and Section 21.	Future
Section 22 Construction (6844) and REI (7723)	Rehabilitation of 16,000 linear feet of 48-inch diameter Section 22 and 5,000 linear feet of 24-inch diameter Section 21.	Future
Section 20 and 58 Rehabilitation Design (6296) and Construction (6298)	Rehabilitation of approximately 19,000 feet of 36-inch diameter steel and cast iron pipes in Morton Street from Shaft 7C of the Dorchester Tunnel to Washington Street.	Future
Section 107 Phase 1 Construction (6845)	Construction of 4,400 linear feet of new 48-inch diameter pipe from East Milton Square to Furnace Brook Parkway in Milton and Quincy.	Completed
Section 107 Phase 2 Construction (7099)	Replacement of Sections 21 and 43 with 9,200 linear feet of new 48-inch diameter pipe from Dorchester Lower Mills in Boston to East Milton Square, and cleaning and lining of 4,000 feet of existing water mains	Completed
Contract 1 A Construction (6885)	Rehabilitation of 4,400 linear feet of Section 22 South.	Completed

#### Expenditure Forecast (in \$000s) and Project Status

Total Budget	Payments thru FY19	Remaining Balance	FY20	FY21	FY19-23	FY24-28	Beyond FY28
\$90,585	\$36,683	\$53,902	\$740	\$852	\$3,241	\$50,423	\$238

Project Status 5/20	41.3%	Status as % is approximation based on project budget and expenditures. Section 22 Rehabilitation Alternatives Analysis and Environmental Permitting was awarded in July 2019.
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#### Changes to Project Scope, Budget, and Schedule

Project Cost			Scheduled Completion Date			FY19-23 Spending		
FY20	FY21	Chge.	FY20	FY21	Chge.	FY20	FY21	Chge.
\$80,308	\$90,585	\$10,277	May-27	May-27	None	\$3,271	\$3,241	(\$30)

#### Explanation of Changes

- Project cost increased due to inflation adjustments for Section 22 Construction and Sections 20 & 58, Design and Construction. Also, new subphase for Section 22 REI.
- Project spending changed primarily due to Section 22 Rehabilitation Alternative Analysis and Environmental Permitting was awarded less than budgeted.

## **CEB Impacts**

- None identified at this time.

# S. 722 Northern Intermediate High (NIH) Redundancy and Storage

## Project Purpose and Benefits

- Contributes to improved public health*
- Extends current asset life*
- Improves system operability and reliability*

**Master Plan Project  2008 Priority Rating 1 (see Appendix 3)**

*The Northern Intermediate High System lacks both pipeline redundancy and sufficient storage. The intent of this project is to identify and take measures that reduce both the risk and impacts of a pipeline failure within the Northern Intermediate High System.*

## Project History and Background

This system serves Reading, Stoneham, Wakefield, Wilmington, Winchester, and Woburn with an average daily demand of 9.9 million gallons. The population served is approximately 150,000. The current six million gallon capacity of MWRA's Bear Hill Tank in Stoneham is both insufficient to meet MWRA's goal of one day of storage for the service area and is not advantageously placed within the NIH system.

Section 89 is a three mile, four foot diameter Prestressed Concrete Cylinder Pipe (PCCP) transmission main with no redundancy other than the low capacity, century old Section 29 that parallels its route for a short distance. The 10,500 foot length of Section 89 northwest of Spot Pond is constructed of Class IV wire which is of significant concern given experience with catastrophic failures elsewhere in the country. Section 29 was originally constructed in 1901 and measures 6,300 feet in length and 24 inches in diameter. Because of its age and the fact that it is unlined cast-iron pipe, tuberculation has reduced the pipeline carrying capacity to approximately 45% of the original design capacity (C-value: 58). In the event of a shut down in Section 89, Section 29 may not be able to meet the minimum hydraulic needs of the area and additional chlorination to maintain water quality may be required.

## Scope

Sub-phase	Scope	Status
Concept Plan, ENF, and Mobile Pump Unit	Developed a concept level plan to evaluate options to reduce the risk and the impacts of potential failures in Sections 29 and 89. Measures evaluated included valve improvements, improved community interconnections, pipeline redundancy, targeted emergency response plans, additional storage and other improvements that can be implemented within the NIH system. Concept planning work included environmental review of the recommended plan and specification and purchase of the Mobile Pump Unit.	Completed
Design CA/RI and construction NIH Impr/Gillis PS Impr./Reading-Stoneham Interconnection (7045/7260/7261)	This phase includes the design and construction of short-term measures identified in the conceptual plan including Gillis PS Improvements and the Reading/Stoneham Interconnection.	Completed

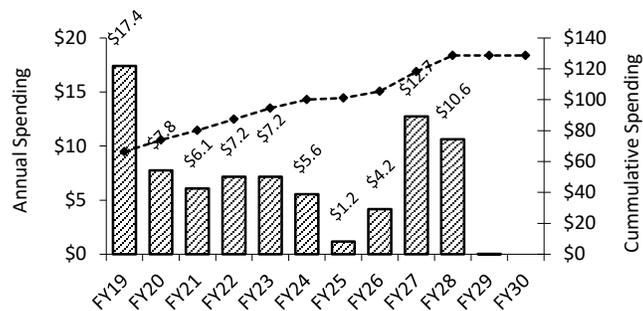
Sub-phase	Scope	Status
Design CA/RI and Construction Section 89/29 Redundancy Phases 1A, 1B, 1C & 2	Contract 6906 includes design and CA/RI for the redundant pipeline Section 110 (approximately 7 miles) consisting of 4 construction contracts. Phase 1 includes Phase 1A West Street Section 110 Woburn/Reading (7066), Phase 1B Section 110 Reading (7471) and Phase 1C Section 110/112 Stoneham and Wakefield (7478). Phase 2 includes Section 110 in Stoneham (7067).	Active/completed
NIH Storage Design & Construction (7311/7068)	The Concept Plan has identified several potential storage locations in the NIH system. This phase includes the design and construction of two 3-MG elevated tanks.	Future
Section 89 Replacement Design/CA (7116), RE/RI Services (7633) and Construction (7117)	Section 89 will be replaced after the redundant pipeline is completed. These phases include design/CA, RE/RI and construction for the replacement of Section 89.	Active/ Future

#### Expenditure Forecast (in \$000s) and Project Status

Total Budget	Payments thru FY19	Remaining Balance	FY20	FY21	FY19-23	FY24-28	Beyond FY28
\$128,729	\$66,302	\$62,428	\$7,764	\$6,084	\$45,574	\$34,250	\$10

Project Status 5/20	57.2%	Status as % is approximation based on project budget and expenditures. Section 89/29 Redundancy Design/CA/RI contract was awarded in March 2011. Reading/Stoneham Interconnections was substantially complete in October 2012. Gillis Pump Station Improvements was substantially complete in December 2014. West St Pipeline Reading Construction Phase 1A was substantially complete in May 2015. Phase 1B and Phase 1C were substantially complete in May 2018 and September 2018, respectively. Phase 2 Construction was substantially complete in June 2020.
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#### NIH Redundancy and Storage



**Changes to Project Scope, Budget, and Schedule**

Project Cost			Scheduled Completion Date			FY19-23 Spending		
FY20	FY21	Chge.	FY20	FY21	Chge.	FY20	FY21	Chge.
\$121,188	\$128,729	\$7,541	Jan-28	Jan-28	None	\$41,066	\$45,574	\$4,508

**Explanation of Changes**

- Project cost increased primarily due to updated cost estimate for Section 89 & 29 Replacement Construction, change orders for Section 89/29 Redundancy Construction Phase 2, and inflation adjustments for NIH Storage contracts.
- Project spending changed primarily due to updated cost estimate for Section 89 & 29 Replacement Construction and change orders for Section 89/29 Redundancy Construction Phase 2.

**CEB Impacts**

- None identified at this time.

## S. 723 Northern Low Service Rehabilitation - Section 8

### Project Purpose and Benefits

- Contributes to improved public health*
- Extends current asset life*
- Improves system operability and reliability*

*To improve the condition and reliability of unlined cast-iron pipes serving a portion of the Northern Low System. These pipelines, have reduced carrying capacity because of rust build-up, and have experienced leaks at above average rates. Improvements will consist of a combination of replacement, cleaning, lining, and valve repairs. Rehabilitation of Sections 37 and 46 will improve the service to East Boston and will allow the shutdown of Section 8. The construction of Section 97A provides needed redundancy to East Boston via the Northern High System.*

### Project History and Background

Section 8 was installed between 1897 and 1915 and serves Malden, Everett, Chelsea, and East Boston. Section 8 is currently functioning at approximately 45% of its original capacity (C-value: 60) due to the build-up of rust deposits and other matter along the interior pipe wall. Excavations for the installation of new valves along portions of Section 8 have indicated severe external corrosion on the pipe wall, which could affect the structural stability of the pipeline.

Before rehabilitating Section 8, the distribution system supplying East Boston must be strengthened. Sections 37 and 46, located in Chelsea, are 36-inch diameter cast iron pipes. These two pipe sections connect between Section 57, portions of which were previously rehabilitated, and the two Chelsea River crossings to East Boston at Sections 8 and 38. It is anticipated that Sections 37 & 46 will need cleaning and cement mortar lining. Section 97A, a new 16-inch diameter pipe provides redundancy to East Boston via Northern High System. The pipeline connects to existing Meter 99 in East Boston and to the Boston low-pressure system through a new pressure-reducing valve.

### Scope

Sub-phase	Scope	Status
Design/CA, Construction, and REI – Section 8 and 57 (7092/6322/7719)	Cleaning and cement mortar lining of the pipeline interior, replacement of all defective and inoperable valves, and the addition of new valves for 7,500 linear feet of 48-inch pipe on Section 8 in Malden and Everett. Replacement work consists of replacing 9,722 feet of 42-inch pipeline with new 36-inch ductile iron main and replacement of blow-off connections from Second Street in Everett to the Mystic River Bridge in Chelsea.	Future
Rehab Sections 37 and 46 Chelsea, East Boston Design/CA, Construction and REI (7405/6962/7718)	Rehabilitation of approximately 3,550 linear feet of 36-inch cast iron main (Section 37) and approximately 2,500 linear feet of 36-inch cast iron main (Section 46). Both sections are located in Chelsea and are critical to the supply of water to East Boston. Section 38, the 36-inch ductile iron pipeline under the Chelsea River, is assumed to not need rehabilitation.	Future
Section 97A Construction (7021)	Installation of approximately 3,000 linear feet of 20-inch, 16-inch and 12-inch water main and a new pressure-reducing valve. This completed work is part of the Northern High System and adds redundancy to East Boston, including Logan Airport.	Completed

Sub-phase	Scope	Status
Sections 50/57 Water Rehabilitation Design CA/RI (7540) and Construction (7541)	Design, CA/RI and construction of rehabilitation of: 600 feet of 20-inch cast iron Northern High System water pipe; and 2,500 feet of 48-inch steel Northern Low System water pipe and associated valves and structures located in Medford, MA.	Active/Future

#### Expenditure Forecast (in \$000s) and Project Status

Total Budget	Payments thru FY19	Remaining Balance	FY20	FY21	FY19-23	FY24-28	Beyond FY28
\$60,945	\$4,907	\$56,038	\$557	\$1,171	\$13,194	\$44,664	\$133

Project Status 5/20	8.7%	Status as % is approximation based on project budget and expenditures. Section 50 & 57 Water & Sections 21/20/19 Sewer Design/ESDC/REI contract commenced in July 2017.
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#### Changes to Project Scope, Budget, and Schedule

Project Cost			Scheduled Completion Date			FY19-23 Spending		
FY20	FY21	Chge.	FY20	FY21	Chge.	FY20	FY21	Chge.
\$69,584	\$60,945	(\$8,639)	Jul-28	Jul-28	None	\$29,898	\$13,194	(\$16,704)

#### Explanation of Changes

- Project cost changed primarily due to updated cost estimate for Section 50 & 57 Water & 21/20/19 Construction offset by inflation adjustments on unawarded contracts.
- Spending changed primarily due to updated cost estimate for Section 50 & 57 Water & 21/20/19 Sewer Construction.

#### CEB Impacts

- None identified at this time.

## S. 727 Southern Extra High Redundancy & Storage

### Project Purpose and Benefits

- ☑ *Contributes to improved public health*
- ☑ *Provides environmental benefits*
- ☑ *Extends current asset life*
- ☑ *Improves system operability and reliability*

**Master Plan Project ☑ 2008 Priority Rating 2 (see Appendix 3)**

*To provide redundancy to the southern extra high mains Section 77 and 88 serving Boston, Canton, Norwood, Stoughton and Dedham-Westwood by construction a redundant pipeline. Also, to increase distribution storage within the service area to improve system operation and reliability.*

### Project History and Background

This project will provide redundancy to Sections 77 and 88 serving Boston, Canton, Norwood, Stoughton, and Dedham-Westwood, through construction of a redundant pipeline. The project will also increase distribution storage within the service area to improve system operation and reliability.

MWRA's Southern Extra High pressure zone serves Canton, Dedham, Norwood, Stoughton, Westwood, portions of Brookline, Milton, Newton, and the Roslindale and West Roxbury sections of Boston. Water is pumped to this pressure zone from the Dorchester tunnel through two pump stations.

The Southern Extra High pressure zone is currently deficient in distribution storage and lacking in redundant distribution pipelines. MWRA maintains two distribution storage tanks (Bellevue Tank 1 and Bellevue Tank 2) totaling 6.2 million gallons of storage for the entire Southern Extra High service area, which is significantly below the goal of one day of storage. Further highlighting the deficiency is the fact that the overflow elevation for the 2.5-million-gallon Bellevue Tank 1 is 25 feet lower than the overflow elevation for the newer 3.7-million-gallon Bellevue Tank 2, limiting its useful capacity.

The five communities in the southern portion of the service area (Canton, Norwood, Dedham, Westwood, and Stoughton) are served by a single MWRA 36-inch diameter transmission main (Section 77), which is five miles long. Canton and Stoughton are served by a branch (Section 88) off of Section 77. Although several of these communities are partially supplied by MWRA, the loss of this single transmission main would result in a rapid loss of service in Norwood and Canton, and water restrictions for Stoughton and Dedham/Westwood.

In addition, the Southern Extra High service area has expanded during the past several years with the addition of the partially-supplied Town of Stoughton and the Dedham-Westwood Water District. This growth has been concentrated to the south while the Bellevue tanks are located at the northern end of the service area. Although several of these communities are partially supplied by MWRA, the Town of Norwood is fully supplied by this line and has no back-up source of supply. There have been several instances when the water supply to Norwood has been interrupted due to valve and/or pipe failures.

### Scope

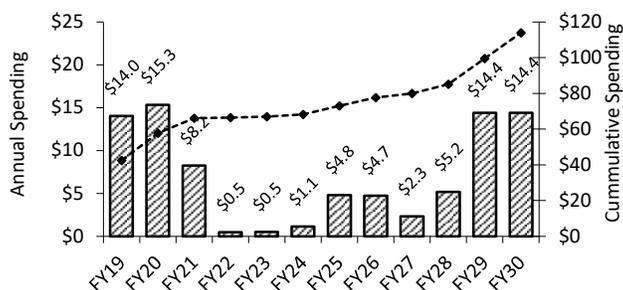
Sub-phase	Scope	Status
Concept Plan (6452)	A study to assess storage, capacity and condition of existing distribution pipes, new pipeline routing options and tank sites were identified.	Completed

Sub-phase	Scope	Status
University Ave Water Main Section 108 (6445)	Initial phase to provide redundant pipeline on University Avenue in Norwood. Project broken out from the larger SEH redundancy and storage projects. This work has been completed.	Completed
Redundancy Pipeline Section 111 Design (6453) & Construction Ph 1 Contracts 1, 2, and 3 (6454, 7504, 7505)	The first phase funds the design and construction of a pipeline from the Bellevue storage tank to East Street in Westwood, which will provide redundancy to Sections 77 & 88.	Active
Storage Design & Construction Phase 2 (6444/7245)	The second phase will provide redundancy to Sections 77 & 88 through design and construction of one (1) 2.5 million gallon distribution storage tank. This tank is needed to provide adequate one day storage to the service area.	Future
Storage Design & Construction Phase 3 Second Tank (7263/7262)	The third phase will provide additional redundancy to Sections 77 & 88 through design and construction of an additional one (1) 2.5 million gallon distribution storage tank. This tank is needed to provide additional one day storage to the service area.	Future
Section 77/88 Design/ESDC, Constr. and REI (7112/7113/7706)	Rehab of Sections 77 & 88 after redundant pipeline is in place.	Future

**Expenditure Forecast (in \$000s) and Project Status**

Total Budget	Payments thru FY19	Remaining Balance	FY20	FY21	FY19-23	FY24-28	Beyond FY28
\$141,243	\$42,462	\$98,781	\$15,311	\$8,227	\$38,522	\$18,114	\$56,162

**SEH  
Redundancy & Storage**



Project Status 5/20	40.3%	Status as % is approximation based on project budget and expenditures. Conceptual Design began in February 2007. University Ave Water Main was substantially complete in November 2008. Redundancy/Storage Phase 1 Final Design/CA/RI commenced in February 2014. Redundancy Pipeline Section 111 Construction 1 was substantially complete in September 2018. Redundancy Pipeline Section 111 Construction 2 began in October 2017. Redundancy Pipeline Section 111 Construction 3 was awarded in May 2018.
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**Changes to Project Scope, Budget, and Schedule**

Project Cost			Scheduled Completion Date			FY19-23 Spending		
FY20	FY21	Chge.	FY20	FY21	Chge.	FY20	FY21	Chge.
\$132,426	\$141,243	\$8,817	Dec-35	Dec-35	None	\$37,378	\$38,522	\$1,144

**Explanation of Changes**

- Project cost Increased primarily due to inflation adjustments on unawarded contracts, and change orders for Redundancy Pipeline Section 111 Construction 2 and 3, and new subphase added for Sections 77 and 88 REI.
- Project spending changed primarily due to change orders for Redundancy Pipeline Section 111 Construction 2 and 3, partially offset by updated schedule for Section 77 and 88 Rehabilitation Design/Engineering Services During Construction.

**CEB Impacts**

None identified at this time

## S. 730 Weston Aqueduct Supply Mains (WASMs)

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### Project Purpose and Benefits

- ☑ *Contributes to improved public health*
- ☑ *Extends current asset life*
- ☑ *Improves system operability and reliability*

*To improve the condition and carrying capacity of these major supply lines and the quality of the water supplied to the communities in the Low, High, Intermediate, and Northern Extra High pressure zones. Increasing the capacity of the WASM 3 Supply Main is a key component of the Long term Redundancy Plan for the metropolitan tunnel system. Timely rehabilitation will reduce the costs of replacing corroded pipes, reduce red water and chlorine tastes, and improve water pressure.*

### Project History and Background

MWRA's tunnels and aqueducts bring water to the metropolitan area from the supply reservoirs in central Massachusetts. In Weston, where the Hultman Aqueduct and the MetroWest Tunnel end, the water is still miles away from most customers. Together, the City Tunnel and the four Weston Aqueduct Supply Mains (WASMs) carry the water this final distance. When rehabilitation of the WASMs is complete, they will transmit about one-third of the water to MWRA's service areas, and the City Tunnel will carry the remaining two-thirds. The WASMs are now the only means of conveying water to the city in the event of a problem with the City Tunnel. The Sudbury Aqueduct can deliver non-potable water during an extreme emergency.

WASM 1 is a 48-inch diameter cast iron pipeline about 38,700 feet long that was constructed in 1904. WASM 2, built in 1916, is a 60-inch diameter cement-lined cast iron pipeline about 34,800 feet long. WASMs 1 and 2 begin in Weston at the Weston Aqueduct Terminal Chamber (WATC) and run parallel through Newton, mostly along Commonwealth Avenue, ending in Boston near Chestnut Hill Reservoir. These pipelines supply water to the Boston Low pressure zone.

WASM 3 is an 11-mile steel pipeline that was installed between 1926 and 1933. This major supply line carries high service water from the 7-ft diameter branch of the Hultman Aqueduct to community connections and MWRA pumping stations serving the Northern High, Intermediate High, and Northern Extra High service systems. It extends from the Hultman Aqueduct branch in Weston northeast to the Shaft 9 line in Medford and supplies more than 250,000 customers. WASM 4 was constructed in 1932 and is predominantly a 60-inch diameter pipeline consisting primarily of unlined steel with some pre-stressed concrete cylinder and cast iron sections. It extends 47,000 linear feet from Weston through Newton, Watertown, and Boston, and into Cambridge.

WASM 3 and WASM 4 were originally part of the Low Service System and conveyed water from the Weston Aqueduct to the Spot Pond Supply Mains. Upon completion of the Hultman Aqueduct, and its interconnection to the Weston Aqueduct Terminal Chamber in 1941, WASM 3 became part of the High Service System. With the addition of Newton to the metropolitan service area in the early 1950s, the western portion of WASM 4 was transferred to the High Service System as a temporary means of conveying water from the Hultman to portions of Newton and Watertown. Supply to the Spot Pond Supply Mains from WASMs 3 and 4 was maintained at their east ends through pressure reducing valves.

WASMs 1, 2, and 4 were previously functioning below full capacity because of the buildup of rust deposits and other matter along the pipeline walls, and undersized main line valves. Rehabilitation of these pipelines was necessary to restore their original carrying capacity and included replacement of valves to provide more efficient operations and emergency response, elimination of tuberculation on the interior walls, and application of cement mortar lining to the interior pipe walls to prevent further internal corrosion and improve water quality.

The joints on WASM 1 and WASM 2 are constructed of bells and spigots filled with lead packing. The bell and spigot construction gives the joints some flexibility, but lead packed joints are more prone to failure compared to push-on or mechanical joints with modern synthetic gasket material. The existing joints are subject to potential failure because of deterioration, pipe movement due to frost, settlement, or adjacent construction. Water leaking from a failing joint can undermine the pipe, causing catastrophic failure. These failures can cause severe damage and disruption. WASM 2 also had insulating joints consisting of cast-iron pipes with wood fillers. These joints were intended to prevent electrical current from flowing along the pipeline but, in general, have been prone to failure and leakage.

The rehabilitation of WASMs 1 and 2 is now complete. WASM 1 and WASM 2 now connect to the new Loring Road tanks in Weston and supply the Boston Low mains in Clinton Road, Beacon Street, and Boylston Street, which were rehabilitated as part of the Boston Low Service Rehabilitation project. With the completion of these projects the entire Boston Low Service System, which accounts for 15% of overall MWRA water demand, is now rehabilitated from Weston to Boston.

There is no back up for WASM 3, which is the sole source of supply for the higher elevation portions of Waltham, Belmont, Arlington, Lexington, Bedford, and Winchester. The southern portion of this pipeline cannot be shut down for maintenance or rehabilitation until a new Waltham Connection to the Northern Extra High system is complete. Next to a failure of the Hultman Aqueduct or the Metropolitan Tunnel System, analysis has shown that a failure of WASM 3 is one of the highest risks in the MWRA distribution system. Improvements to WASM 3 are included in Project 628 Metropolitan Redundancy Interim Improvements. Replacement of Section 36 improves redundancy in the Northern Extra High pressure zone between Spring Street pump station and Brattle Court pump station, and installation of a redundant line from WASM 3 to Spring Street pump station provides flexibility to maintain flow to the Spring Street pump station during the rehabilitation of WASM 3.

Nonantum Road construction (rehabilitation by sliplining and cleaning and lining) was completed in March 1997 and the rehabilitation of the western portion of WASM 4 was completed in March 2001, including meter upgrades. In order to remove the western portion of WASM 4 from service to allow it to be rehabilitated, MWRA provided alternative supplies for Watertown Meter 103 and Newton Meters 104 and 105. Meter 103 was upgraded and local water main improvements were built along Galen Street in Watertown. These efforts allow the other Watertown meters to temporarily supply the area normally served by Meter 103. These improvements were constructed as non-participating bid items (i.e., funded by MWRA) under a contract administered by the Massachusetts Highway Department. Alternative sources for the Newton northern pressure district, normally supplied by Meters 104 and 105, have been constructed. Two pressure reducing valves, one at Chestnut Street and one at Walnut Street, were installed to allow the southern pressure district that is supplied by the Commonwealth Avenue Pumping Station to temporarily serve the northern pressure district. The rehabilitation of the eastern portion of WASM 4 included fixing a portion of the South Charles River Valley Sewer Sections 163 (D) and 164 (E), a 100+ year old brick sewer that is located directly below the water main. The rehabilitation of WASM 4 is complete.

WASM 4, since rehabilitated will continue to operate as a high service main from the Hultman Aqueduct Branch connection to Shaft W of the MetroWest Tunnel up to the pressure reducing valve facility at Nonantum Road. It will then continue as a low service main to its connection with the East and West Spot Pond Supply Mains. WASM 4 also has the capability to operate completely as a low service main. This flexibility in operating conditions allows WASM 4 to best support the system.

**Scope**

Sub-phase	Scope	Status
Design/CA/RI – WASMs 1 & 2 (6142)	Design, construction administration, and resident inspection for the rehabilitation of WASM 1 and WASM 2 (construction contracts 6280 and 6281).	Completed

<b>Sub-phase</b>	<b>Scope</b>	<b>Status</b>
Design/CA/RI - WASM 4 (5147)	Design, construction administration, and resident inspection for the rehabilitation of WASM 4 (construction contracts 6203, 6175, 6312, 6176, and 6313).	Completed
Construction - Newton WASMs 1 & 2 (6280)	Construction work on WASM 1 and WASM 2 along Commonwealth Avenue and WASM 1 through Centre Street to the Newton Commonwealth Golf Course.	Completed
Construction - Boston WASMs 1 & 2 (6281)	Construction on the remaining lengths of WASMs 1 and 2 consists of rehabilitation of 8,640 linear feet of Section 4 of WASM 1 through the Newton Commonwealth Golf Course to Gatehouse #1, rehabilitation of 11,450 linear feet of Sections 7 and 8 of WASM 2 between Grant Avenue and Cleveland Circle, and installation of 650 linear feet of 36-inch pipe from Shaft 7 to Section 47.	Completed
Construction - Arlington Section 28 CP1 (6546)	Rehabilitation of Section 28, the suction main to the Brattle Court Pumping Station, from the WASM 3 connection to the pumping station.	Completed
Construction - Auburndale WASMs 1, 2 & 4 (6175)	Cleaning and lining of 5,300 linear feet of 48-inch and 12,300 linear feet of 60-inch diameter mains of WASMs 1, 2 and 4 (Sections 2, 5, 13 and portions of 1) from Weston across the Charles River along Commonwealth Avenue to the Mass Pike in Newton, as well as replacement of existing line valves, air/vacuum valves and blow-off valves.	Completed
Construction - Newton WASMs 2 & 4 (6312)	Cleaning and cement lining of 21,200 linear feet of 60-inch pipe on WASM 4 (Sections 13 & 14) along Rowe, Webster, Elm and Washington Streets in Newton, and 5,800 linear feet of 60-inch pipe on WASM 2 (Section 2) along Commonwealth Avenue from Bullough Parkway to Grant Avenue as well as rehabilitation of Meters 104 and 105.	Completed
Construction - Allston WASM 4 & W. Ave Sewer (6313)	Replacement of the Nonantum Road PRV and sliplining of 1,600 linear feet of pipe from Brooks Street to North Beacon Street, sliplining with some limited pipe replacement and cement lining of 10,538 linear feet of 60-inch pipe mostly along Western Avenue, 1,008 linear feet of 42-inch pipe mostly along Memorial Drive, 808 linear feet of twin parallel 30-inch pipes within the Western Avenue Bridge, replacement of Master Meter 100 and rehabilitation of the South Charles River Valley Sewer to include installation of a cured-in-place liner in approximately 5,150 feet of sewer, as well as removal and disposal of sediment in the existing brick sewer, power washing, and rehabilitation of existing manholes and installation of new manholes.	Completed
Construction - WASM 3 PCCP SPL12 (7000)	Replacement of approximately 2,100 linear feet of 60-inch Prestressed Concrete Cylinder Pipe (PCCP) on WASM 3 (Section 12) in Arlington. Includes replacement of air release manhole, replacement of two blow-offs and addition of a mainline butterfly valve with chamber and separate air release manhole.	Completed
Design CA/RI WASM 3 PCCP SPL12 (7001)	Design, construction administration and resident inspection services for the replacement of the PCCP pipe portion of WASM 3 (construction contract 7000).	Completed

Sub-phase	Scope	Status
Design CA/RI Section 36/ WS/Waltham Connection (6540)	Design, construction administration and resident inspection services for the replacement of Section 36, rehabilitation of the Watertown Section, a new 11B interconnection to WASM 3, replacement of meter 86 in Arlington, and replacement of butterfly valve S9-A in Medford. (construction contracts 7222, 7448).	Completed
Construction Watertown Section (7222)	Rehabilitation of approximately 5,795 linear feet of the Watertown Section.	Completed
Construction Section 36/W11/S9-A11 Valve (7448)	Replacement of approximately 5,200 linear feet of 1911 vintage 16-inch diameter cast-iron pipe from the Brattle Court pumping station to the Arlington Heights Standpipe, construction of a new 11B interconnection to WASM 3, replacement of meter 86 in Arlington, and replacement of 48 inch mainline butterfly S9-A11-A in Medford.	Completed
Design CA/RI Section 28 (7083)	Design, construction administration, and resident inspection services for the rehabilitation of Section 28, suction main to the Brattle Court Pumping Station, from the WASM 3 connection to the pumping station (construction phase CP1, contract 6546).	Completed

#### Expenditure Forecast (in \$000s) and Project Status

Total Budget	Payments thru FY19	Remaining Balance	FY20	FY21	FY19-23	FY24-28	Beyond FY28
\$80,457	\$80,403	\$54	\$54	\$0	\$54	\$0	\$0

Project Status 5/20	99.9%	Status as % is approximation based on project budget and expenditures. Rehabilitation of WASMs 1, 2 & 4 are complete. Section 28 Arlington CP-1 was substantially complete in April 2011. Design CA/RI Section 36/Watertown Section/Waltham Connection commenced in January 2011. Watertown Section Rehabilitation was substantially complete in December 2013. Section 36/W11/S- 9-A11-A Valve was substantially completed in December 2016.
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#### Changes to Project Scope, Budget, and Schedule

Project Cost			Scheduled Completion Date			FY19-23 Spending		
FY20	FY21	Chge.	FY20	FY21	Chge.	FY20	FY21	Chge.
\$80,457	\$80,457	\$0	Dec-16	Dec-16	None	\$54	\$54	\$0

#### Explanation of Changes

- N/A.

**CEB Impacts**

- None identified at this time.

# S. 735 Section 80 Rehabilitation

## Project Purpose and Benefits

- Contributes to improved public health*
- Extends current asset life*
- Improves system operability and reliability*

**Master Plan Project  2009 Priority Rating 3 (see Appendix 3)**

*Rehabilitation of approximately 16,197 feet of pipe along Route 128/95. Section 80 supplies water to Wellesley and Needham. Rehabilitation will improve water quality to these two MWRA communities.*

## Project History and Background

Section 80 is a steel main that runs from Shaft 5 of the City Tunnel in Weston extending through Newton to supply Wellesley and Needham. The main runs along portions of 128/95 and has been exposed to highly corrosive conditions and the cathodic protection system has not been maintained. Complaints from residents in Needham and Wellesley of a tar-like smell in the water indicate deterioration of the pipe liner. Testing indicated phenols levels 10 times above allowable limits. Failure of Section 80 would create huge traffic challenges on this major metro-Boston highway.

## Scope

Sub-phase	Scope	Status
Section 80 Rehabilitation Design/CA (6892), Construction (6891), and REI (7675)	Design and rehabilitation of approximately 16,197 feet of Section 80 along route 128/95.	Future
Section 80 Repair Construction (7532)	Replacement of 200 linear feet of Section 80 that was leaking.	Completed

## Expenditure Forecast (in \$000s) and Project Status

Total Budget	Payments thru FY19	Remaining Balance	FY20	FY21	FY19-23	FY24-28	Beyond FY28
\$16,024	\$1,925	\$14,099	\$0	\$3	\$858	\$13,240	\$0

Project Status 5/20	12.0%	Status as % is approximation based on project budget and expenditures. Section 80 Repair Construction was substantially complete in June 2018.
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## Changes to Project Scope, Budget, and Schedule

Project Cost			Scheduled Completion Date			FY19-23 Spending		
FY20	FY21	Chge.	FY20	FY21	Chge.	FY20	FY21	Chge.
\$13,552	\$16,024	\$2,472	Jul-26	Jul-26	None	\$706	\$858	\$152

**Explanation of Changes**

- Project cost and spending changed primarily due to inflation adjustments on Section 80 Rehabilitation Design/Construction Administration and Construction.

**CEB Impacts**

- None identified at this time.

## S. 753 Central Monitoring System

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### Project Purpose and Benefits

- ☑ *Contributes to improved public health*
- ☑ *Improves system operability and reliability*
- ☑ *Extends current asset life*
- ☑ *Results in a net reduction in operating costs*

*To provide a modern centralized system for monitoring, coordinating, and controlling critical waterworks functions. Many existing MWRA facilities are monitored and operated using obsolete methods and equipment, which can hinder emergency response capabilities and prevent coordinated system operation. Two operations control centers are already operational, and various field facilities have been equipped with telemetry and communications equipment as part of this project.*

### Project History and Background

MWRA has been converting to system-wide remote monitoring and control of essentially all hydraulic and hydroelectric operations. The original instrumentation used to measure operating parameters was incomplete, old, and in poor condition. In many cases necessary instrumentation did not exist. The system also lacked telemetry to provide centralized and immediate information on system performance, and the ability to remotely intervene when malfunctions occurred. Without telemetry, operating decisions had to be delayed until field personnel were dispatched to collect measurements. This was a cumbersome and undesirable mode of operation, particularly in emergency situations.

The lack of flow measurement within the water delivery system also impeded identification of sources of unmetered water. When fully implemented, the central monitoring system will generate instantaneous data on water flow and pressure in 18 subsystems beginning with the supply sources and ending at the delivery points to user communities. The data will assist operations staff in detecting and pinpointing leaks in the system. The response time for leak repair work can then be lessened, resulting in significant savings of water and reduction in potential MWRA liability for public safety and property damage.

The central monitoring project has grown from the initial automation of the Reservoir Road Pump Station to include eight other pump stations. Monitoring and control of water treatment facilities has expanded to include the Interim Corrosion Control Facility in Marlborough, the Cosgrove Disinfection Facility, the Norumbega Temporary Disinfection Facility and the Ware Disinfection Facility. In addition, water quality is monitored at seven locations from two Operations Control Centers. Real time Supervisory Control and Data Acquisition (SCADA) monitoring of Telog data is being established with 150 sites currently active. Operation control centers (OCCs) at the MWRA Chelsea and Clinton facilities provide remote monitoring and control of all the SCADA facilities. Also, as part of its Integrated Water Supply Improvement Program, MWRA built several new and upgraded facilities. These included the Nash Hill Covered Storage facility and the Loring Road Covered Storage facility, Carroll Water Treatment Plant, MetroWest Water Supply Tunnel, and the Norumbega Covered Storage facility. The existing system-wide backbone microwave communications network has been improved to connect these facilities to the waterworks communications system.

## Scope

Sub-phase	Scope	Status
Study	Study to determine the implementation phases.	Completed
Design	Design of the replacement and rehabilitation of 34 existing master meter sites, 22 new master meter sites, 15 western revenue meter sites, 28 reservoir level instrumentation sites, ten pumping stations, eight pressure regulator control sites, four major throttle valve sites, six chemical feed sites, four hydroelectric sites, five weather stations, five sluice gate control sites, one stream gauging station, and other facilities.	Completed
Communications Structures	Installation of two radio towers, five antennas, one satellite dish, and an equipment shelter.	Completed
CS/Start-Up Services	Construction and startup services for the metropolitan Operations Control Center, as well as metering and monitoring construction.	Completed
Equipment Pre-Purchase	Purchase of instrumentation equipment, mechanical equipment, and new master meters.	Completed
Construction 1 – Reservoir Road and Cosgrove Pilots	Purchase and installation of equipment to automate the Reservoir Road Pump Station and an aqueduct monitoring system for use by the Cosgrove Intake and Shaft 4 operators. MWRA staff installed the equipment.	Completed
SCADA Implementation	Purchase of Supervisory Control and Data Acquisition System (SCADA) equipment for monitoring, control and metering sites.	Active
Microwave Equipment	Purchase of services and equipment necessary to allow MWRA to convert from analog to digital communications to continue to utilize the Commonwealth's Interagency Microwave System.	Completed
Construction – Operations Center	Construction of a 5,000 square feet center including an environmentally controlled computer room, a printer room, a control room, office space, and sanitary facilities in Chestnut Hill.	Completed
System Wide Backbone C.P. Construction– Monitoring & Control Communications Network	Improvement of the existing Waterworks system wide backbone including upgrades of microwave antennas at MDC Hill and Bellevue water tank and provision of new microwave antennas at five facilities.	Completed
Study and Design – Waterworks Monitoring & Control Communications Network	Provision of microwave antennas and radio equipment at twelve facilities.	Completed

Sub-phase	Scope	Status
Microwave Communication for Waterworks Facilities	Furnish and install seventeen microwave antennas (dishes), three 3-legged, 90- to 100-foot towers, one unpowered 80-foot steel monopole, and two prefabricated concrete shelters to house radio equipment with associated racks, cabinets and wiring.	Completed
Quabbin Power, Communication & Security Design CA/RI and Construction	Design and construction of 2.4 miles of power, and communication to Quabbin Aqueduct Shaft 12 and 1,500 feet to the DCR Boat Cove. Also, upgrading 9,000 feet of existing overhead power line from Winsor Power Station to Quabbin Lookout Tower to insure uninterrupted service of the communication network. Increased security will be provided at Shaft 12, Winsor Power Station, CVA Intake, Nash Hill gate house, William A. Brutsch Water Treatment Facility, DCR Boat Cove and Quabbin Administration building. The Verizon communications service needed for the security devices to communicate to the Chelsea Head-end Facility was extended to support this function.	Completed
Waterworks SCADA/PLC Upgrades (CWTP SCADA Upgrades Design Programming RE and Construction, Other Design and Programming Services, Other Construction, and Other Equipment/Hardware)	Replacement of existing SCADA PLC's nearing their end of life with an updated PLC platform. New PLC's further provide enhanced security capabilities, continued vendors support and future reliability. Secondary goals include standardizing PLC logic and HMI graphics, and upgrading aging field instrumentation. During FY17 staff purchased equipment and contracted outside support to replace the obsolete PLC at the Commonwealth Ave. West Pump Station. This work was complete in the spring of 2017. Additional work to upgrade the Brutsch Water Treatment facility chemical feed PLC through CIP purchases and use of In-house staff for design and installation will be complete in 2019. In-house work to scope out the design contract to upgrade the JJC WTP was completed, and an engineering design services contract was awarded in December 2018. The initial conditions assessment and conceptual report has been completed with the construction contract for JJCWTP SCADA improvements scheduled to be awarded in May 2020.	Active/Future

**Expenditure Forecast (in \$000s) and Project Status**

Total Budget	Payments thru FY19	Remaining Balance	FY20	FY21	FY19-23	FY24-28	Beyond FY28
\$42,082	\$21,197	\$20,885	\$1,066	\$3,500	\$16,960	\$4,418	\$0

Project Status 5/20	52.8%	Status as % is approximation based on project budget and expenditures. Quabbin Power Communications & Security Construction was substantially complete in April 2017. CWTP SCADA Design Programming RE was awarded in December 2018.
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**Changes to Project Scope, Budget, and Schedule**

Project Cost			Scheduled Completion Date			FY19-23 Spending		
FY20	FY21	Chge.	FY20	FY21	Chge.	FY20	FY21	Chge.
\$39,002	\$42,082	\$3,080	Oct-28	Oct-28	None	\$10,203	\$16,960	\$6,757

**Explanation of Changes**

- Project cost and spending changed primarily due to updated cost estimate for CWTP SCADA Upgrade Construction.

**CEB Impacts**

- None identified at this time.

## S. 763 Distribution Systems Facilities Mapping

### Project Purpose and Benefits

- Contributes to improved public health*
- Improves system operability and reliability*

*To produce a complete, up-to-date set of appropriate scale maps of all underground waterworks facilities, along with a comprehensive database inventory. Existing maps were outdated and unreliable, complicating emergency response, field repairs, and planning.*

### Project History and Background

In 1995 MWRA did not have an adequate, updated set of maps of all of its underground waterworks facilities. Existing maps did not consistently show current conditions and were often incompatible or contradictory with MWRA databases. Engineering, operations, and emergency response were all affected by this inadequacy. Outdated maps hampered engineering because maps needed to be re-created. Field operations crews could not predict with certainty the results of valve shut-offs during repair efforts. The planning process was impaired because management did not have authoritative, consolidated data to evaluate pipe condition, age, C-Values, materials, and soil conditions. Additionally, the lack of a comprehensive understanding of the relationships between MWRA and local community pipe systems could result in service delays. The former mapping system created the possibility of incorrect actions, and in critical instances could have resulted in exacerbated property damage.

Reliable engineering records do not exist for certain sections of the distribution system. The Records Development sub-phase will create, update and automate record drawings and detail records for high priority areas.

### Scope

Sub-phase	Scope	Status
Planning/Design	Creation of a complete set of 200 to 400 scale maps of the distribution system with an associated verified inventory of size, material, age, and condition of pipes.	Completed
Data Purchase	Purchase of project related data from Boston Edison.	Completed
Records Development (6525)	Automation of MWRA record drawings.	Future
Update of Record Drawings (7489)	Update record drawings and detail record information for selected water pipeline sections using information from detail records, plans, field books, surveys, and valve inventories. Establish procedures for continued updating and maintenance of detail record information.	Future
Water System Hydraulic Model (7613)	Upgrade and calibrate the water system hydraulic model.	Future

**Expenditure Forecast (in \$000s) and Project Status**

Total Budget	Payments thru FY19	Remaining Balance	FY20	FY21	FY19-23	FY24-28	Beyond FY28
\$2,799	\$1,036	\$1,763	\$0	\$231	\$1,183	\$580	\$0

Project Status 5/20	37.0%	Status as % is approximation based on project budget and expenditures. Water System hydraulic Model is expected to begin in October 2020.
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**Changes to Project Scope, Budget, and Schedule**

Project Cost			Scheduled Completion Date			FY19-23 Spending		
FY20	FY21	Chge.	FY20	FY21	Chge.	FY20	FY21	Chge.
\$2,799	\$2,799	\$0	Oct-23	Oct-24	12 mos.	\$1,549	\$1,183	(\$366)

**Explanation of Changes**

- Project schedule and spending shifted due to updated schedule for the Records Development project.

**CEB Impacts**

- None identified at this time.

## S. 765 Local Water System Assistance Program

### Project Purpose and Benefit

- Contributes to improved public health*
- Provides environmental benefits.*

*To provide loans to facilitate water system improvements in MWRA communities.*

### Project History and Background

The Local Water System Assistance Program is a critical piece of MWRA's Integrated Water Supply Improvement Program. In November 1999, the Board of Directors approved the Phase 1 Local Pipeline Assistance Program, supported through a Tax Exempt Commercial Paper (TECP) program, to make \$25 million available annually in loans to MWRA communities for pipeline relining and replacement in proportion to each community's share of total unlined pipe miles. Communities are required to pay back principal for each loan during a ten-year time period beginning one year after the project funding is approved. MWRA increased the initial total program budget to \$256,796,500 to provide funds for additional water system communities: Stoughton (\$4,480,000), Reading (\$1,916,000), Lynnfield (\$320,000), Dedham/Westwood (\$7,500), and Wilmington (\$73,000). The Phase 1 Local Pipeline Assistance Program concluded at the end of FY13 with a total of \$222.3 million in interest-free loans distributed to member water communities.

An additional \$210 million was added to the FY11 budget for the Phase 2 Local Water System Assistance Program. Community distributions from this program will be made from FY11 through FY23 with repayments scheduled for FY12 through FY33. The \$210 million is split with \$200 million allocated among 42 Metro-Boston/Metro-West communities and \$10 million allocated among three Chicopee Valley Aqueduct (CVA) communities.

The Local Water System Assistance Program was expanded beginning in FY17 to include \$100 million in interest-free loans to communities solely for efforts to fully replace lead service lines. The *Lead Service Line Replacement Loan Program* is budgeted over twenty years, but the pace of spending for the program will depend on the level of participation by communities, the communities' ability to work with individual homeowners, and future regulatory requirements.

In FY18 Local Water System Assistance Program Phase 3 was added in the amount of \$292 million. Community distributions from this program will be made from FY18 through FY30 with repayments scheduled for FY19 through FY40.

### Scope

Sub-phase	Scope	Status
Community Loans	Loans for MWRA water communities to replace and rehabilitate local water pipelines based on each community's share of total unlined pipe miles. These loans will be complete by the end of FY13.	Completed
Community Repayments	Principal repayment over a ten-year period beginning one year after origination of the loans.	Active
Local Water System Assistance Program Loans	This is a continuation of the program of providing interest-free loans to water system communities for pipeline replacement, cleaning and lining, water metering and other local water system improvements.	Active
Local Water System Assistance Program Repayments	Principal repayment over a ten-year period beginning one year after origination of the loans.	Active

CVA Loans	This is an extension of the Local Water System Assistance program to the CVA communities to provide interest-free loans to water system communities for pipeline replacement, cleaning and lining, water metering and other local water system improvements.	Active
CVA Repayments	Principal repayment over a ten-year period beginning one year after origination of the loans.	Active
Lead Service Line Replacement Loans	Replacement of lead service lines budgeted over a twenty year period beginning in FY17.	Active
Lead Service Line Replacement Repayments	Principal repayment over a ten-year period beginning one year after origination of the loans.	Active
Local Water System Assistance Phase 3 Loans	This is a continuation of the program (Phase 3) of providing interest-free loans to water system communities for pipeline replacement, cleaning and lining, water metering and other local water system improvements.	Active
Local Water System Assistance Phase 3 Repayments	Principal repayment over a ten-year period beginning one year after origination of the loans.	Active
Local Water System Assistance Phase 3 CVA Loans	This is an extension of the Local Water System Assistance program to the CVA communities to provide interest-free loans to water system communities for pipeline replacement, cleaning and lining, water metering and other local water system improvements.	Active
Local Water System Assistance Phase 3 CVA Repayments	Principal repayment over a ten-year period beginning one year after origination of the loans.	Active

#### Expenditure Forecast (in \$000s) and Project Status

Total Budget*	Payments thru FY19	Remaining Balance	FY20	FY21	FY19-23	FY24-28	Beyond FY28
\$0	\$154,098	(\$154,098)	\$5,834	\$33,180	\$54,163	\$4,819	(\$199,255)

\*Total Loan Distributions less Loan Repayments.

Project Distribution Status 5/20	54.4%	Through May 2020, MWRA has distributed \$448.7 million in loans to fund 466 projects in 42 communities under the Local Water System Financial Assistance Program.
Project Repayment Status 5/20	34.9%	Through May 2020, a total of \$287.4 million has been repaid by member communities receiving interest-free loans under the Local Water System Assistance Program.

**Changes to Project Scope, Budget, and Schedule**

Project Cost			Scheduled Completion Date			FY19-23 Spending		
FY20	FY21	Chge.	FY20	FY21	Chge.	FY20	FY21	Chge.
\$0	\$0	\$0	May-46	May-46	None	\$37,498	\$54,163	\$16,665

**Explanation of Changes**

- Spending change is primarily due to updated cash flows for Lead Service Loans and Phase 3 Local Water Supply Assistance Program distributions and repayments as well as Phase 1, Phase 2 and CVA repayments.

**CEB Impact**

- The annual interest paid for the Commercial Paper program supporting the Local Water System Assistance Program initiative is \$1.45 million average per year based on the last 5 years of actual spending.

## S. 766 Waterworks Facility Asset Protection

### Project Purpose and Benefits

- Contributes to improved public health*
- Extends current asset life*
- Improves system operability and reliability*

*To protect the investment of MWRA ratepayers by ensuring timely replacement of equipment and systems.*

### Project History and Background

This project was developed to ensure that MWRA maintains ongoing service while optimizing operations in its water facilities. This project in its current form addresses immediate critical facility and equipment issues. This project will eventually include five areas:

1. Equipment replacement (pumps, HVAC equipment, blowers, etc.).
2. Architectural projects (concrete corrosion, etc.).
3. Utilities projects (water, sewer, drainage, electrical wiring, heating system, etc.).
4. Support Projects (process control system upgrades, etc.).
5. Specialty Projects (instrumentation upgrades, fuel storage tanks, etc.).

While the current schedule indicates a completion date of 2023 for construction, the Waterworks Facility Asset Protection project will be ongoing throughout the useful life of the facilities.

### Scope

Sub-phase	Scope	Status
Meter Vault Manhole Retrofits Design and Construction (6689/7479)	Retrofit approximately 195 meter manholes.	Future
Painting for Deer Island Water Storage Tank (7601)	Exterior and interior abrasive blast cleaning and painting for Deer Island Tank. Structural and concrete repairs. Removing, storing, installing and reinstalling components of the microwave communication system. Erection and maintenance for scaffolding and staging including enclosures with protection and ventilation.	Active
Painting for Bellevue 2 and Turkey Hill Steel Water Storage Tanks (7634)	Exterior and interior abrasive blast cleaning and painting for Bellevue 2 and Turkey Hill Tanks. Structural and concrete repairs and design and erect scaffolding to support the temporary antenna relocation at Turkey Hill. Installation of the interior components of the cathodic protection system.	Active
Design/CA for Steel Tank Improvements (6832), Construction (7493) REI (7676), Phase 2 Constr. (7727) and REI (7728)	Design and construction to repaint, replace cathodic protection systems and make necessary improvements to 3 steel water storage tanks (Bellevue 1, Park Circle, and Walnut Hill). Design and construction for improvements to the recently painted Bellevue 2, Turkey Hill and Deer Island storage tanks.	Future
Waltham Pipe Bridge Replacement (6910)	Replacement of approximately 100 feet of 30-inch steel pipe over commuter rail tracks in Waltham including a bridge crossing.	Completed

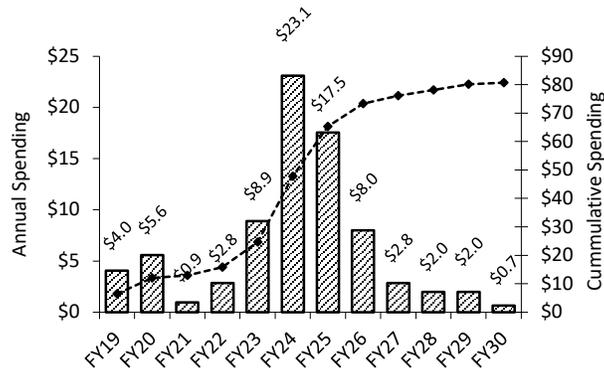
Sub-phase	Scope	Status
Design and Construction Cosgrove Valve Replacement (7064/7065)	Replacement of isolation sluice gates at Cosgrove Intake to improve reliability for emergency shut down of Cosgrove facility and to isolate new sliding sleeve valves to facilitate preventive maintenance and any future corrective maintenance.	Future
Transformer at Cosgrove Intake Building (7228)	Replacement of a 45 year old main service transformer and load break switch. This transformer supplies power to the Cosgrove Intake Building. If it were to fail, the building would be running on generator power for a significant period of time.	Completed
Fells/Loring Road Covered Storage Tank Rehabilitation Design and Construction (7385/7482)	Rehabilitation of Fells and Loring Road Covered storage facilities commencing in FY19. The valves, sluice gates, and piping should be considered for rehabilitation by this time, as each facility will be more than 20 years old.	Future
Electrical Distribution Upgrades at Southborough (7425)	Upgrade of existing 13.8kV distribution system that supplies the various buildings at Southborough Complex due to on-going service disruptions. Install electrical metering equipment to better manage electrical use in facility.	Future
Water Meter Upgrade Replacement and Meter Vault Manhole Retrofit Phase 1 Design/CA (7542, Construction (7453), and REI (7707) and Phase 2 Design/CA (7708) Construction (7709) and REI (7710)	Replace five older Venturi meters and seven above ground cabinets in Boston. Remove fire flow bypasses of four additional water meters and upgrade the venture tube at each of the meters. Retrofit the manholes of a total of nine of these existing meters. This will provide more accurate and reliable meter data since current meters are beyond their life expectancy.	Future
Beacon Street Line Repair Design CA/RI (7474) and Construction (7458)	Repair of 48" water main in Brookline serving Boston Meter 44. This main provides important water supply redundancy to Meter 60 which serves the Longwood Medical Center in Boston. Construction Contract 7458 was awarded with an NTP dated June 23, 2016. Project substantial completion achieved March 31, 2017.	Completed
Cosgrove Construction (7022)/and Gillis PS/Cottage Farm CSO Construction (6888) Flat Roof Replacements	Replacement of the entire flat roofs at Cosgrove, Gillis Pump Station, and Cottage Farm CSO Facility. Designs have been developed with the assistance of Technical Assistance Consulting Services Task Orders. Limited Task Order services are being used to support ESDC services.	Active
New Roofs at Water Pumping Stations Construction (7626)	Replace pump station roofs at Belmont (membrane), Brattle Ct (slate), Spring St (membrane), Newton St (membrane) and Lexington St in Belmont, Arlington, Waltham and Brookline. Design is being developed through the Technical Assistance Consulting Services Task Orders.	Future

Sub-phase	Scope	Status
Generator Docking Station (7025) and REI (7024)	To install an electrical switchboard at eleven facilities, 5 - Water and 6 - Wastewater as a means for a quick connection to a towable generator. Generator will be deployed for use as a back-up in the event of prolonged utility failure or failure of the in-house emergency power generator. Construction Contract 7025 was awarded with an NTP on April 23, 2019. REI Contract 7024 awarded at April 17, 2019 BOD meeting.	Active
Masonry/Structural Repairs Bellevue 1/Arlington Heights Design/ESDC (7711), Construction (7694), and REI (7712)	Evaluate the current structural condition of the concrete/masonry at the Bellevue 1 standpipe and the Arlington Heights tank and provide recommendations and preliminary design documents for the repair/replacement to be utilized for the future preparation of design and construction bid documents for one construction project.	Active
Water Tanks Paint Phase 1 Design/ESDC, Construction, REI Bellevue 2/Deer Island/Turkey Hill (7739, 7740, 7748, 7741)	Rehabilitate Bellevue 2, Deer Island, and Turkey Hill storage facilities including repaint, replace cathodic protection and other improvements.	Future
Water Tanks Paint Phase 2 Design/ESDC, Construction, REI Bellevue 1/Park Circle/Walnut Hill (7742, 7743, 7744)	Rehabilitate Bellevue 1, Park Circle, and Walnut Hill storage facilities including repaint, replace cathodic protection and other improvements.	Future
Cosgrove Tunnel Rehabilitation Design/ESDC (7738)	Repairs need to the Cosgrove Tunnel as a result of an inspection in 2003. This project would be for the design and engineering services during construction for these repairs.	Future
Beacon Street Line Rehabilitation Design/ESDC, Construction, REI (7729, 7730, 7731)	Rehabilitation of the remaining portion of the Beacon Street line near the Chestnut Hill area.	Future

**Expenditure Forecast (in \$000s) and Project Status**

Total Budget	Payments thru FY19	Remaining Balance	FY20	FY21	FY19-23	FY24-28	Beyond FY28
\$108,639	\$6,425	\$102,214	\$5,572	\$942	\$22,274	\$53,447	\$30,534

### Waterworks Facilities Asset Protection



Project Status 5/20	10.0%	Status as % is approximation based on project budget and expenditures. Transformer Replacement at Cosgrove Intake Building contract was completed in July 2012. Beacon Street Line Repair construction was substantially complete in April 2017. Cosgrove Roof Replacement was substantially complete in September 2019. Gillis PS/Cottage Farm CSO Roof Replacement NTP issued in July 2019. Bellevue Hill II and Turkey Hill Tanks Repainting were substantially complete in October 2019. Generator Docking Station construction was substantially complete in April 2020
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#### Changes to Project Scope, Budget, and Schedule

Project Cost			Scheduled Completion Date			FY19-23 Spending		
FY20	FY21	Chge.	FY20	FY21	Chge.	FY20	FY21	Chge.
\$41,884	\$108,639	\$66,755	Jul-26	Jul-41	180 mos.	\$24,776	\$22,274	(\$2,502)

#### Explanation of Changes

- Project cost changed due to new projects that were added for Water Tank Painting/Improvements, Cosgrove Tunnel Rehab Design/ESDC, Beacon St Line, updated cost estimates for Masonry/Structural Repairs Bellevue 1/Arlington Heights Tanks, Water Meter Vault Manhole Phases 1 and 2, Steel Tank Improvements Phases 1 and 2, change orders for Generator Docking Station and Cosgrove Intake Roof Replacement as well as inflation adjustments on unawarded contracts.
- Project spending changed primarily due to updated cost estimates, restructuring and rescheduling of several projects including Masonry/Structural Repairs Bellevue 1/Arlington Heights, Steel Tank Improvements, and Water Meter Vault Manhole Improvements.

#### CEB Impacts

- None identified at this time.