



MASSACHUSETTS WATER RESOURCES AUTHORITY

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October 31, 2022

Todd Borci
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Susannah King
Northeast Regional Office
Massachusetts Department of
Environmental Protection
1 Winter Street
Boston, MA 02108

RE: NPDES Permit Number MA0103284
O&M Annual Report/Status Sheets

Dear Mr. Borci and Ms. King:

Enclosed please find the MWRA's annual status sheets on plant performance and maintenance for the period covering July 2021 – June 2022. This submittal fulfills the requirements of MWRA's NPDES Permit MA0103284 - Section 1.18.f and 1.18.g that states in part:

...The permittee shall report on the [operations and maintenance] plan's implementation and results to EPA and the MADEP on a yearly basis....An annual maintenance update shall be published in the MWRA's Annual Report. The MWRA shall submit an annual status sheet to EPA and the MADEP on plant performance, using key indicators for maintenance and providing detailed information on any necessary equipment replacement. The annual status sheet shall be placed on the MWRA web page for public information purposes.

Annual status sheets are posted at <http://www.mwra.com/harbor/html/archive.htm#maintenance>. If you have questions or need additional information, please feel free to email Betsy Reilley at Betsy.Reilley@mwra.com.

Sincerely,

David W. Coppes
Chief Operating Officer

Enclosures:

- Annual Report on Operations and Maintenance, FY2022
- Status Sheets with key indicators of maintenance, FY2022
 - Deer Island Treatment Plant
 - Wastewater Transport System
 - Fore River Pellet Plant

cc: F. Laskey, MWRA

MWRA Annual Report on Operation & Maintenance

July 2021 - June 2022

This report fulfills the requirements of MWRA's NPDES Permit MA0103284, Section 1.18.f which states:

“Within ninety (90) days of the effective date of this permit, the permittee shall develop and implement a long-range operations and maintenance plan that will maximize the life of the treatment facility. The permittee shall report on the plan's implementation and results to EPA and the MADEP on a yearly basis.”

Also included with this submittal are the annual status sheets on plant performance and maintenance as required in section I.18.g.

1. SYSTEM OVERVIEW

MWRA's Metropolitan Boston wastewater system consists of the Deer Island Sewage Treatment Plant, the wastewater collection system, and the Pelletizing Plant, described below.

Deer Island Sewage Treatment Plant

The Deer Island Sewage Treatment Plant (DITP) is the centerpiece of MWRA's \$3.8 billion program to protect Boston Harbor against pollution from Metropolitan Boston's sewer systems. The DITP's purpose is to remove human, household, business, and industrial pollutants from the wastewater that is collected and transported through 5,400 miles of pipes, community owned sewer lines, and approximately 240 miles of Authority owned interceptors and tunnels.

DITP is a state-of-the-art wastewater treatment facility and one of the most automated in the country. The MWRA has made a considerable capital investment in the DITP and is fully committed to ensuring that this valuable public asset is maintained in the best possible manner. The MWRA's Board of Directors, Executive Director, management team, and staff are dedicated to providing the highest quality of asset management. The MWRA has assembled a highly skilled and qualified staff that will ensure that the treatment plant is operated and maintained to the satisfaction of the regulatory agencies and the public.

Wastewater Transport System

The Wastewater Operations Department operates and maintains MWRA's wastewater transport system, which transports wastewater from MWRA member communities to the Deer Island Treatment Plant. This system includes a network of 240 miles of interceptor sewer lines and related appurtenances, a screen house, 13 pumping stations, 4 remote headworks facilities, 3 combined sewer overflow (CSO) treatment facilities and 2 CSO storage facilities. The primary goal is to operate the system in a manner that will provide uninterrupted wastewater transport service in a safe, cost-effective, and environmentally sound manner.

Fore River Pelletizing Plant

The operation and output of the Fore River Pelletizing Plant is regulated, in part, by the terms of the federal NPDES permit, 40 CFR 503 regulations, and state sludge regulations in Massachusetts (310 CMR 32.00) and the states to which the pelletized product is shipped. Other important external factors that influence operation of the pellet plant include an extensive residuals management facilities plan developed as part of the permitting process as well as commitments to local communities.

Under the terms of the current operating agreement between New England Fertilizer Company (NEFCo) and MWRA, NEFCo budgets for and performs all necessary predictive, preventive and routine maintenance at the pellet plant. NEFCo's agreement contains a plan for the maintenance, repair and operation of the facility. At this time, NEFCo performance meets the necessary standard for proper operation and maintenance. Since the inception of the agreement in March of 2001, there has not been an incident requiring an interruption in service.

The operating agreement requires NEFCo to provide a letter of credit for \$1,000,000 (adjusted for inflation) that MWRA might draw on in the event that there is a material breach of the operating agreement, such as failing to adequately maintain the facility.

2. PERMIT VIOLATIONS

There were no violations at MWRA facilities due to inadequate maintenance efforts.

3. FACILITIES ASSET MANAGEMENT PROGRAM

The goals of the MWRA multi-year maintenance plan include coordinated, consistent asset inventory; condition assessment; maintenance scheduling and long-term replacement planning. The MWRA has developed and implemented the Facilities Asset Management Program (FAMP). This asset management program addresses the goal of becoming more efficient by developing consistent best practices and cost-effective operations and maintenance procedures.

MWRA had been conducting its maintenance on a calendar-based schedule in accordance with the original equipment manufacturers' (OEM) recommendations. This approach to maintenance was primarily driven by contractual obligations of the OEM warranties. MWRA's management team believed that it was important to modify its existing program with the goal of achieving a more rational approach to maintenance management. MWRA management acknowledges the importance of asset management and developed FAMP to meet the long-term demands of facility maintenance. The main objective of FAMP was to develop a sound maintenance strategy that would ultimately lead to better overall asset management, extended equipment life and increased reliability.

MWRA expanded its efforts in the areas of condition monitoring utilizing Reliability Centered Maintenance (RCM). This program focuses on asset replacement prioritization, capital improvements, and training of staff. Since the Maximo upgrade in 2018, DITP is continuing to build the program with the addition of the Clinton site, and continuing to use the methodology of RCM, consolidating the tool database into Maximo, expanding condition monitoring oil analyses by using on site testing equipment, and continuously reviewing our metrics to ensure we are at or

above industry benchmarks. Due to the COVID-19 outbreak during the 3rd and 4th quarters of FY20, some benchmarks were below the internal goals and industry standards.

4. COMPUTERIZED MAINTENANCE MANAGEMENT SOFTWARE

Maximo is the Enterprise Asset Management (EAM) software program used by MWRA. The MWRA uses Maximo version 7.6.0.9 (7.6), which is supported by Maximo developer IBM. Maximo EAM includes job and safety plan modules allowing MWRA to document hazardous areas and materials at DITP. Maximo can develop Lock-Out Tag-Out (LOTO) tasks and generate associated work orders for field personnel. Maximo's document management function streamlines maintenance and regulatory functions and workflow capabilities for synchronizing operations. Maximo applications can be fine-tuned to suit specific work processes or interface with other software programs.

Maximo gives operations and maintenance staff the ability to plan, prioritize and assign work, based on labor and required spare parts availability. Maximo's data analytic and reporting tools analyze failure trends in equipment, enabling staff to optimize preventive maintenance tasks and budget and plan asset replacement projects.

Maximo 7.6 added functionality to track labor, material, service, service contract, spare part costs and usage for over 144,000 assets.

Maximo 7.6 provides the MWRA with updated technology, increasing functionality for maintenance and improved reporting capabilities. The MWRA is now on one instance of Maximo with Deer Island, Field Operations, Information Technology (IT) (formerly Management Information Systems group), Laboratory asset tracking, and Vehicle Maintenance accessible in a single-organization, multi-site application. This increases productivity and limits the number of software systems to perform asset management functions. In addition, Maximo 7.6 add-ons include Maximo Calibration for instrumentation and SCADA assets and Maximo Spatial for buried assets and pipelines.

Clinton Advanced Wastewater Treatment Plant is now using Maximo 7.6. The Clinton Maximo site continues to be built out and PM schedules are in process.

Operations and Maintenance continues to collaborate with IT enhancing Maximo's automation capabilities, data display and reporting efficiencies, and end-user usability, along with preparing to upgrade Maximo to version 7.6.1.

NEFCo has its own computerized maintenance management software, "E-maint." E-maint is used for work order management including preventive and corrective maintenance work.

5. SERVICE CONTRACTS

MWRA's maintenance program is supplemented by a series of service contracts. These contracts are intended to provide specialized services beyond the resources of the MWRA maintenance staff. Tables 1 and 2 below show the service contracts currently used by MWRA.

TABLE 1
DEER ISLAND CURRENT SERVICE CONTRACTS
Laser alignment
Boiler maintenance
CCTV maintenance
Centrifuge maintenance
Combustion Turbine Generator maintenance
Continuous emissions monitoring
Catch Basin Contract
Copier/fax maintenance
Crane maintenance
Cryogenics facility maintenance
Digester Mixer overhauls
Electrical testing
Elevator maintenance
Facilities coatings
HVAC chemical treatment (Legionella testing)
Fire Sprinkler Repair Contract
Hydro turbine generator maintenance
Hydraulic maintenance
Janitorial services
Lab hood certification
Locksmith services
Lube oil analysis
Oil/water separator cleaning
Overhead door maintenance
Pest control
Plant and Public access landscape services
Plant instrumentation and control system (PICS) maintenance
Pratt Whitney (CTG OEM) Preferred service
Reactor Mixer gearbox rebuild
Recycle contract (Scrap/Paper)
Security
Steam turbine generator maintenance
Trash removal
Vibration analysis

**TABLE 2
FIELD OPERATIONS CURRENT SERVICE
CONTRACTS**

Elevator Maintenance
Crane Maintenance
Hydraulic Equipment Maintenance
Instrumentation Maintenance
Fuel Storage Tanks
Fire Alarm and Sprinkler
Air Compressor Service
Boiler and Water Heater
Pest Control Services
Trash Removal
Electrical Testing
Grounds keeping
Lube Oil Analysis
Union Park Station Operation and Maintenance
Generator Maintenance
Overhead Door Maintenance
Vibration Monitoring

6. ANNUAL STATUS SHEETS

The attached pages constitute the annual status sheets on plant performance, using key indicators for maintenance. There are status sheets for Deer Island, Wastewater Transport (Field Operations), and the Fore River Pelletizing Plant.

Status Sheets
Deer Island Treatment Plant
July 2021 - June 2022

Deer Island Maintenance reporting on Key Performance Indicators for FY22.

- Preventive Maintenance (PM) - Maintenance has a goal to complete 100% of all PM work orders. PM completion rate for FY22 was 98.7%. Maintenance initiated 22,022 PM work orders this year. This year's completion rate was slightly under our goal.
- Work Order Kitting - The first step to increase wrench time is to have all parts available for work orders. Kitting is a task where the maintenance planner identifies the specific parts required for a task on the work order and electronically sends the information to warehouse personnel to assemble the parts in one location (kit) for the technician to pick up and install. Deer Island met its goal of 57% in FY22.
- Predictive Maintenance - Extending the useful life of equipment, by monitoring and trending equipment characteristics, allows for better planning for equipment replacement. 7,697 work orders were completed for vibration, acoustic ultrasonic, ultrasonic thickness, and oil analysis. Deer Island met its goal of 25% in FY22 of all work orders being categorized as predictive maintenance.
- Maintenance Backlog in Hours - Backlog is determined by totaling the planned craft hours on open work orders and comparing them to available craft resources. The average backlog in FY22 was 17,649 hours, equaling 6.2 weeks of work for the entire Maintenance workforce. This backlog slightly above the industry standard of 8,730 hours to 17,460 hours or 4 to 6 weeks. DITP monitors these metrics very closely to ensure the backlog does not adversely impact equipment availability.
- Maintenance Overtime - The goal is to maintain maintenance overtime at or below 5% of total wages and salaries. DITP was below the benchmark at 4.4%.

Critical Equipment Availability: 12-Month Average — 99.8%

An equipment availability report is generated daily that details the critical equipment required to treat the maximum flow of approximately 1.3 billion gallons per day. Higher maintenance priority is given to critical equipment that drops below the number required to treat the maximum flow. No operational impact has occurred in the past year from a 99.8% versus 100% availability because the plant normally operates at approximately one-quarter of the design flow capacity.

Average Craft Hours and Work Orders per Month:

Preventative Maintenance	3832 hours	34%	1711 work orders	55%
Predictive Maintenance	147 hours	1%	765 work orders	25%
Corrective Maintenance	6036 hours	55%	278 work orders	9%
Emergency Maintenance	124 hours	1%	12 work orders	1%
Project Work	77 hours	1%	2 work orders	1%
Other (SERV, CBM, NPL, NE, EVT, STND.)	855 hours	8%	269 work orders	8%
Total	11,071 hours	100%	3037 work orders	100%

Total Work Orders:

36,444 work orders initiated in FY22
 34,880 work orders completed/closed in FY22

Maintenance Projects and Equipment Replacement:

- Digester Mixer Rebuild \$100,940
 There are twelve egg-shaped anaerobic sludge digesters at DITP, which have been in operation for more than 23 years. DITP operates eight mixers concurrently and continuously. A key component common to all of the digesters is the central mixer assembly. The mixer is critical to the proper operation of the digester. Routine maintenance is performed on the mixer assembly along with Predictive Maintenance. Acoustic and vibration tasks monitor asset health and can indicate impending failures before the failure becomes catastrophic and costly. When an impending failure is detected, staff removes and ships the mixer assembly to the manufacturer for refurbishment to original equipment manufacturers (OEM) specifications. Digester Module 1 Mixer assembly 4 was refurbished.
- Reactor Aerator/Mixer Gearbox Rebuilds: \$344,479
 Secondary Reactor Batteries A, B, and C contain nine aerator trains, each train has (4) aerators and (4) mixers. In total, 72 gearbox drives with 36 aerators and 36 mixers. Each aerator and mixer has a triple reduction gearbox and mixing blade. When condition-monitoring techniques (oil analysis, vibration data and physical inspections) indicate a potential failure, staff removes and ships out gearbox to be refurbished back to original operational specifications. Six gearboxes were refurbished with new bearings, gears, seals and shafts.
- Boiler, STG and Hydro Plant Maintenance: \$1,632,973
 A maintenance contract was established for annual boiler preventive maintenance including necessary repairs. This contract was combined with similar contracts for the Hydroelectric plant and steam turbine generator (STG). The intention of combining three contracts under one was to save money on like equipment and on mobilization costs. Maintenance spent additional money on gas compressor valves, inspecting deaerator tank, repairing Hydro wicker gates, installing dampeners on fuel oil lines and purchasing new oil pumps.

- Cryogenic Facility Repairs: \$383,332
The Cryogenic facility has an annual maintenance contract to handle preventive maintenance and some project maintenance work. The maintenance work includes two shut downs per year and scheduled projects. The scheduled projects completed include replacing vaporizer #1, oil changes for all three chillers, replacement of stage 2 intercooler and replacement of motorized glycol by-pass valve on chiller #3.
- Grinder Rebuilds: \$88,626
The Residuals Complex at Deer Island has small Muffin Monster grinders, installed "in-line" to provide continuous grinding of sludge into uniform, homogenized slurry. The sludge, which travels through these in-line grinders, is transported from Primary and Secondary treatment processes. The in-line grinders in Residuals are used after pre-treatment solids and rags are removed. Normal wear and tear to the grinders caused by constant operation wears the gears and seals requiring periodic service to re-build the grinders or cutter blocks. Maintenance has noticed an increase in grinder rebuilds. Staff replaced twelve in-line grinders this year.
- Electric Vehicles: \$184,000
Deer Island Treatment Plant staff perform multiple job-related activities and tasks all around the large expanse of the DITP and its numerous buildings and facilities on a daily basis. The expansive nature of DITP's terrain requires use of electric vehicles to ensure the most efficient transport of staff, tools, equipment, and supplies. Electric Vehicles save countless staff hours throughout the year. Utilizing these smaller electric vehicles is less costly than conventional vehicles, in addition to being significantly more environmentally friendly. Deer Island purchased seven short beds for operations staff and ten long beds for maintenance staff.
- HVAC Replacement: \$175,000
HVAC staff replaced two ventilation fans at the Hydroelectric building, installed one large condenser at the Disinfection facility, installed two heating coils in Administration Lab Building and purchases a new roof top unit for Thermal Power Plant. These were direct replacements because existing units were problematic and maintenance cost was increasing rapidly.
- Centrifuges Refurbishment \$586,835
There are twelve waste sludge centrifuges, which, due to high speed rotating assembly and critical nature of the process, require maintenance. Centrifuges require refurbishment at regular intervals based upon running hours for normal wear and tear. Due to the intricacy and complexity of the equipment, all overhauls are sent back to Alfa Laval, the original equipment manufacturer. In the past year, four waste sludge centrifuges were refurbished. MWRA Staff is responsible to install and perform functional test units.
- Elevator Controllers Replacements \$171,791
This contract covers Preventive Maintenance and project work. We have done substantial project work on elevators to increase reliability. We replaced the oil tank reservoir in the Maintenance Building. We changed out the door closers and rubber gaskets in South System

Pump Station. We replaced control panel, contactors and motor in Secondary Operations Building. This has increased reliability and reduce nuisance calls for the contractor.

Capital Projects

In addition to the maintenance projects listed above, the following Capital Improvement projects included work for Deer Island in FY22:

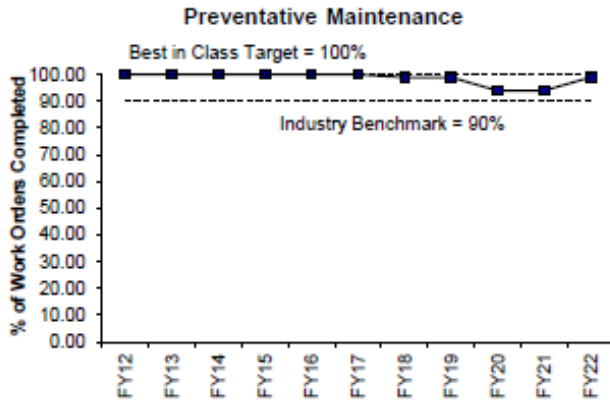
- Winthrop Terminal Facility Pump and VFD Replacement, Contract 6875 (\$12.0m)
- Gravity Thickener Rehabilitation, Contract 7428 (\$20.4m)
- Chemical Tank and Digester Pipe Contract 7373 (\$8.9m)

The following pages adapted from MWRA's quarterly performance report to the Board of Directors, the "Orange Notebook", summarize key indicators relating to Deer Island maintenance.

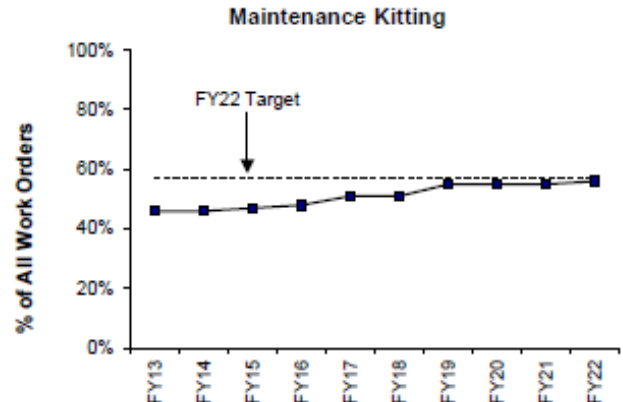
The full Orange Notebook can be found at:

<http://www.mwra.com/quarterly/orangenotebook/orangenotebook.htm>.

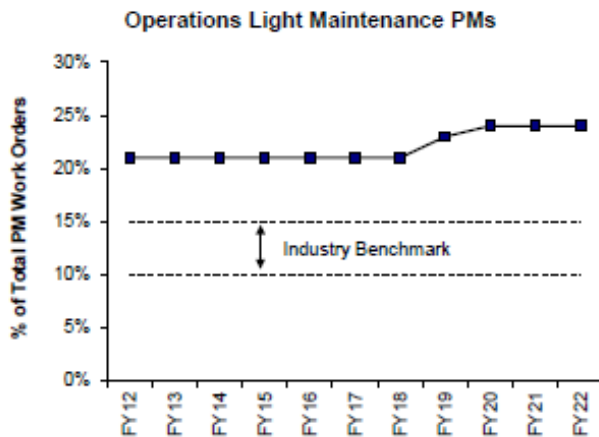
Deer Island Yearly Maintenance Metrics FY22 Proactive and Productivity Measures



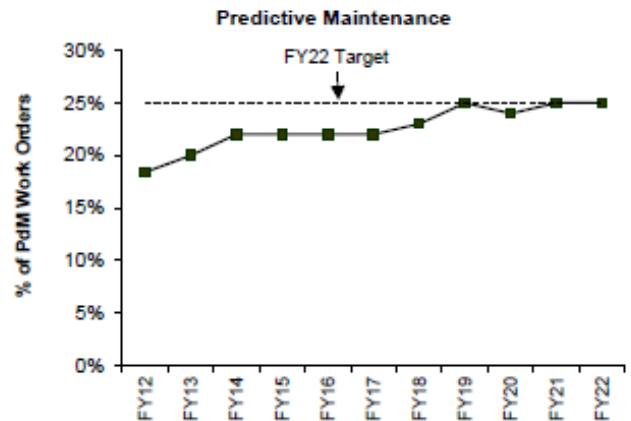
The industry benchmark is 90% for Preventative Maintenance (PM) completion. Upon reaching the 90% goal in FY05, the target goal was increased to the "Best in Class" Target of 100% PM completion. Reliability-Centered Maintenance (RCM) and PM optimization efforts have continued since FY01. PM completion rate was 99% in FY22.



Preventive Maintenance (PM) inventory items were loaded into Maximo to assign spare parts for equipment to PM work orders. DITP reached the PM kitting goal of 100%. In FY12 a new graph was developed to track kitting of all maintenance work orders in an effort to increase wrench time. Staff continues to fine-tune the process to "kit" all maintenance work orders. Kitting is considered a best practice by maintenance and reliability professionals. It entails staging parts necessary to complete maintenance work. Kitting allows maintenance staff to spend more time "turning the wrench" and less time waiting for parts at the stockroom window. Kitting for FY22 was 57%, meeting DITP's goal of 57%.



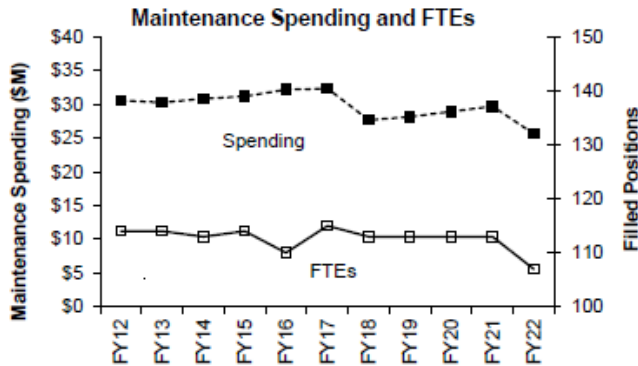
The percentage of preventive maintenance work order hours completed by Operations staff (non maintenance staff) increased from less than 1% in January 2002 to the current level of 24% in FY22. DITP reached the industry benchmark range of 15% in April 2003 and has exceeded the goal through FY22. Operations completes approximately 684 PM work orders per month.



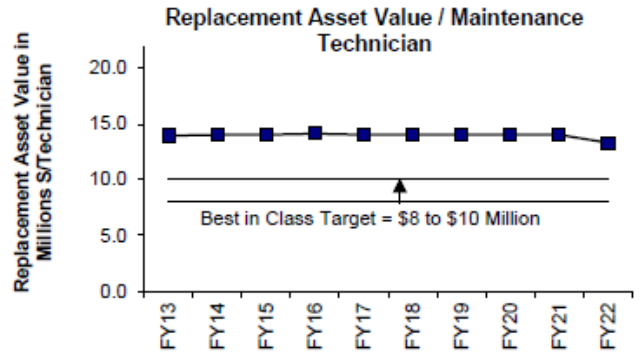
Predictive maintenance has steadily increased from 2% in FY03 to 25% in FY22, DITP's met the FY25 goal of 25%. This percentage in predictive maintenance was achieved through the expanded use of lubrication, vibration, thermography, and acoustic ultrasonic testing techniques. The Condition Monitoring Group continually reviews and investigates new opportunities and initiatives to expand condition monitoring testing and analysis.

Deer Island Yearly Maintenance Metrics FY22

Overall Maintenance Program Measures

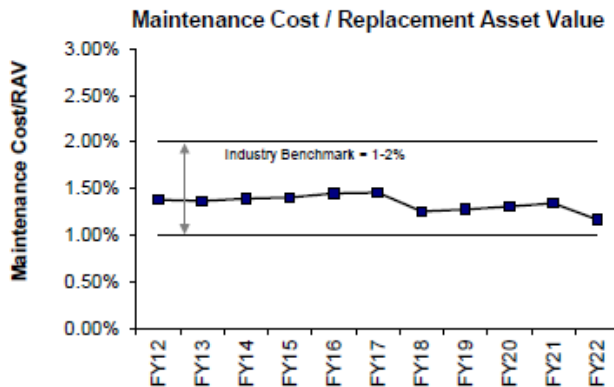


DITP's Maintenance staff is currently at 107 FTE's. Maintenance staff levels ended at 107 due to retirements and hiring challenges for trades personnel. Maintenance has worked to meet our goals through implementation of numerous maintenance efficiencies including: Operations performing light maintenance, cross-functional training and flexibility, and Reliable-Centered Maintenance. This year's Maintenance spending decreased for materials and services.

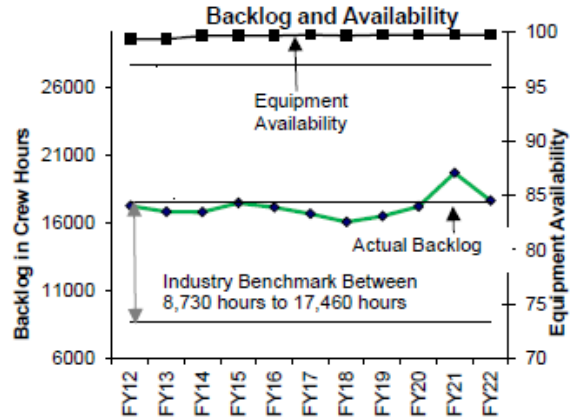


DITP adopted a "best in class" target of \$8-\$10 Million/Technician for maintenance staffing. DITP remains above this Best in Class. However, as the plant ages and additional equipment replacements are expected, DITP management will reassess staffing as needed.

The Maintenance Spending graph shows actual annual maintenance spending and CIP asset replacements (equipment costs only). Maintenance staff continues to evaluate plant assets and requirements for replacement of obsolete equipment to ensure the plant operates at maximum efficiency. In FY22, overall spending decreased slightly from FY21 due to a reduction in CIP Spending. Maintenance Projects in FY22; SSPS VFD Replacements, Gravity Thickener Rehabilitation, Gravity Thickener Overflow Piping Replacement, Gas Protection System Replacements, Installation of two W3 Strainers, and installation of LED Emergency Lights throughout DITP.



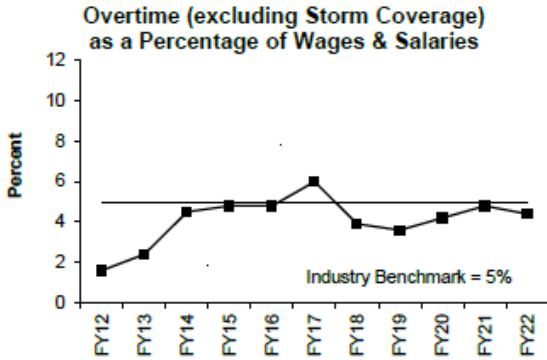
The industry benchmark for annual maintenance spending is between 1% to 2% of replacement asset value, currently DITP is at 1.17%. The plant's replacement asset value is calculated at approximately \$2.6 billion dollars. DITP's current maintenance spending is within the industry benchmark. Overall maintenance spending has decreased slightly from last year. DITP maintenance CEB spending is \$22.9 million. CIP spending was \$2.6 million (equipment costs only), down \$2.4 million from the previous year. CIP/CEB spending totaled \$25.6 million in FY22.



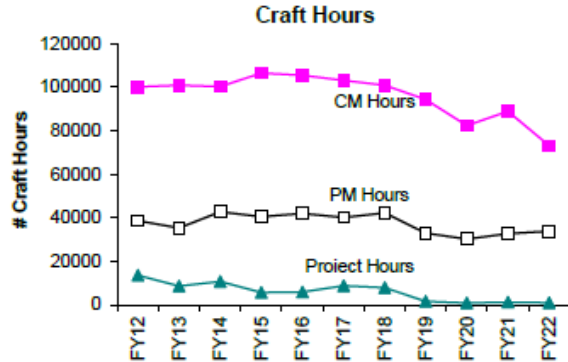
Industry benchmark for Equipment Availability is 97%. Deer Island has exceeded this benchmark over for the last ten years. In FY22 the availability was 99.8%. The high percentage in Equipment Availability during FY22 is due to redundancy of equipment and effective/efficient maintenance practices.

Industry Benchmark for Backlog is between 8,730 to 17,460 hours for maintenance based on current staffing, the total average backlog for FY22 was 17,649 hours, which is slightly above industry benchmark. DITP Maintenance has made significant progress in decreasing our backlog.

Deer Island Yearly Maintenance Metrics FY22 Overall Maintenance Program Measures (cont.)



Management continues its effort to keep overtime below the industry benchmark. DITP maintenance overtime was 4.4% for FY22. Management has taken steps to reduce overtime spending by limiting overtime to repair critical equipment and systems only. DITP has been under the Industry Benchmark every year except FY17, due to the increase in overtime for the Eversource Cable Outage.



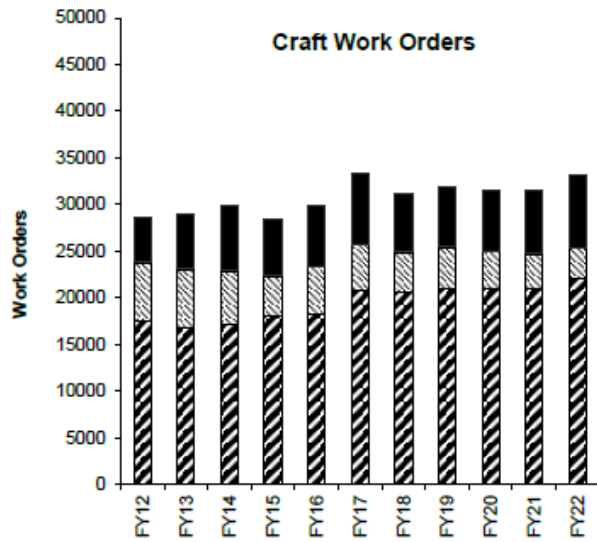
This years significant decrease in Corrective Maintenance (CM) hours was due to staffing issues (retirements and hiring challenges for trades personnel

Preventative and Project work orders roughly stayed the same.

Continued optimization of the Preventive Maintenance (PM) program through the transfer of some light maintenance tasks from Maintenance to Operations staff (24% of PM work orders in FY22), elimination of duplicate work orders, combining some PM's, increasing PM frequency due to equipment history.

This years significant decrease in Corrective Maintenance (CM) hours was due to staff focused on critical work orders only to ensure all required equipment was available.

Maintenance did complete some significant maintenance work in FY22: Overhauled Centrifuge #10, Repaired Dewatering Line, Repair of Winthrop Terminal Facility RWW Pump #5, Disinfection W3L Valve Installation, Fabrication of RSL Shafts/Access Hatches, Installation of Vapor Coil Bundle for CJ:LOX.TK/LVAP-1, Rebuild of Admin/Lab Chiller #3, Waste Gas Burner Flare #2 Manifold Pipe Repair and DITP Parking Lot Upgrade, Installation of two W3 Strainers, and Installation of LED Emergency Lights throughout DITP.



During FY22, the overall number of work orders increased .4% from the previous year. The increase is due to aging equipment replacements, with increased preventative schedules. The Planning department is continuously modifying PM, PdM, and CM Job Plans to ensure maintenance is being performed efficiently and effectively, while ensuring reliability and availability of DITP's Assets.

- Predictive Maintenance
- Emergency Maintenance
- ▨ Project
- ▩ Corrective Maintenance
- ▧ Preventive Maintenance

Status Sheets
Wastewater Transport System
July 2021 - June 2022

The Field Operations Department Equipment Maintenance reporting on key indicators of performance for FY22. Monthly maintenance data are tracked under six headings.

- **Operations Light Maintenance Hours** – In an effort to free up Maintenance staff to complete more detailed and complex maintenance, Operations staff have been committed to completing a number of the routine monthly preventative maintenance (PM) tasks. These tasks generally consist of observation and light maintenance tasks. The industry benchmark is 10% - 15% of the total preventative maintenance hours. In FY22, Operations staff completed an average of 289 hours per month which accounted for 14.10% of the total preventative maintenance hours.
- **Overall Preventive Maintenance** – The preventive maintenance work orders are completed by both operation and maintenance staff. The goal for FY22 was to complete 100% of all preventative maintenance work orders. The PM completion for FY22 was 100%.
- **Work Order Kitting** – In an effort to more efficiently complete work, maintenance staff and work coordination center staff have utilized the Lawson/Maximo interface to better kit stock and non-stock material. The goal is to kit 60% of all work orders. The average for FY22 was 63.75% of all work orders.
- **Operations Light Maintenance % PM Completion** – In an effort to free up Maintenance staff to complete more detailed and complex maintenance, Operations staff have been committed to completing a number of the routine monthly preventative maintenance duties. The goal for Operations staff is to complete 100% of the Preventative Maintenance work orders. In FY22, Operations staff completed 100% of the work orders.
- **Maintenance Backlog in Crew Hours** - Backlog is determined by totaling the planned craft hours in open work orders and comparing them to craft resources available. The FY22 backlog average was 19,896 hours, which is above within the industry standard of 6,636 to 13,275 hours. This backlog slightly above the industry standard of 6,636 to 13,275 hours or 4 to 6 weeks. Metro Maintenance monitors these metrics very closely to ensure the backlog does not adversely impact equipment availability.
- **Maintenance Overtime** – Maintenance overtime spending was \$311,306 under budget for FY22. The overtime was used to support call-ins for emergency maintenance and planned overtime; it was also used for maintenance coverage related to weather events.

Facilities Operational Statement

During FY22 Wastewater Transport facilities operated at full capacity throughout the year. All required equipment to maintain flow and processing of wastewater was available. The CSO facilities operated with sufficient chlorination and de-chlorination, though some NPDES exceedances were reported. The required number of pumps in each gravity and pumping CSO was available throughout the year.

Critical Equipment Availability

The average equipment availability for FY22 was 99.97%. An equipment availability report generated daily, that details the critical equipment required to collect and transport the wastewater flow at the facility design capacity. Higher maintenance priority is given to equipment that drops below the number required. Because of the high daily equipment availability, no operational impact has occurred in the past year.

SCADA Program

The MWRA Supervisory Control and Data Acquisition (SCADA) system provides a means of monitoring and controlling facilities and equipment from a remote centralized location, as well as providing a continuous record of facility operations. The SCADA System has been in place at all field facilities since FY10. SCADA staff perform minor and medium updates on the system throughout the year, and as Capital Improvement Projects are planned at each facility, SCADA improvements are included as part of the facility upgrade.

MWRA SCADA staff perform the required maintenance and upgrades to the majority of the field instrumentation and control panel equipment to ensure accurate measurements and continued operation throughout MWRA's field facilities. During FY22, these efforts were supplemented by an Instrumentation Service Contractor who was primarily responsible for performing calibrations and corrective service to the gas monitoring systems within facilities. SCADA staff also maintain, upgrade, program, and patch the computers and hardware used in collecting, controlling, transmitting and displaying facility data. During FY22, continued emphasis was placed on improving MWRA's cyber security posture. This included the expansion of the SCADA communications network "Domain" architecture, where user accounts and policies are centrally managed via a "Domain Controller."

Maintenance Projects and Equipment Replacement

Equipment replacement is part of the overall maintenance strategy that ensures compliance with permit requirements. Projects and initiatives are completed during each fiscal year to maintain redundancy and continued reliability. Many projects are extensive, requiring significant in-house resources and use of specialty/service contractors. Some examples of key improvements, equipment replacement, or significant repair work during the past fiscal year include in-house and outsourced projects.

In-House Projects

Work continues to maintain reliability and availability of the equipment at all wastewater facilities through Preventive and Predictive Maintenance Practices. The following is a detailed list of in-house work performed at all water and wastewater facilities in Metro East.

- Hayes Pump Station: Plumbers installed new suction and discharge gauges needed for flow tests for rehabilitation
- DeLauri Pump Station: Machinist's fabricated new rake guides with structural enhancements which will prevent the rakes from catching and tripping the clutch
- New Neponset Pump Station: Electricians replaced fixtures with more efficient LED explosion proof lighting in the Wet Well and Screen Room areas
- Hingham Pump Station: Electricians installed new LED explosion proof fixtures in Wet Well
- Hingham Pump Station: Plumbers installed new suction, discharge and check valves for three RWW pumps
- Hingham Pump Station: Plumbers installed new plug valve on the bypass pump connection
- Braintree Weymouth Intermediate Pump Station: Electrical Service Vendor removed and replaced Facility Main Transformer with Temporary Transformer
- Nut Island Headworks: Machinists, Welders and Mechanics fabricated and installed a new baffle box Grit Vortex #6
- Nut Island Headworks: Mechanics and Machinist replaced Screen Conveyor #2 carry belt, worn bearings, shafts and rollers
- Columbus Park Headworks: Mechanics rehabilitated #3 channel, replacing all collector and drive chain, a headshaft shaft, sprockets and flights
- Chelsea Creek Headworks: Mechanics inspected Channel # 1 as part of facility turn over from Construction
- Somerville CSO Chemical Building: Electricians installed new LED exterior lighting
- Chelsea Administration Building: Plumbers and Facility Specialists removed and replaced shower stalls in first floor women's locker room

- Electrical Thermal Imaging: Electrical Service Contractor and Medium Voltage Electricians performed non-invasive thermal imaging scans at Columbus Park Headworks, Ward Street Headworks, Hayes Pump Station, Squantum Pump Station, New Neponset Pump Station, Braintree/Weymouth Replacement Pump Station, Quincy Pump Station, Framingham Pump Station, Somerville Marginal CSO, Cottage Farm CSO, Somerville Marginal CSO and Cottage Farm CSO

Capital Projects

In addition to the maintenance projects listed above, the following Capital Improvement projects are underway or completed in FY22.

Construction and Design Projects Started or On-going during FY22 Include:

- Chelsea Creek Rehabilitation – Construction Contract 7161 (100% Complete)
- Nut Island Headworks Odor Control & HVAC Improvements – Construction Contract 7548 (ongoing)
- Fuel Oil Tank Replacement at the Hayes Pump Station – Construction Contract 7554 (100% Complete)
- Dorchester Interceptor Rehab. Sections 240, 241 & 242 – Construction Contract 7279 (100% Complete)
- Braintree-Weymouth Pump Station Improvements - Construction Contract 7366 awarded
- Remote HW Access Shaft Improvement – Construction Contract 7550 awarded
- CHE008 Pipe Replacement Construction – TO Contract 7691 – bids received, award pending
- Somerville Marginal CSO Facility MWR205 Tide Gate Replacement – Construction Contract OP-429 awarded
- Ward St. & Columbus Park Headwork Design/CA – Contract 7429 (in progress)
- Hayes PS Rehab. Design/CA – Contract 7162 (60% design in review)
- Siphon Structure Rehab Design/CA – Contract 6224 (100% design in review)
- Interceptor Renewal No. 7 Malden-Melrose Design/CS – Contract 7216 (100% design in review)
- Caruso, DeLauri, Framingham and New Neponset Pump Stations and Cottage Farm CSO Facility Fuel Storage Tank Replacements – Siting Evaluation, Final Design and Bidding - Contract No. 7692 Task Order 4 – design initiated

Pipeline Preventative Inspection and Maintenance Projects

Manhole Inspection and Rehabilitation Program

The Technical Inspections Unit (TIU) of the Wastewater Operations Department conducts manhole inspections. These inspections facilitated the beginning of the manhole rehabilitation program. Specialized equipment and training are the essential elements of the program. Pipeline maintenance crews perform manhole renovations and repairs that result in reduced I/I. The manholes are coated using cementitious material applied with spinning equipment and then covered with special coatings to resist corrosion from hydrogen sulfide.

In FY22 TIU staff inspected a total of **814** manholes. Approximately 47 manholes were rehabilitated utilizing in-house staff. The rehabilitation work included frame and cover replacement, external repairs to raised manholes, internal repairs using the spin-cast application, and other miscellaneous repair work.

Pipeline Rehabilitation Projects

Pipeline Rehabilitation projects are first identified by the TIU during routine television inspections of the pipelines and interceptors. MWRA engineers review these projects and perform or coordinate all necessary design and construction contracting. The following are the pipeline construction/rehabilitation projects under design & construction in FY22:

- Interceptor Renewal No. 3, Dorchester Interceptor Sewer Design CA/RI - Contract 7512
- Charles River Valley Sewer Rehabilitation Construction (Section 191 & 192) - Contract 7643
- Siphon Structure Rehab Design/CS/RI - Contract 6224
- Interceptor Renewal No. 7, Malden/Melrose Interceptor Sewer Design CA/RI - Contract 7216

Pipeline Inspection and Cleaning Projects

The Technical Inspection and Wastewater Pipeline Maintenance groups were merged to more efficiently and consistently maintain the wastewater collection system. The work performed by the inspection staff is an important element to the planning and execution of pipeline maintenance work. The inspection tasks are shared by the entire staff and the maintenance workload is prioritized based on inspection data and information.

TIU conducts internal inspections of MWRA structures and pipelines to reveal potential problem areas and identify locations requiring maintenance. Pipeline inspections average about 70% of the workload followed by inspections of other structures and manholes. Approximately 30.69 miles of pipelines were TV inspected in FY22.

Pipeline maintenance crews perform a variety of maintenance activities for the MWRA's Wastewater Transport system. The Transport collection system includes 240 miles of

interceptor sewer lines. Approximately 38.00 miles of pipeline and 47 siphons were cleaned in FY22.

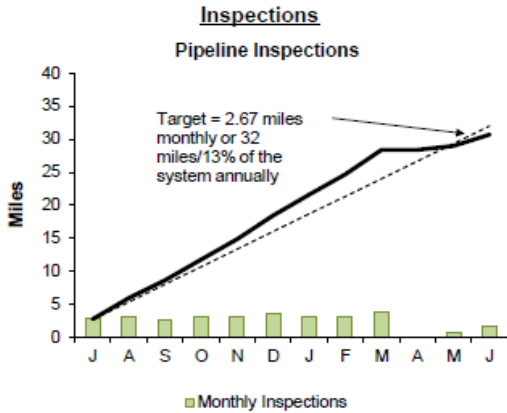
In addition to general pipeline and manhole repair work performed under this program, the following are other activities pipeline crews perform during the year:

- Pipeline spot repair work in shallow excavations
- Clear obstructions and clean sections in community lines under the Community Assistance Program
- Snow plowing and removal during winter months
- NPDES inspections and best practice management activities
- Emergency pumping activities for communities during major wet weather events
- By-pass pumping for contracted pipeline rehabilitation or repairs
- Emergency response and overflow monitoring during wet weather events
- Response to odor complaints in the system

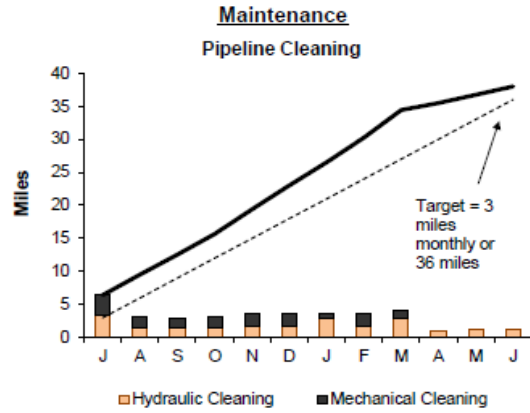
The following pages adapted from MWRA's quarterly performance report to the Board of Directors, the "Orange Notebook", summarize key indicators relating to Wastewater Transport Pipeline Maintenance and Equipment/Facility Maintenance. The full Orange Notebook can be found at: <http://www.mwra.com/quarterly/orangenotebook/orangenotebook.htm>.

Wastewater Transport

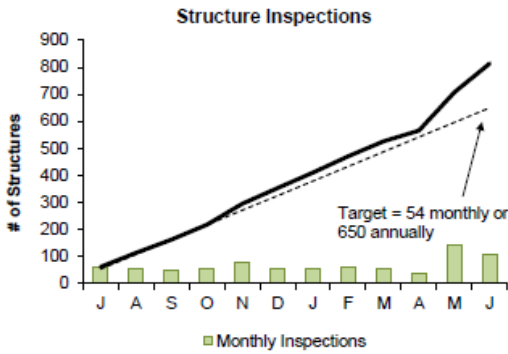
Overall Field Operations' Metropolitan Equipment & Facility Maintenance FY22



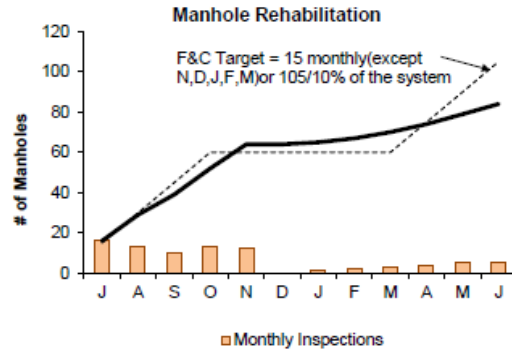
Staff conducted 1.70 miles internal inspections of MWRA sewer pipes during this month. The year to date total is 30.69 miles. No Community Assistance was provided. The numbers reflect IA, filling open positions and Covid 19 issues.



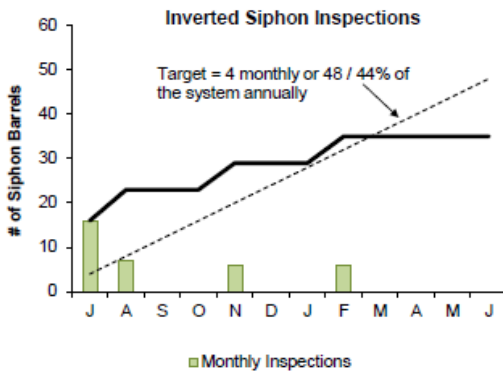
Staff cleaned 1.27 miles of MWRA sewer pipe, and removed 12 yards of grit. The year to date total is 38.00 miles. No Community Assistance was provided.



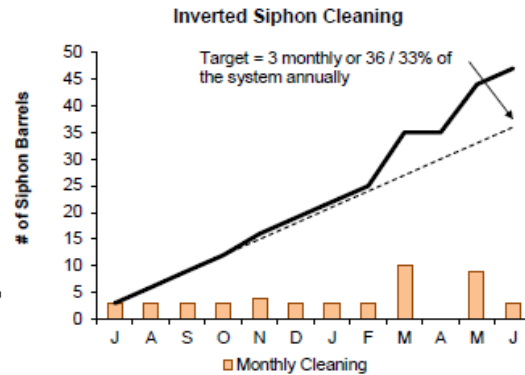
Staff inspected the 12 CSO structures and performed 94 other additional manhole/structure inspections during this month. The year to date total is 814 inspections.



Staff replaced 5 frames and covers this month. The year to date total is 84.



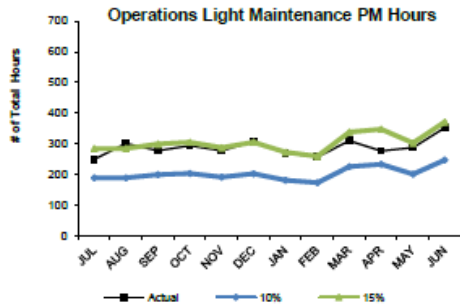
Staff did not inspect any siphon barrels this month. The year total is 35 inspections. The numbers reflect IA, filling open positions and Covid 19.



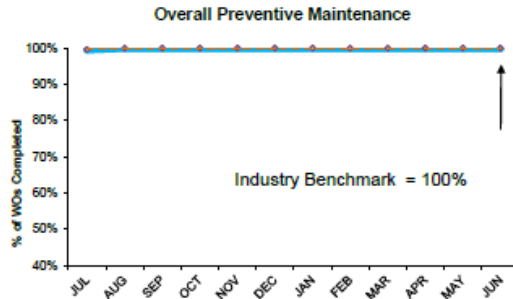
Staff cleaned 3 siphon barrels this month. The year total is 47.

Wastewater Transport Wastewater Pipeline and Structure Inspection and Maintenance

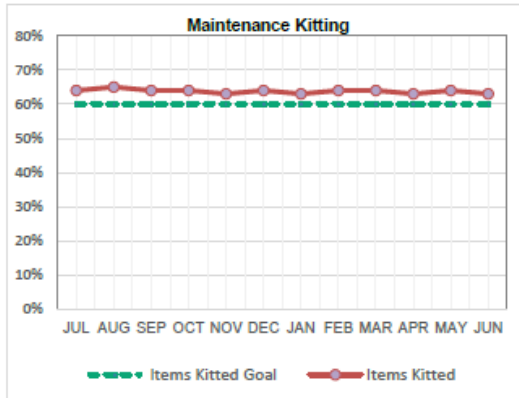
Several maintenance and productivity initiatives are in progress. The goal for the Overall PM completion and the Operator PM completion is 100%. The Operator PM and kitting initiatives frees up maintenance staff to perform corrective maintenance and project work, thus reducing maintenance spending. Backlog and overtime metrics monitor the success of these maintenance initiatives.



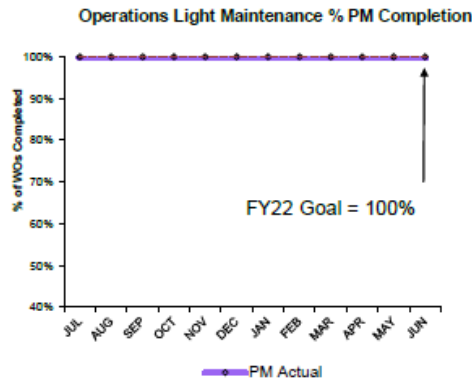
As part of efforts to improve efficiency, Operations staff completed 353 hours of preventive maintenance in June, about 14% of the total PM hours, which is within the Industry Benchmark of 10% to 15%. Operations completed 100% of their scheduled PMs.



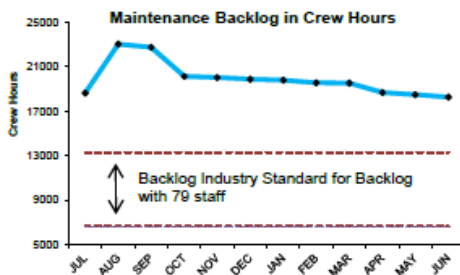
In June, Field Operations completed 100% of all PMs. Maintenance staff completed 100% of their assigned PMs and Operations staff completed 100% of their assigned PMs.



Operations' FY22 maintenance kitting goal has been set at 60% of all work orders to be kitted. Kitting is the staging of parts or material necessary to complete maintenance work. In June, 63% of all applicable work orders were kitted. This resulted in more wrench time and increased productivity.

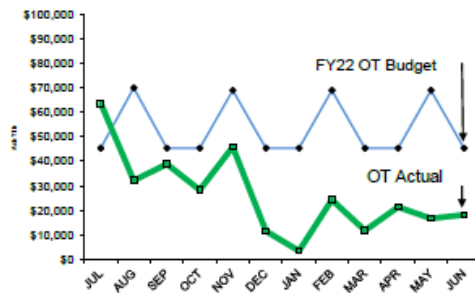


Wastewater Operations complete light maintenance PM's which frees up maintenance staff to perform corrective maintenance. Operations' PM goal is the completion of 100% of all PMs each month; Operations completed 100% of their PMs in June.



Current backlog is at 18,264 hours while overtime spending was \$27,188 under budget for June. The industry standard for maintenance backlog with 79 staff is between 6,636 and 13,275 hours. There are currently ten vacant positions; one HVAC Specialist, two Unit Supervisors, one M&O Specialist, four Facility Specialists, one Welder and one Toolmaker.

Overtime Spending



Maintenance overtime spending for June was \$18,128 which was \$27,188 under budget. Overtime in June was used for critical maintenance repairs and wet weather events.

Status Sheets
Fore River Pelletizing Plant
July 2021 – June 2022

Critical Equipment Availability: 83.33%

Operating logs indicate that of the 2,190 machine days in the FY22, centrifuges were available for 1,825 days for an availability of 83.33%. Two rotating assemblies were at the OEM repair shop for a total of 365 days. The centrifuges and ancillary equipment make up the critical components at the Pelletizing Plant because dewatered sludge can be processed through the dryers or it can be sent through a bypass system to trucks and taken to a landfill. The primary driver of downtime was disassembly and cleaning of the rotating assemblies. At the present time, 10 of 12 centrifuges are available giving the Plant more than enough capacity to process flows from Deer Island. The facility is currently operated on a 5-day workweek ceasing operations on most weekends.

Maintenance Work Orders and Backlog:

In FY22, there were 1,800 work orders created in the eMaint Computerized Maintenance Management System; 1,187 of those were PM's, 92 were planned, 433 were unplanned and 88 were listed as safety work orders. As of 7/1/22, there were 185 open work orders, 33 of them PM's representing a 89.7% completion rate. Currently, there are still 70 FY22 work orders outstanding.

The Preventative Maintenance system is continuously being modified to include updates for equipment changes, new lubrication schedules and new equipment inspection and cleaning practices. In addition, the operations staff are utilizing the system to track non-routine cleaning tasks to better gauge necessary frequency and to allow these cleanings to be scheduled as preventative rather than corrective actions.

Maintenance:

More than \$1.40 million was spent on replacement parts and maintenance related items in FY2021, including:

- Replaced train 1 Mixer A screw, patched trough, installed new liners
- Replaced silo 2 thermocouple ropes
- Removed and rebuilt crusher 4
- Disassembled, cleaned and rebuilt heat exchangers 1, 2, 3, 4
- Replaced ceramic media in two of four RTO's
- Centrifuge repairs – two complete rotating assembly were sent back to the manufacturer and have been overhauled to OEM condition
- Rebuilt multiple Dzurick valves
- Replaced train 1 and train 3 dryer feed screws

- Conveyor Repairs – Several small to medium repairs were completed