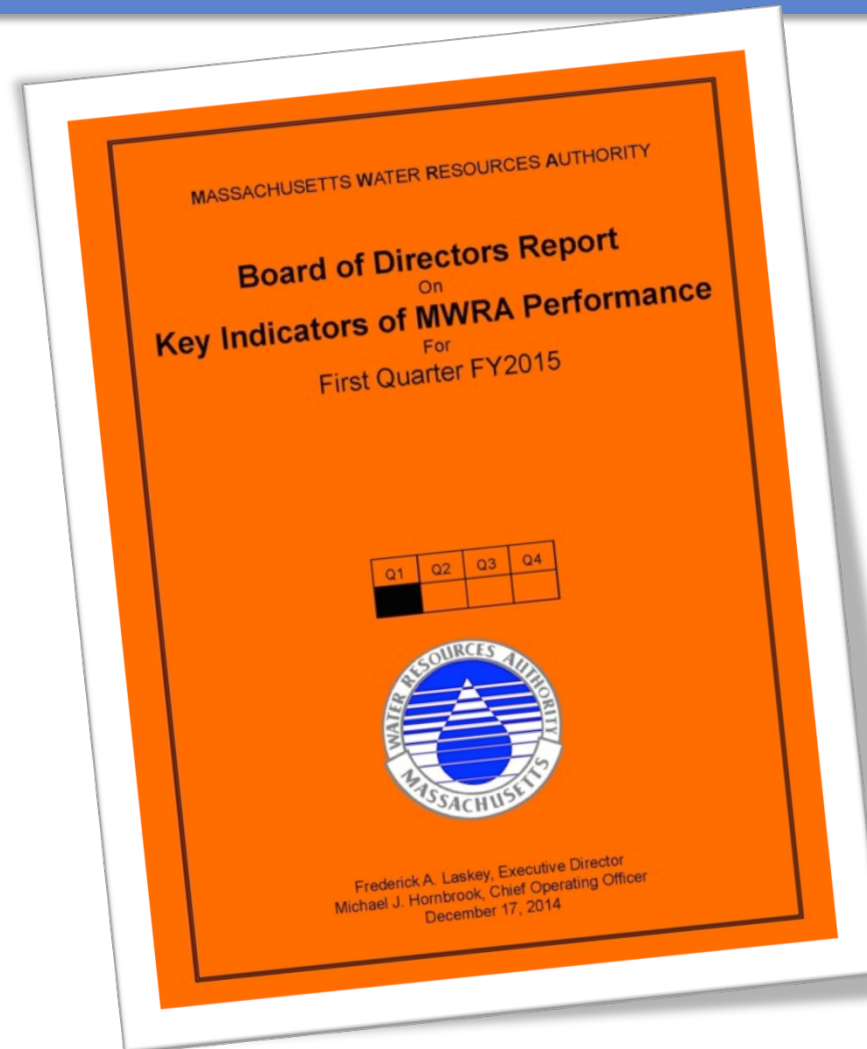




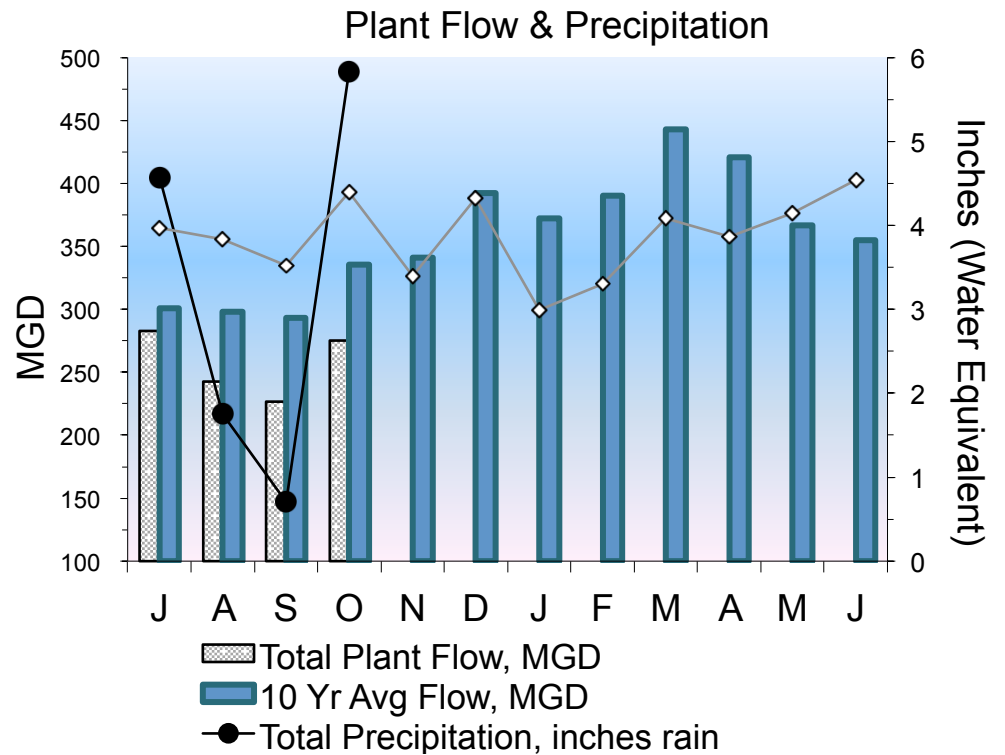
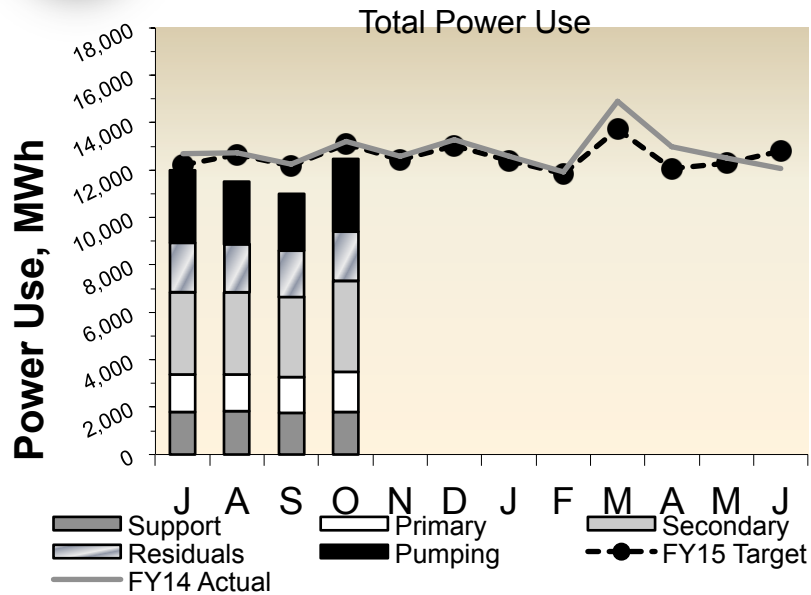


Massachusetts Water Resources Authority





Deer Island Flow and Power Through October 2014

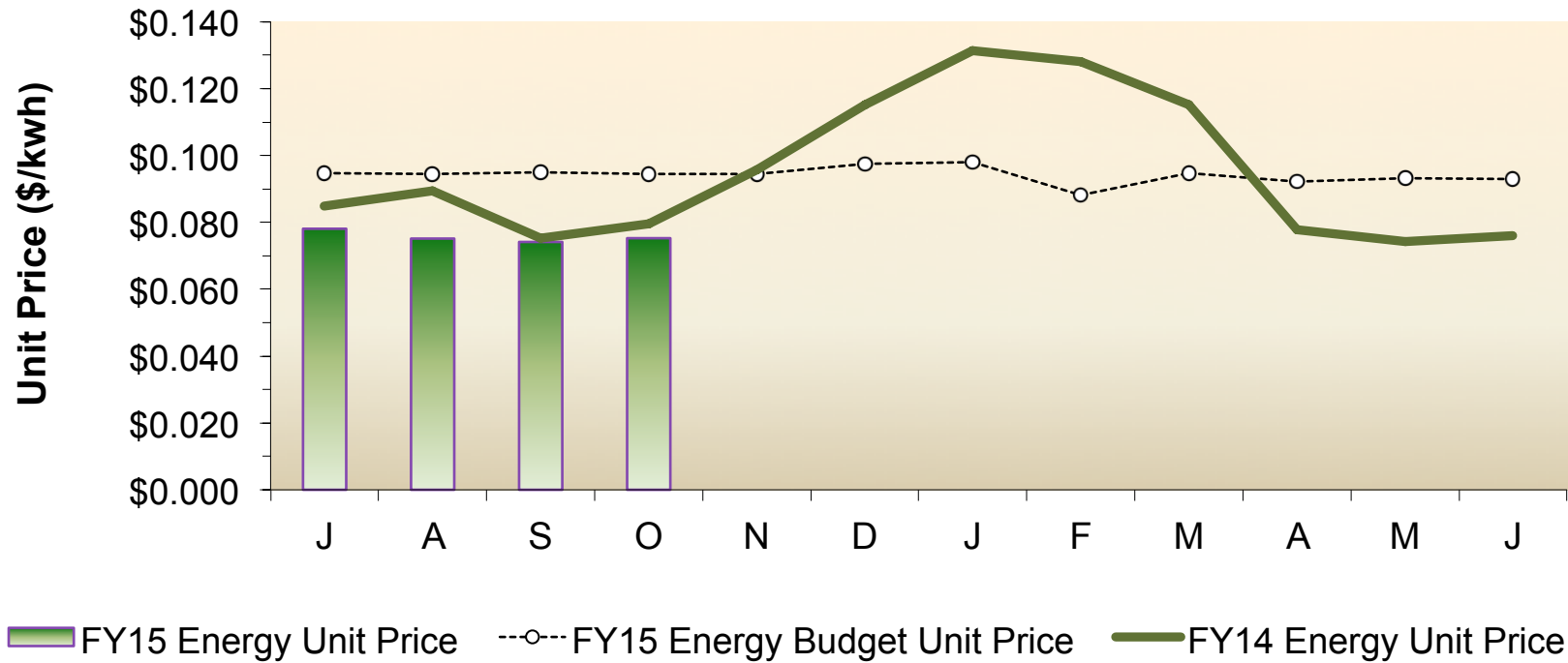




Deer Island Electrical Pricing

Total Unit Electricity Pricing

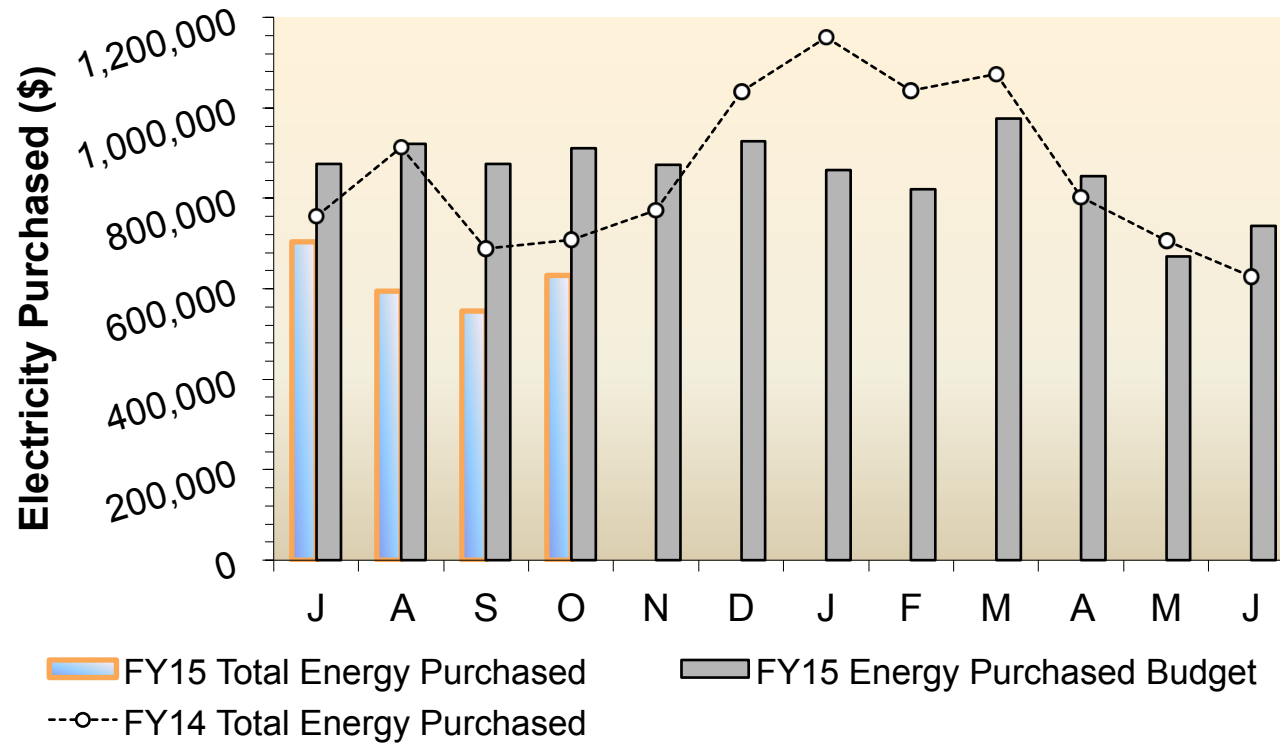
(includes spot energy price, ancillary costs, and NSTAR's transmission & distribution costs)





Deer Island Cost of Electricity

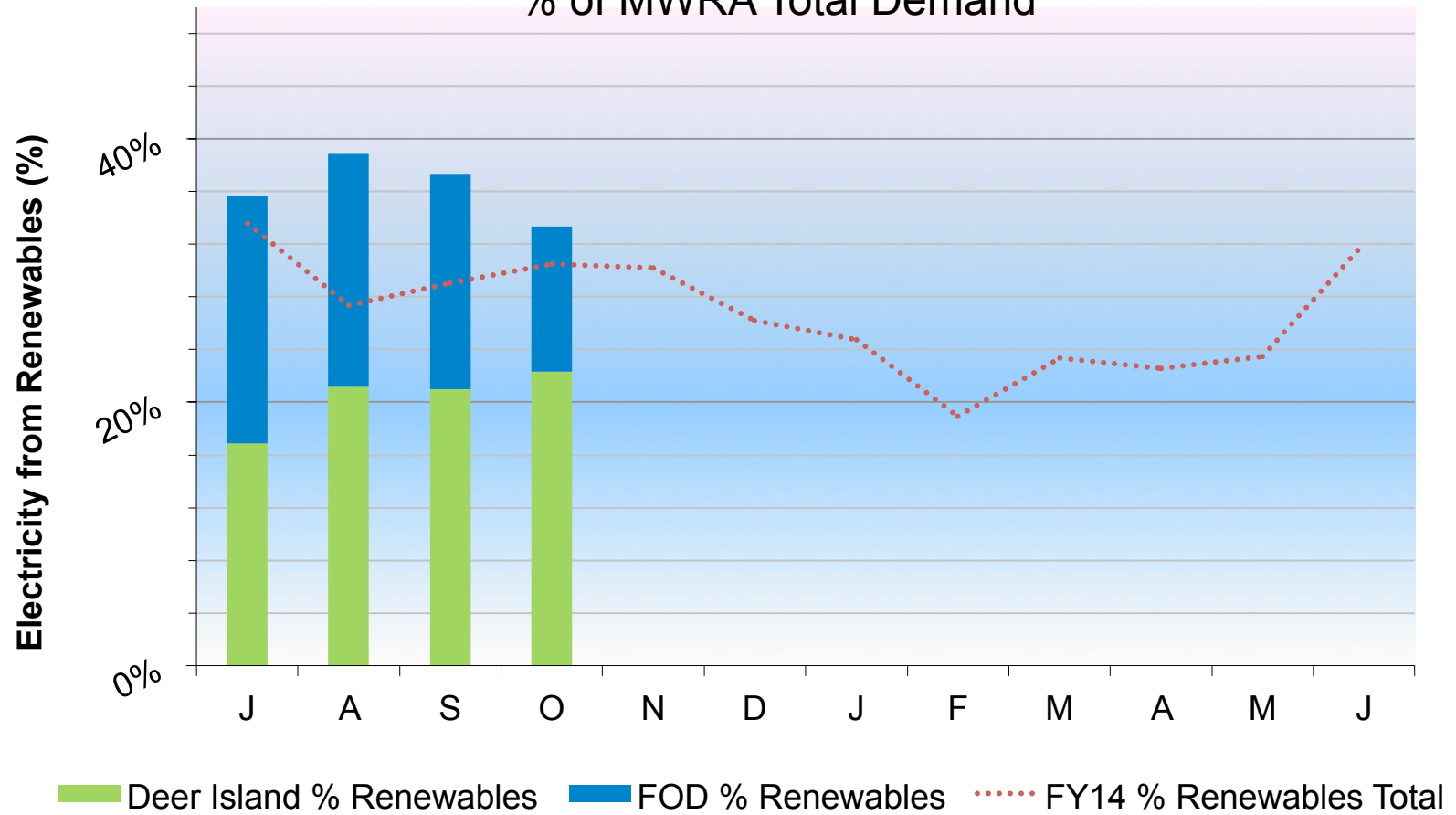
Total Cost of Electricity





Renewable Energy at MWRA

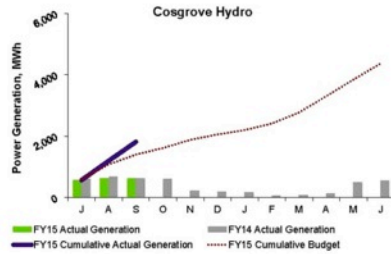
Renewable Electricity Generation as
% of MWRA Total Demand



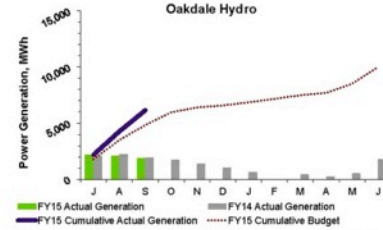


Green Energy - Field Operations Renewable Electricity Generation Revenue

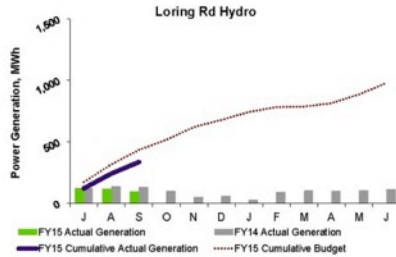
1st Quarter - FY15



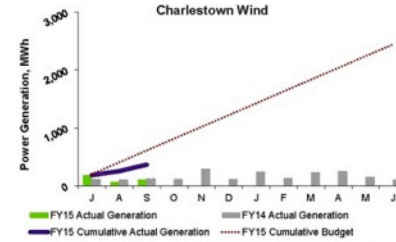
In the 1st Quarter, the Cosgrove Hydroelectric Station generated a net of 1,819 MWh; approximately 6% less power than was generated during the same quarter in FY14. The revenue generated in the 1st quarter was approximately \$69,796 (September revenue has not yet been received and is based on approximation).



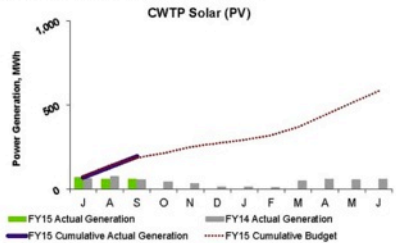
In the 1st Quarter, the Oakdale Hydroelectric Station generated a net of 6,146 MWh; approximately 2% less power than was generated during the same quarter in FY14. The revenue generated in the 1st quarter was approximately \$267,575 (September revenue has not yet been received and is based on approximation).



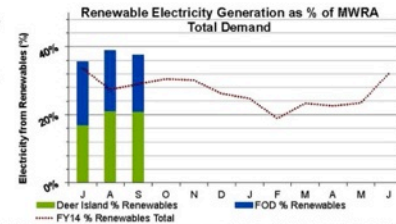
In the 1st Quarter, the Loring Rd hydroelectric Station generated a net of 336 MWh; approximately 14% less power than was generated during the same quarter in FY14. The revenue generated in the 1st quarter was \$10,589 (this only represents power sold to the grid, it does not reflect power used on-site). Power is generated as water conveyed from Nonumbega to the Loring Road storage tanks is reduced in pressure and the energy available in this pressure reduction is captured by the turbine. The facility operates continuously. Some power is consumed on site, with the bulk exported to the grid.



In the 1st Quarter, the Charlestown Wind Turbine generated a net of 368 MWh; 7% more power than was generated during the same quarter in FY14. The revenue generated in the 1st quarter was \$74,227.



In the 1st Quarter, the CWTP Solar PV generated a net of 195 MWh; approximately 2% less power than was generated during the same quarter in FY14. The revenue generated in the 1st quarter was \$30,844.



In the 1st Quarter, DI generated an average of 20% of MWRA's total electrical demand and FOD generated an average of 18%. The MWRA Total Demand is based on the FY15 budget. Field Operations Division (FOD) Renewables Generation includes power produced from all non-Deer Island Renewable Electricity Generation Facilities including Cosgrove Hydro, Oakdale Hydro, Loring Road Hydro, Charlestown Wind Turbine, and Carroll Water Treatment Plant solar PV.

In August and September the percentage of electricity production of total demand met by green power increased by 10% from last year, partly due to the BPSTG upgrades on DI.

In addition to electricity generation from on-site renewable sources MWRA also purchases additional green power. In FY14 approximately 7,110 MWh of green power (National Green-e Renewable Energy Certificates) was purchased. MWRA is currently in the process of contracting with a new vendor for the purchase of FY15 green power.

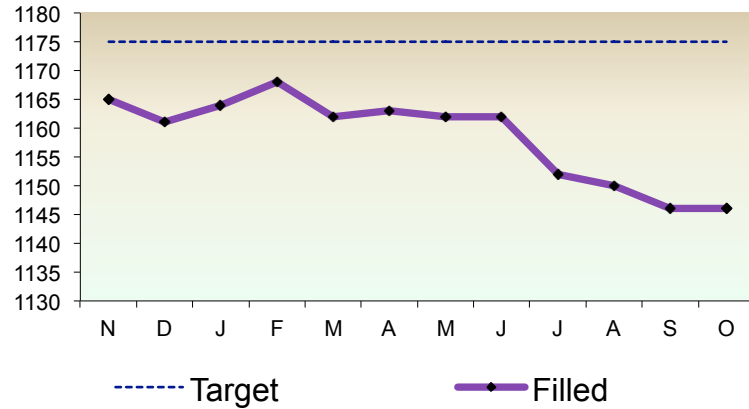
Green Energy

Field Operations Renewable Electricity Generation

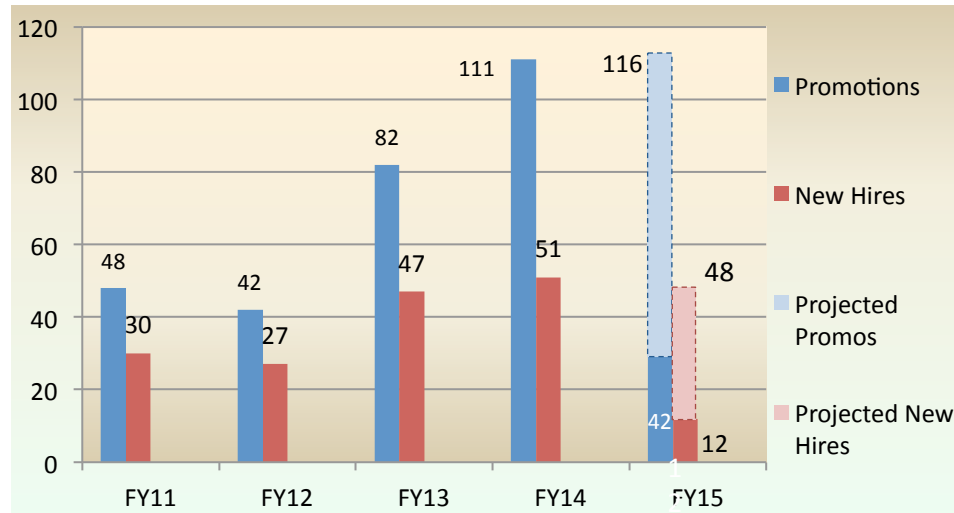
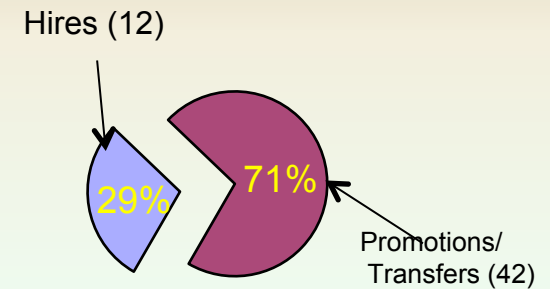


Workforce Management Through October 2014

Filled Position Tracking



Positions Filled by Hires/Promotions FY15 (YTD)







Massachusetts Water Resources Authority

***FY16 Proposed
Capital Improvement Budget***

December 17, 2014



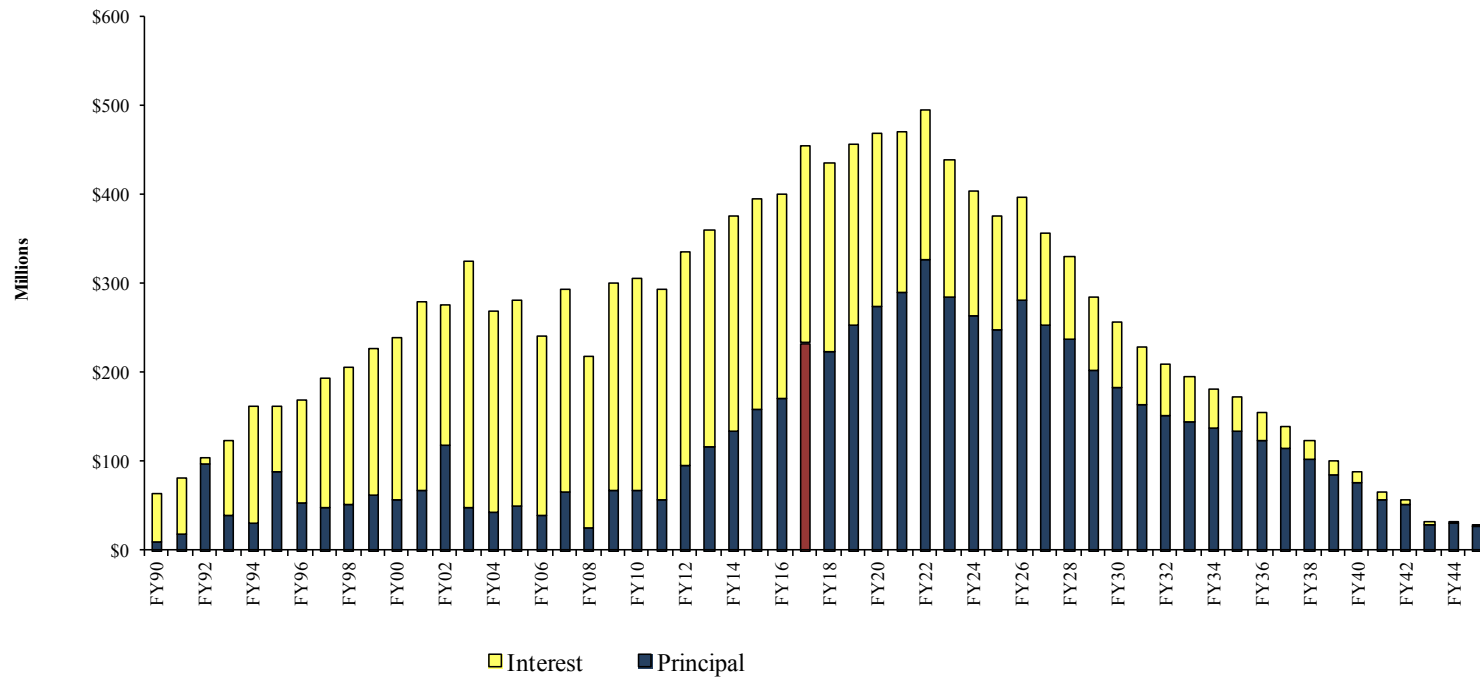
FY16 Proposed CIP

- ✓ MWRA continues to focus on Asset Protection and Long Term Redundancy initiatives;
- ✓ MWRA continues to reduce debt levels, paying more principal than interest; and
- ✓ FY16 Proposed CIP meets all Cap requirements.



Paying More Principal than Interest

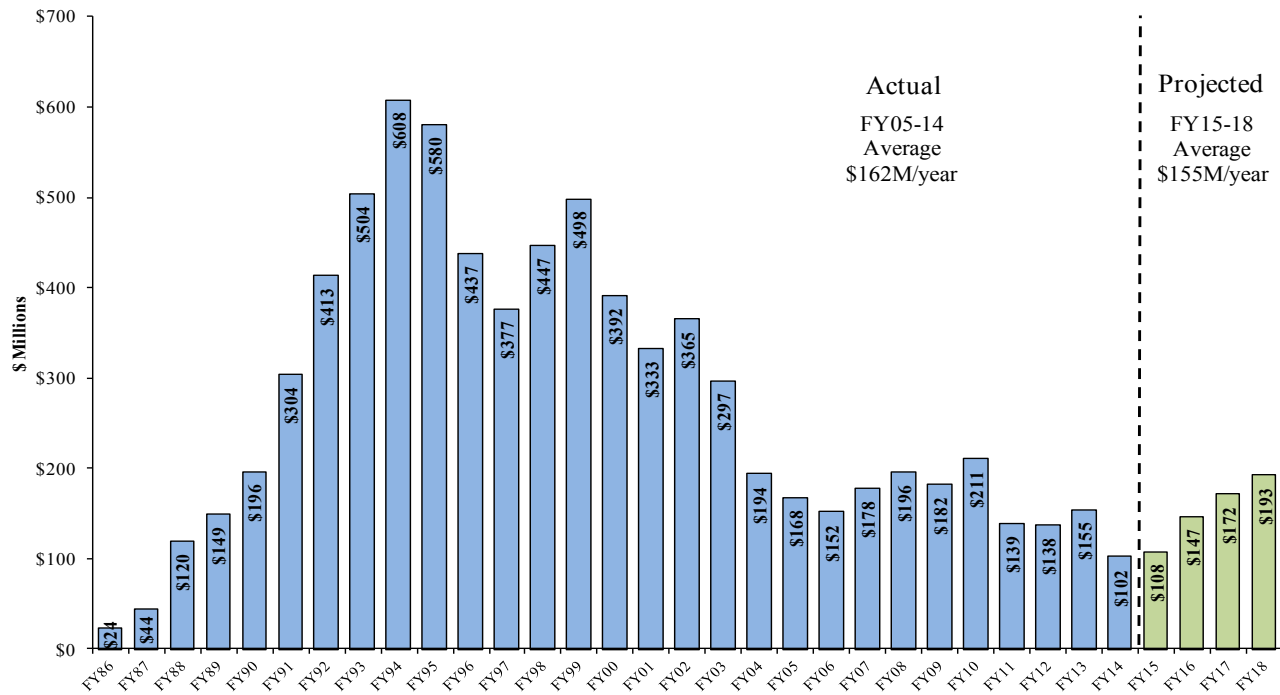
**MWRA Principal and Interest
Payment History and Projections**





Historic and Projected Capital Improvement Spending

CIP Historical and Projected Spending



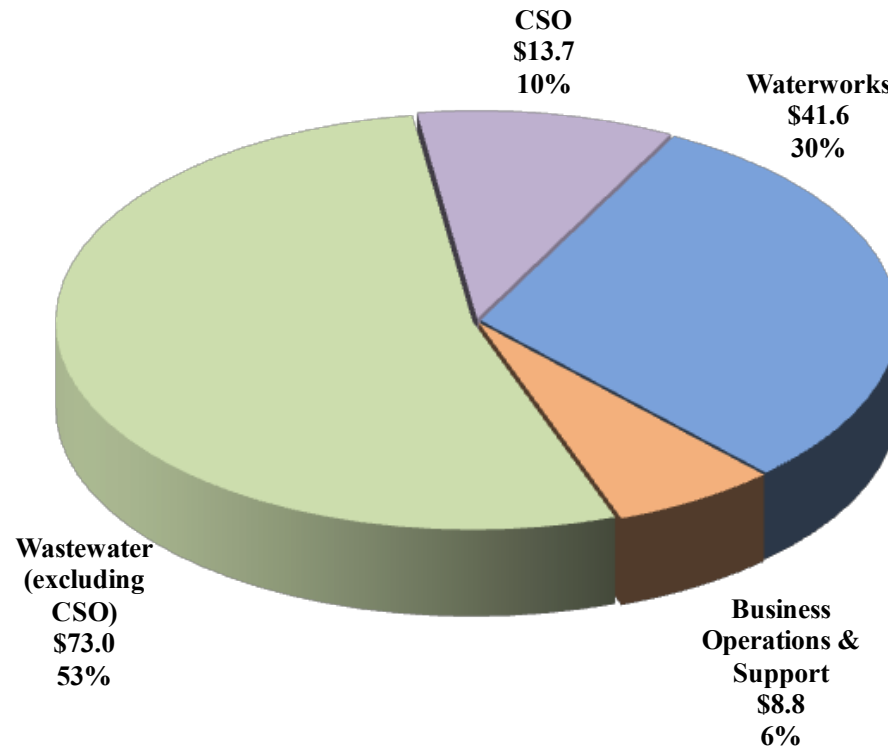


FY14-18 Base-Line Cap as Compared with FY16 Proposed Spending

FY14-18 Base-Line Cap		FY14	FY15	FY16	FY17	FY18	Total FY14-18
	Projected Expenditures	\$142.5	\$147.6	\$149.3	\$141.8	\$136.8	\$718.0
Contingency	7.6	9.5	10.1	9.8	9.3	46.1	
Inflation on Unawarded Construction	0.8	4.2	8.4	11.1	13.5	37.9	
Less: Chicopee Valley Aqueduct Projects	(5.0)	(2.2)	(1.4)	(1.3)	(0.4)	(10.3)	
FY14-18 Base-Line Cap	\$145.8	\$159.1	\$166.4	\$161.3	\$159.1	\$791.7	
FY16 Proposed		FY14	FY15	FY16	FY17	FY18	Total FY14-18
	Projected Expenditures	\$102.2	\$108.1	\$147.1	\$177.6	\$186.8	\$721.8
Contingency	0.0	5.3	8.2	10.8	11.6	35.9	
Inflation on Unawarded Construction	0.0	0.0	1.4	5.5	9.2	16.1	
Less: I/I Program	0.0	(11.2)	(16.9)	(18.9)	(18.1)	(65.1)	
Less: Water Loan Program	0.0	1.6	2.2	2.5	(0.1)	6.1	
Less: Chicopee Valley Aqueduct Projects	(5.6)	(1.5)	(0.0)	(0.1)	(0.2)	(7.3)	
FY16 Proposed FY14-18 Spending	\$96.6	\$102.3	\$141.9	\$177.5	\$189.2	\$707.5	
FY16 Proposed vs FY14-18 Base-Line Cap		FY14	FY15	FY16	FY17	FY18	Total FY14-18
	Projected Expenditures	(\$40.3)	(\$39.4)	(\$2.2)	\$35.8	\$50.0	\$3.8
Contingency	(7.6)	(4.2)	(1.9)	1.1	2.3	(10.2)	
Inflation on Unawarded Construction	(0.8)	(4.2)	(7.0)	(5.6)	(4.2)	(21.8)	
Less: I/I Program	0.0	(11.2)	(16.9)	(18.9)	(18.1)	(65.1)	
Less: Water Loan Program	0.0	1.6	2.2	2.5	(0.1)	6.1	
Less: Chicopee Valley Aqueduct Projects	(0.6)	0.7	1.4	1.3	0.2	3.0	
FY14-18 Cap (\$ Change)	(\$49.2)	(\$56.7)	(\$24.5)	\$16.1	\$30.1	(\$84.2)	
FY14-18 Cap (% Change)	-33.8%	-35.7%	-14.7%	10.0%	18.9%	-10.6%	



FY16 Proposed CIP Expenditures by Major Programs





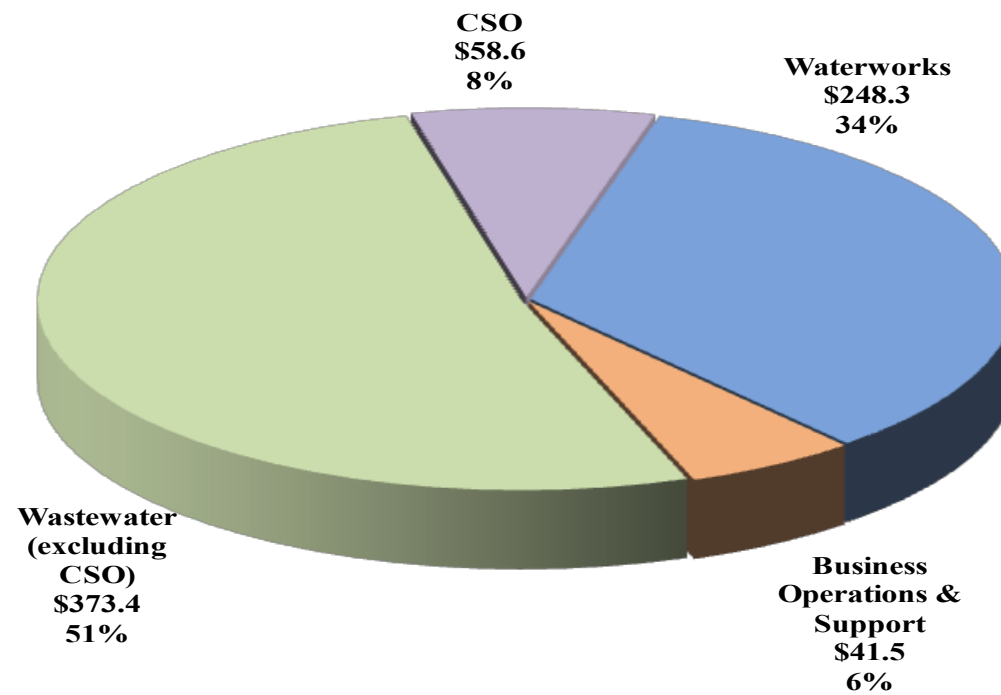
FY16 Big Spenders

	FY16 Planned Spending
DI Treatment Plant Asset Protection	\$ 45.2
Long-Term Redundancy	18.3
Facility Asset Protection	17.1
I/I Local Financial Assistance	16.9
Cambridge Sewer Separation	11.9
Weston Aqueduct Supply Mains	6.1
NIH Redundancy and Storage	5.5
Clinton Wastewater Treatment Plant	2.6
Applications Improvement Program	2.3
Central Monitoring System	2.3
Top 10 Spending in FY15	\$ 128.2
FY16 Spending	\$ 147.1

The top ten projects account for 87.1% of FY16 planned spending.



FY14-18 Proposed CIP Expenditures by Major Programs





On-Going Capital Projects



Deer Island Asset Protection



Total Budget	\$720.9M
Spending Through FY14	<u>\$176.3M</u>
Remaining Spending:	\$544.6M
FY14-18 Spending:	\$182.0M
FY16 Spending:	\$ 45.2M



Deer Island: Scum Skimmer Replacement

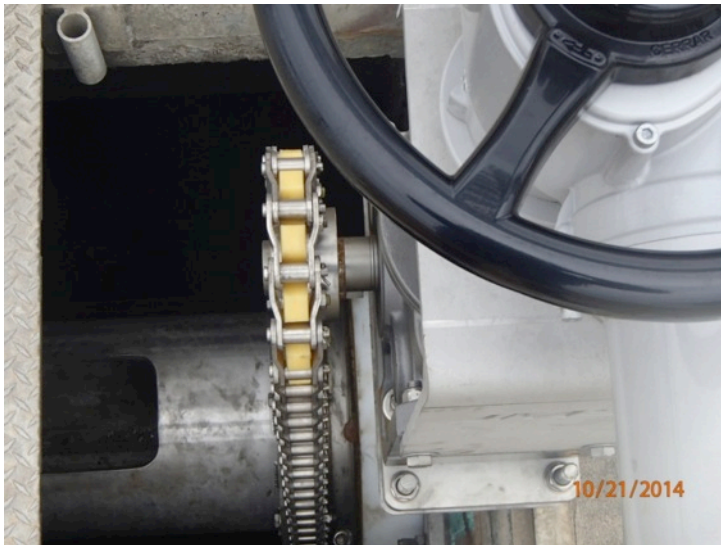
NTP: October 2013

SC : October 2016

Total Contract: \$20.2M

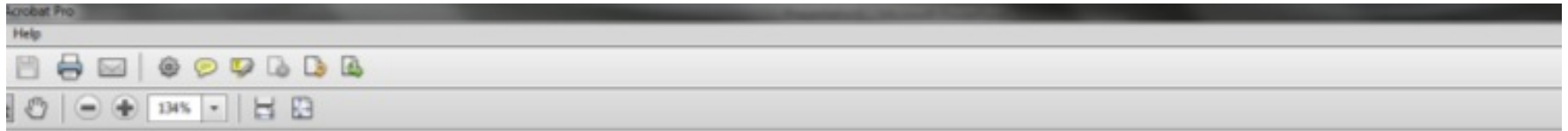
FY14-18 Spending: \$20.2M

FY16 Spending: \$ 6.0M

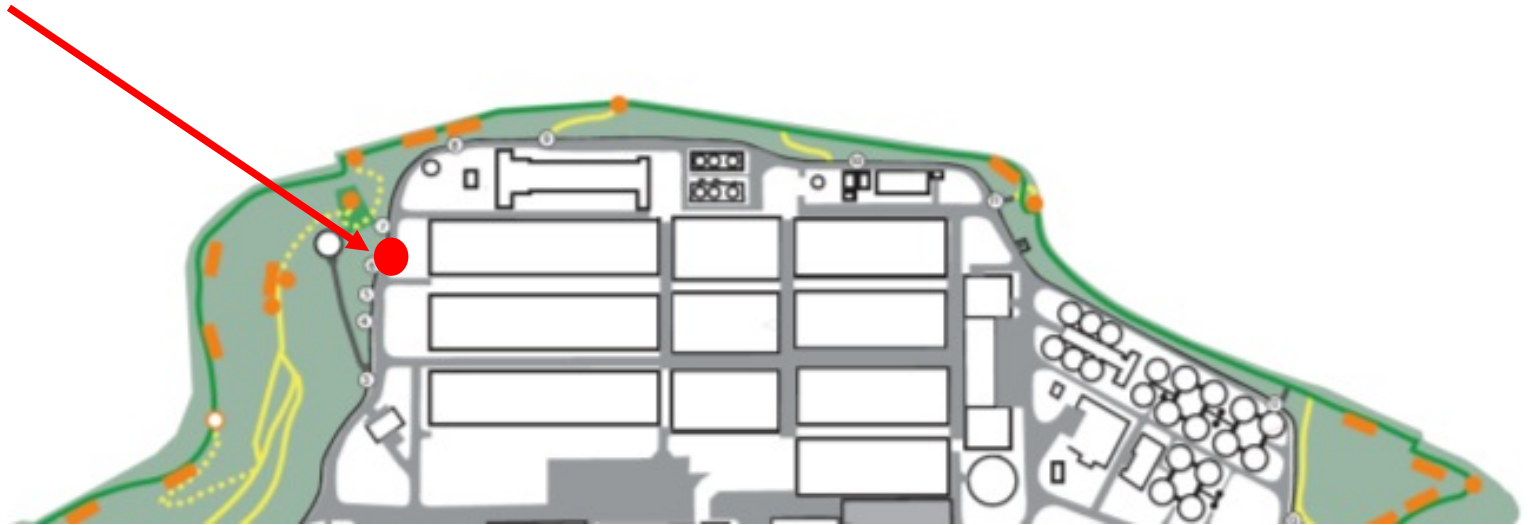




Deer Island North Main Pump Station



North Main
Pump Station





Deer Island: North Main Pump Station Motors/VFDs



NTP: December 2011
SC : March 2016

Total Contract: \$24.3M
FY14-18 Spending: \$17.8M
FY16 Spending: \$ 4.2M





North Main Pump Station & Winthrop Terminal Facility Valve Replacements



NTP: June 2014
SC : June 2017



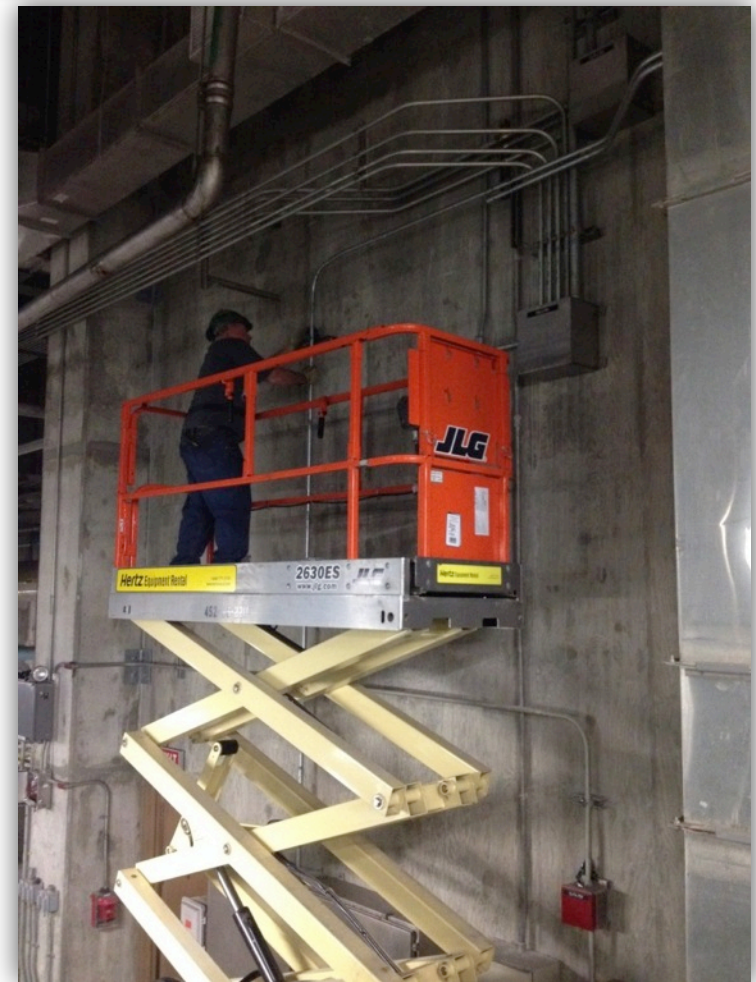
Total Contract:	\$17.0M
FY14-18 Spending:	\$17.0M
FY16 Spending:	\$ 5.7M



Deer Island Electrical Upgrades - Construction 4

NTP: May 2013
SC : May 2016

Total Contract: \$10.9M
FY14-18 Spending: \$10.9M
FY16 Spending: \$ 4.5M





Spot Pond Covered Storage Facility and Pump Station

NTP: November 2011
SC : May 2015



Total Contract:	\$51.4M
FY14-18 Spending:	\$33.8M
FY16 Spending:	\$ 1.5M



Cambridge Sewer Separation



Contract 9

NTP: July 1998
SC : December 2015

Total Contract:	\$92.1M
FY14-18 Spending:	\$41.7M
FY16 Spending:	\$11.9M



Contract 8B - Concord Avenue



Clinton Treatment Plant Phosphorous Removal



Design & Construction

NTP: November 2013

SC : August 2018

Total Contract:	\$8.3M
FY14-18 Spending:	\$8.3M
FY16 Spending:	\$0.7M



Upcoming Capital Projects



Chelsea Headworks Rehabilitation

Design

NTP: July 2010

SC : June 2020

Total Contract: \$7.9M

FY14-18 Spending: \$5.2M

FY16 Spending: \$0.1M



Construction

NTP: December 2015

SC : June 2019

Total Contract: \$54.8M

FY14-18 Spending: \$35.7M

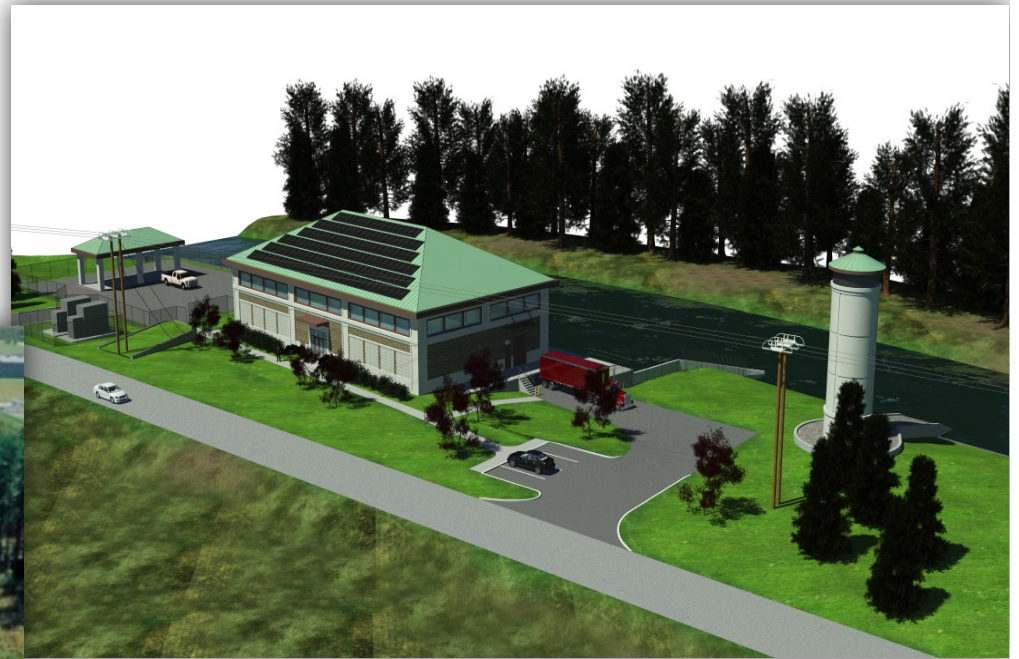
FY16 Spending: \$ 5.1M



Wachusett Aqueduct Pump Station

NTP: April 2015

SC : November 2018



Total Contract:	\$60.5M
FY14-18 Spending:	\$49.5M
FY16 Spending:	\$16.5M



Southern Extra High Redundancy – Section 111

Design

NTP: February 2014

SC : August 2021

Total Contract: \$7.7M

FY14-18 Spending: \$4.7M

FY16 Spending: \$1.2M



Construction

NTP: August 2016

SC: June 2020

Total Contract: \$29.8M

FY14-18 Spending: \$12.3M

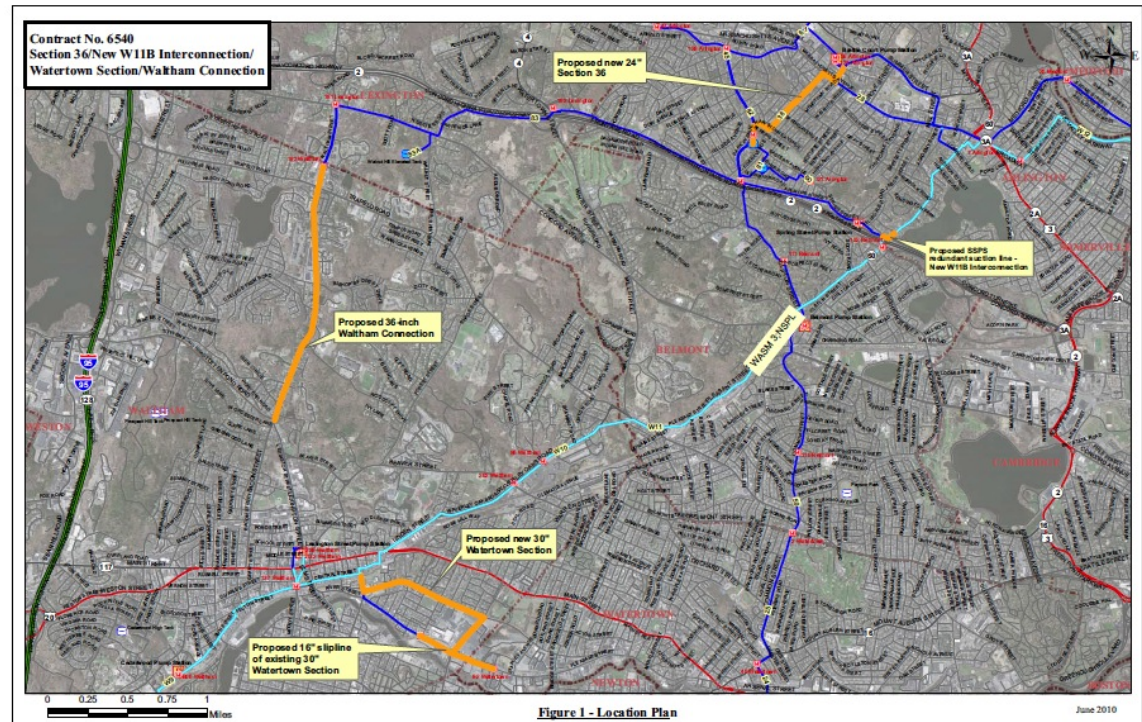
FY16 Spending: \$ 0.0M



Weston Aqueduct Supply Mains (WASM) – Section 36

NTP: October 2014
SC : March 2017

Total Contract: \$11.2M
Fy14-18 Spending: \$11.2M
FY16 Spending: \$ 4.5M





Alewife Brook Pump Station Rehabilitation

NTP: March 2015
SC : July 2017



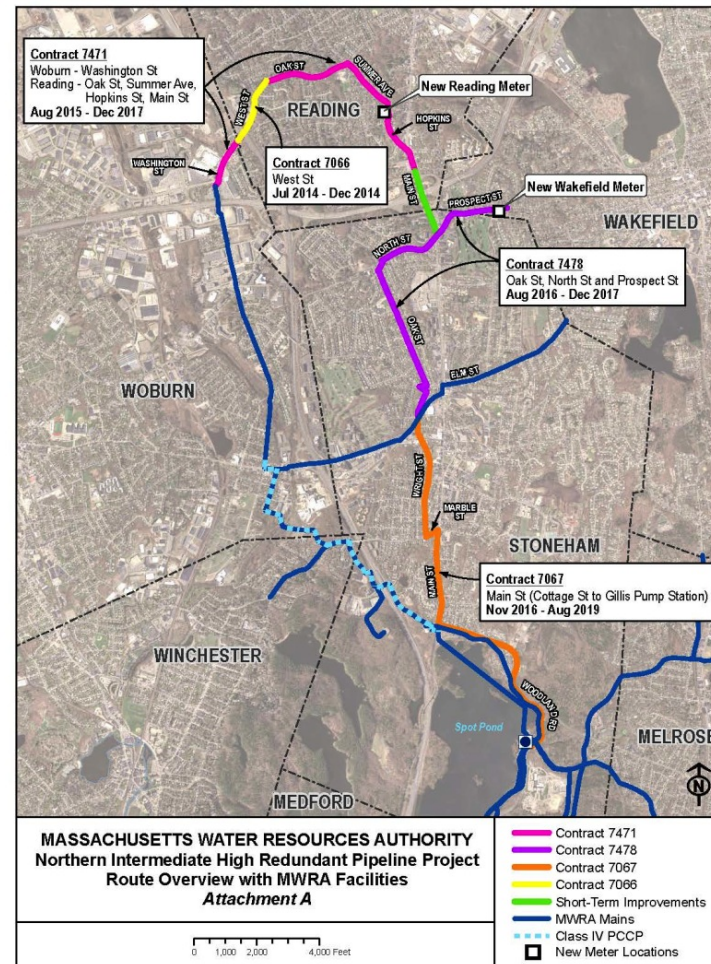
Total Contract:	\$10.4M
Fy14-18 Spending:	\$10.4M
FY16 Spending:	\$ 2.4M



Northern Intermediate High – Section 89 Redundant Pipeline

NTP: August 2015
SC : December 2017

Total Contract: \$20.2M
FY14-18 Spending: \$17.5M
FY16 Spending: \$ 4.4M





Deer Island Combined Heat and Power

Design

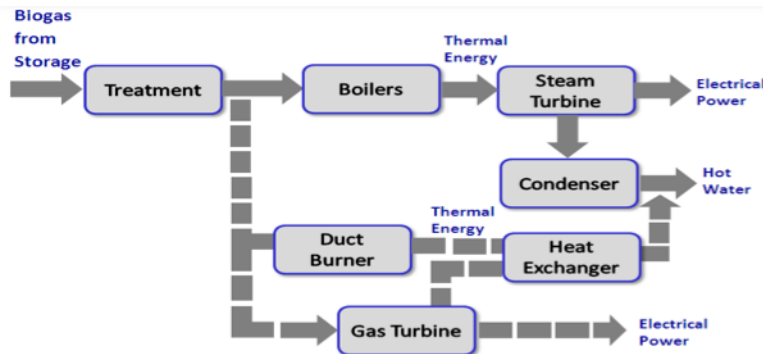
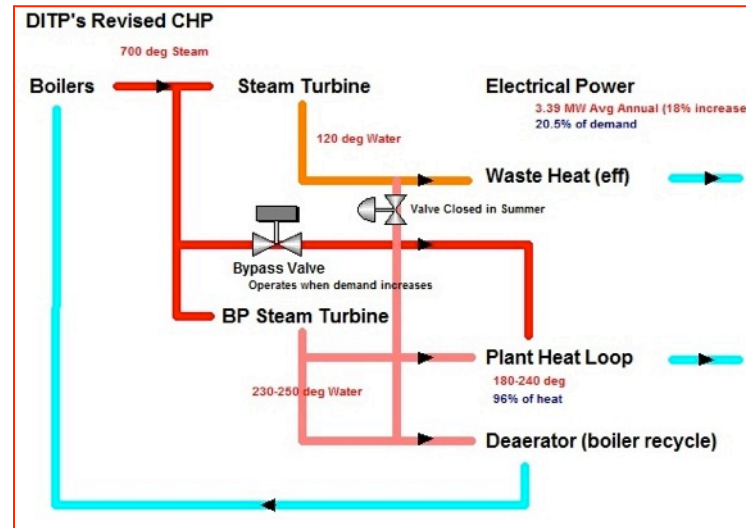
NTP: January 2016

SC : July 2022

Total Contract: \$6.0M

FY14-18 Spending: \$3.0M

FY16 Spending: \$0.1M



Construction

NTP: July 2018

SC : July 2022

Total Contract: \$83.0M

FY14-18 Spending: \$ 0.0M

FY16 Spending: \$ 0.0M



FY16 Proposed CIP Summary

Total CIP increased \$157.0 million over FY15 Final CIP.

4 Projects account for over \$106 million, or 68% of the increase.

Project	FY16 Proposed Increase	Effect on increase on FY14-18 Cap
Deer Island Treatment Plant Asset Protection	\$ 63.0	\$ 1.0
Central Monitoring System	18.6	1.7
Long-Term Redundancy	18.3	(0.1)
Northern High Service - Revere and Malden Pipe	<u>6.2</u>	<u>(1.6)</u>
	\$ 106.1	\$ 1.0



FY16 Projected Contract Awards (\$ in millions)

Project	Subphase	NTP	FY16 Proposed
Facility Asset Protection	Chelsea Creek Upgrade Construction	Dec-15	\$54.8
NIH Redundancy & Storage	Sec 89/29 Redundancy Construction Phase 1B	Aug-15	20.2
DI Treatment Plant Asset Protection	HVAC Equipment Replacement - Construction	Mar-16	17.1
Clinton Wastewater Treatment Plant	Phosphorus Reduction Construction	Feb-16	7.1
DI Treatment Plant Asset Protection	Sodium Bisulf & Hypochlorite Tank Rehabilitation	Mar-16	6.6
DI Treatment Plant Asset Protection	Combined Heat & Power Design	Jan-16	6.0
Carroll Water Treatment Plant	Existing Facilities Modifications - CP7	Jul-15	5.5
DI Treatment Plant Asset Protection	Ancillary Modifications - Final Design 4	Jan-16	4.3
Applications Improvements Program	Enterprise Content Management	Sep-15	4.0
Central Monitoring System	Quabbin Power Communications & Security	Oct-15	2.8
Top 10 Awards for FY16			\$128.4
45 Contract Awards Planned for FY16			\$166.5

The top ten awards account for over 77% of FY16 planned awards.



Future Risks/Uncertainties

- Co-Digestion Deer Island Receiving Facilities
- Fish Hatchery Pipeline/Hydro
- Sudbury Aqueduct – tunnel vs. surface pipeline;
- Residual Processing/Asset Management; and
- New regulatory mandates.





Massachusetts Water Resources Authority

***Report on Impacts From Nor'Easter Storm
of December 9/10th***

December 17, 2014



Antecedent Conditions

Previous Rainfall

October:	5.83-inches 3 rd wettest Oct. in 11 years
November:	5.27-inches 2 rd wettest Nov. In 11 years
December:	1.87-inches (prior to storm) 3.3 to 5.4 inches (12/09 storm)



Antecedent Conditions

Groundwater

Boston Groundwater Trust Data through December 2

127 GW wells at highest level ever

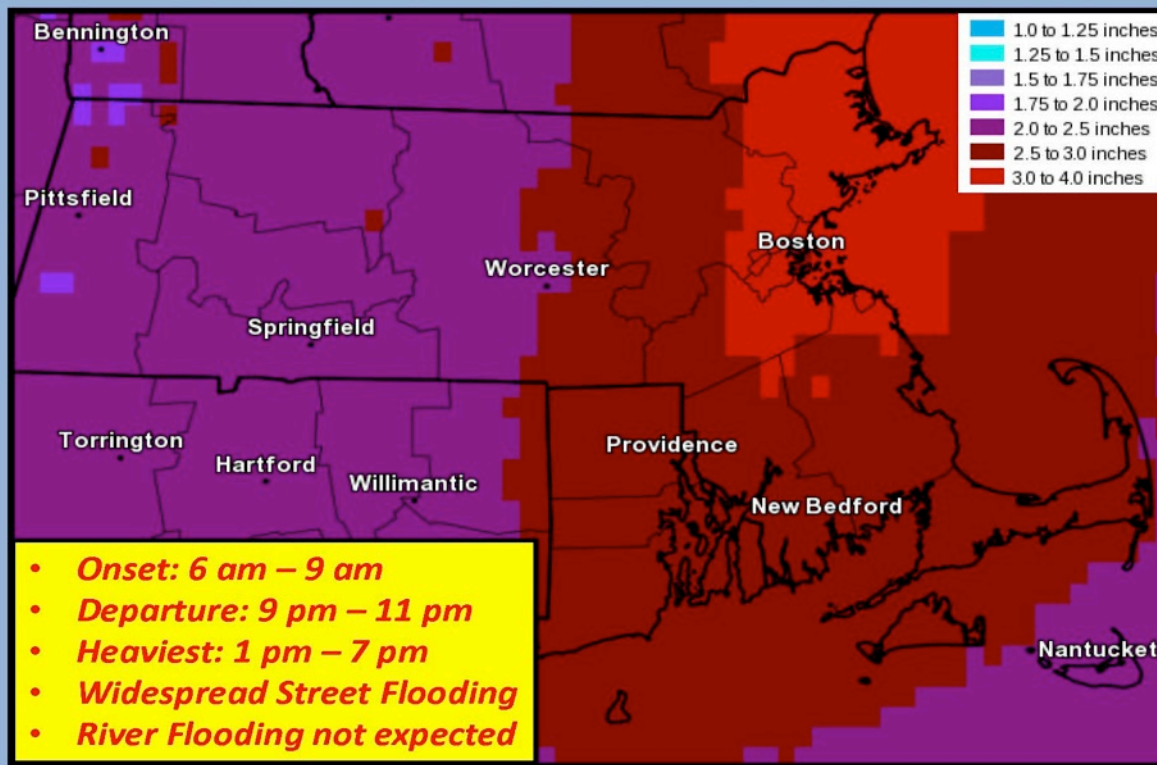
208 GW wells at highest level of the year

Ground surface frozen, increasing runoff

12.2 foot High Tide with storm surge



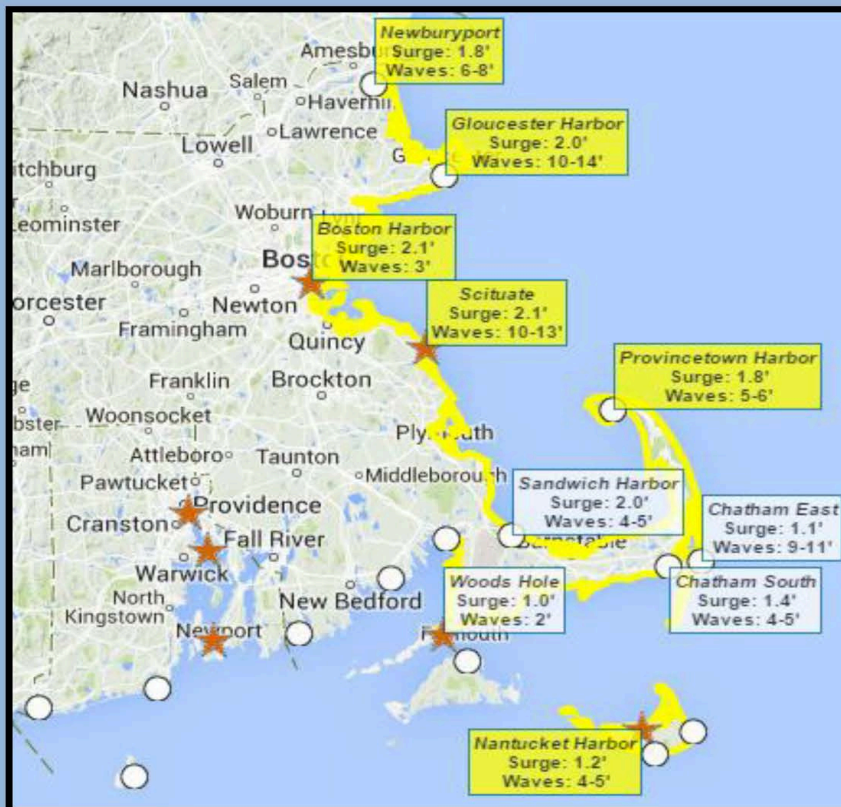
Heavy Rainfall



**National Weather Service
Boston, MA**



Coastal Flooding Potential



Coastal Flood Advisory

- **Impacts: Minor Coastal Flooding**
- **Where: Entire Eastern MA Coastline**
- **Storm Surge: 1.5 ft – 2.5 ft**
- **Timing: Tue 11 am – 3 pm**



Rainfall Totals Throughout the MWRA Service Area

December 9-11, 2014

Date	Braintree Weymouth	Chelsea Creek	Columbus Park	Framingham Pumping Station	Hanscom	Hayes Pumping Station	New Neponset Pumping Station	Ward Street
12/9/2014	3.67	4.38	4.04	3.11	3.17	4.09	4.85	3.78
12/10/2014	0.59	0.27	0.41	0.15	0.17	0.17	0.35	0.32
12/11/2014	0.00	0.04	0.02	0.05	0.19	0.10	0.02	0.04
Total	4.26	4.69	4.47	3.31	3.53	4.36	5.22	4.14

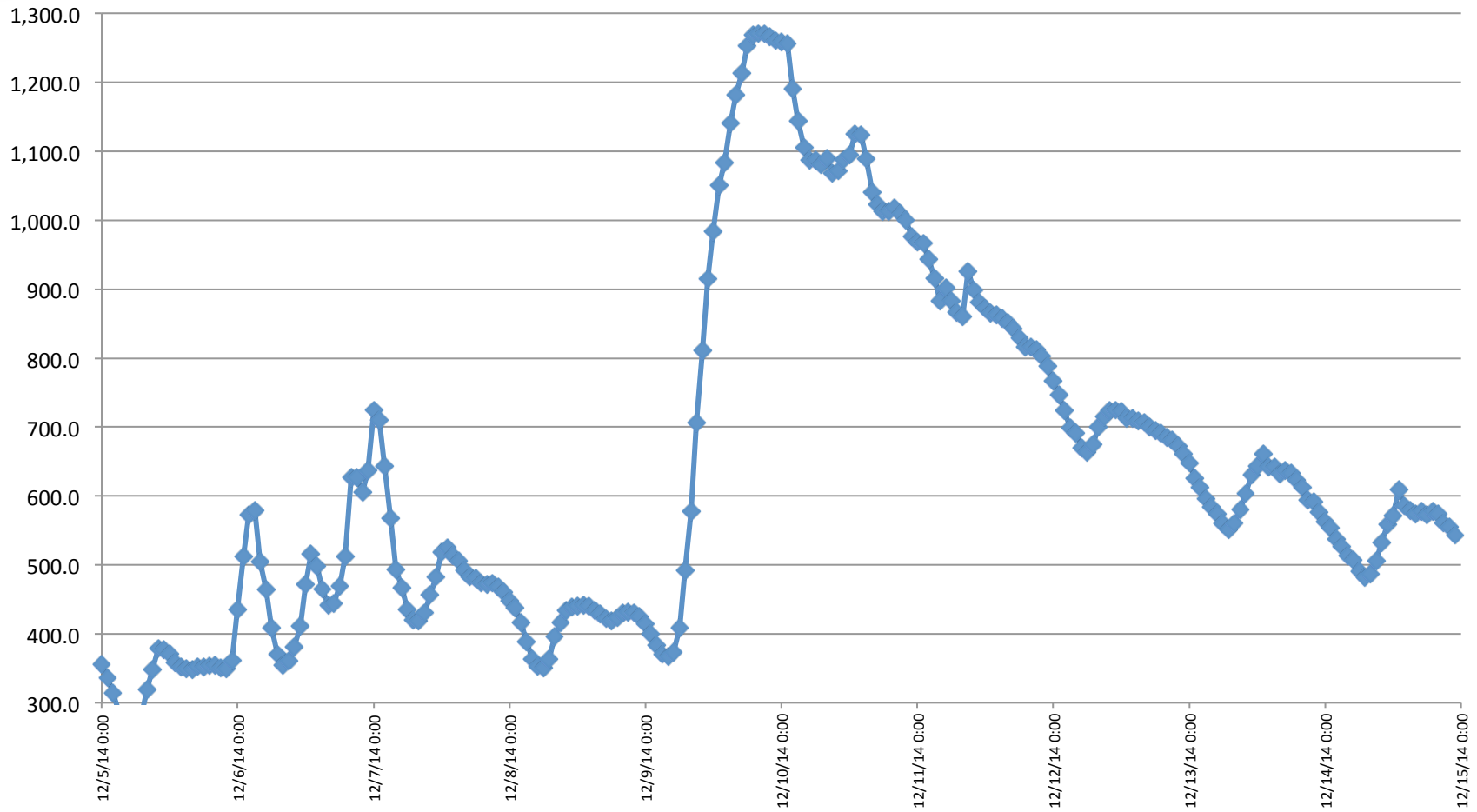


MWRA Sand Bagging the Green Line at Kenmore



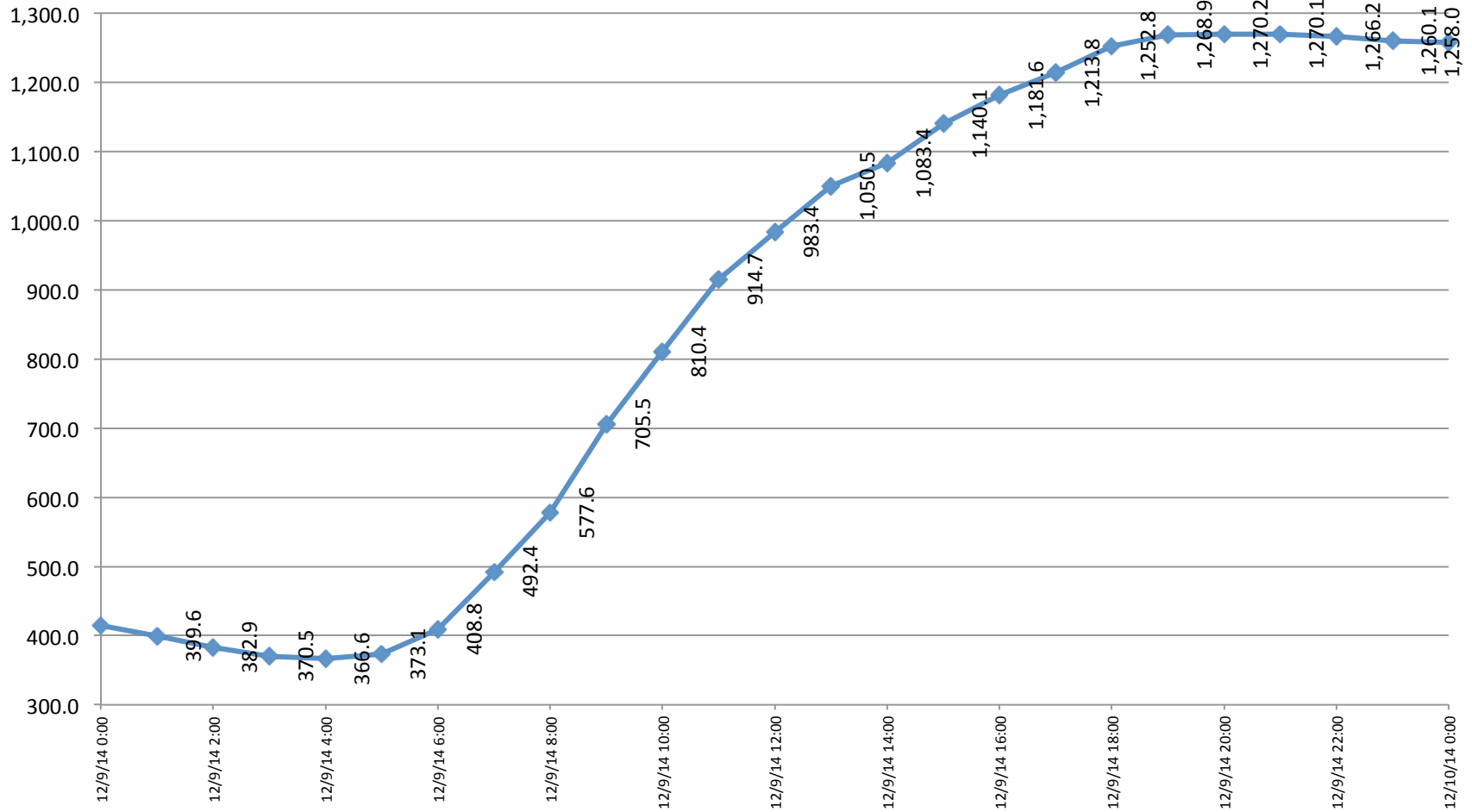


Deer Island Total Plant Flow MGD: Dec 5-Dec 15



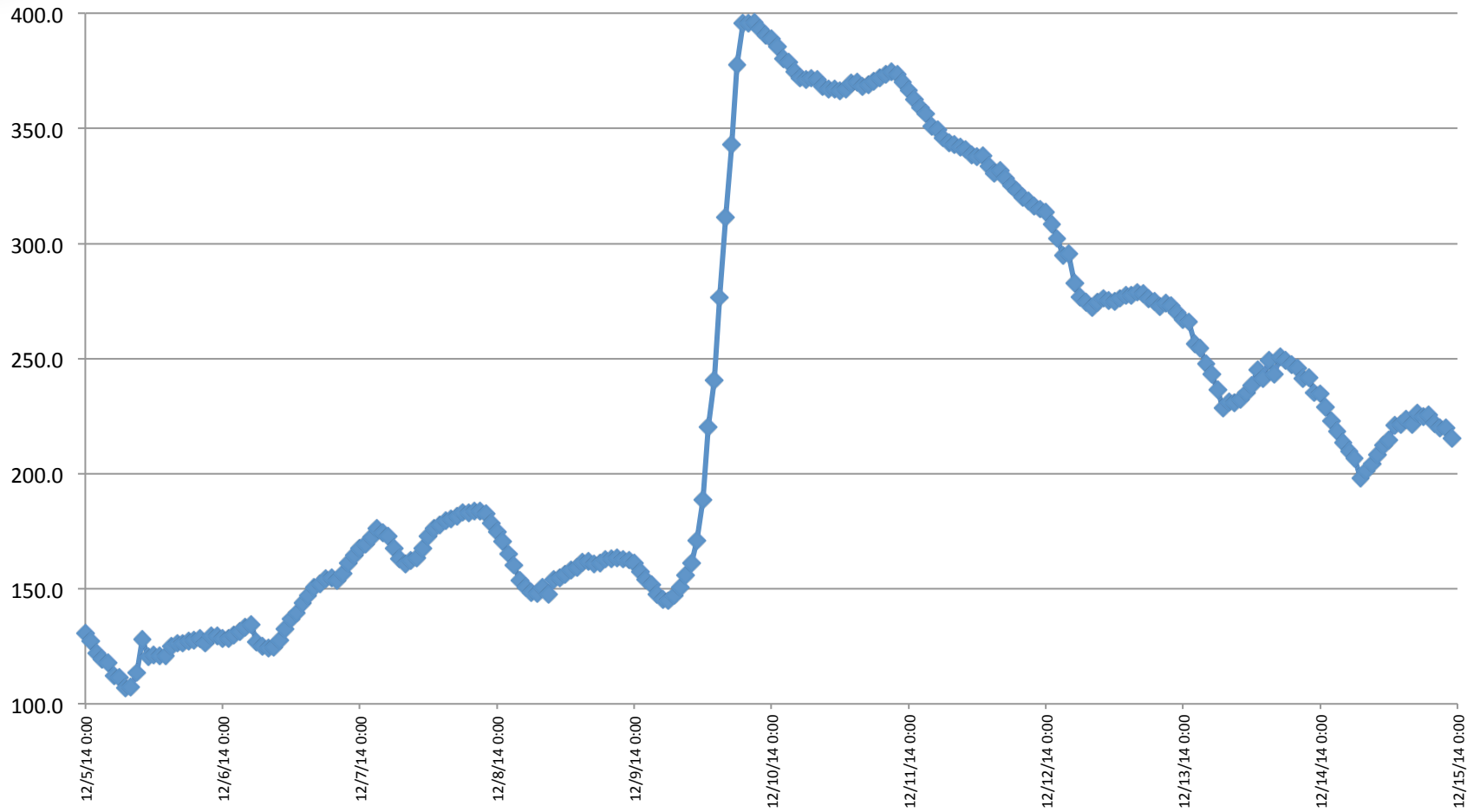


Deer Island Total Plant Flow MGD: Dec 9, 2014



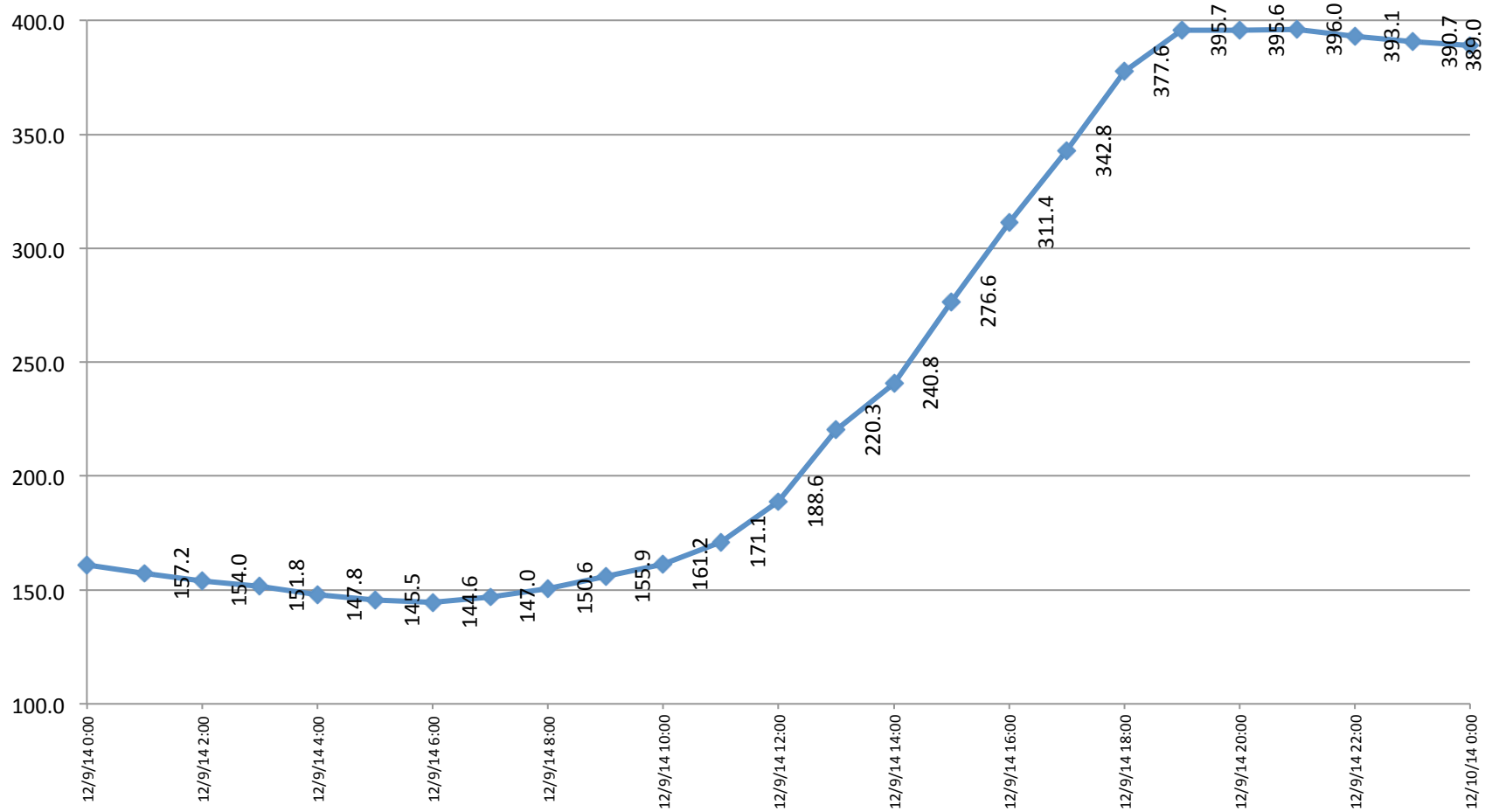


Total South System Flow MGD: Dec 5-Dec 15





Total South System Flow MGD: Dec 9, 2014





MWRA System Performance

Peak flow rate at Deer Island:	1.29 Billion Gallons per Day
Peak flow rate treated by CSO facilities:	871 MGD (Prison Point, Cottage Farm, Somerville Marginal and Union Park)
Total flow stored at CSO facilities:	18.2 MG
South Boston Tunnel:	storm water gates were closed after capturing First Flush (1MG) and rainfall was forecasted to exceed 4" in 24 hours, stormwater discharged to beach
All headworks reached hydraulic design capacity	
All MWRA pump stations reached capacity – except Hingham and Framingham	



MWRA System Performance

EOC staffed for 48 hours

Operations & Maintenance staffed over 48 hours

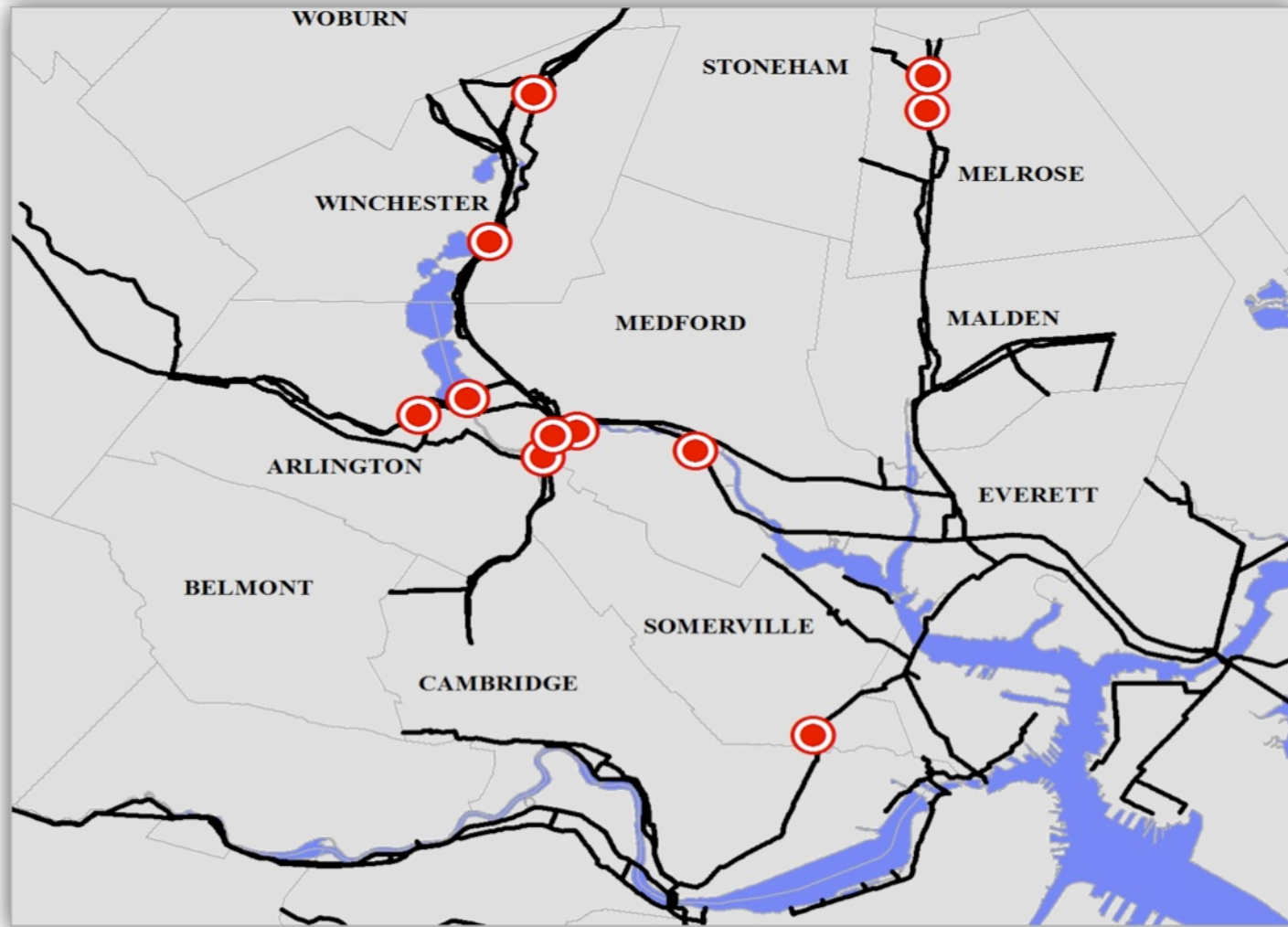
CSO facilities staffed for duration of storm

Field staff monitored interceptor levels

Both Deer Island CTGs placed in operation



North System SSO Locations During Dec. 9-10, 2014 Event





South System SSO Locations During Dec. 9-10, 2014 Event





Section 27, Manhole Structure, Somerville





Section 27, Manhole Structure, Somerville





Nor'Easter Summary

3.5 to 5.4-inches of rainfall

Saturated ground water conditions

All MWRA facilities operated as designed

Deer Island at max. capacity

All CSO facilities at max. capacity

SSOs occurred





Massachusetts Water Resources Authority

***6877 –VFD Additions Secondary Oxygen
Reactor Batteries A, B and C-
Deer Island Treatment Plant***

December 17, 2014



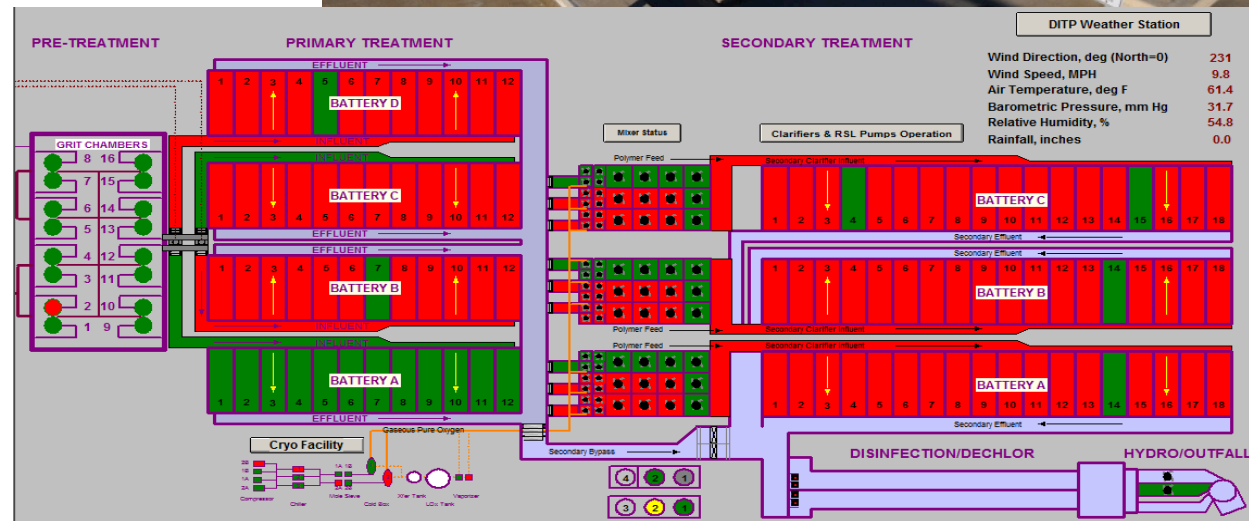
Contract 6877 Summary

- **Contractor:** Dagle Electric Construction Co.
- **Contract Price:** \$2,243,243
- **Contract Duration:** 540 days
- **Scope:** Furnish and install the following equipment:
 1. **Secondary Reactor Battery A mixers:** Six new 100 HP Variable Frequency Drives (VFDs) and replace six 100 HP motors
 2. **Secondary Reactor Battery B mixers:** Six new 100 HP VFD and replace six 100 HP motors
 3. **Secondary Reactor Battery C mixers:** Six new 100 HP VFD and replace six 100 HP motors
 4. **New environmentally controlled equipment room to place the new Secondary Reactor A and B equipment** (Secondary Reactor C equipment will be located in an existing electrical room)



Aerator System Background

- Mix pure oxygen into secondary reactor head space
- Mixers/aerators help dissolve oxygen into reactor liquid
- Oxygen assists in biological process to remove solids in secondary clarifiers
- 6 of 9 reactor trains operate 24/7
- Equipment has been in operation for approx. 18 years





Aerator System Background

- Three Reactor Batteries (A, B and C) each has three trains
- Each train has eight mechanical aerators.
- Aerators are driven by 50 to 150 HP motors
- Four of the eight motors in each train are two-speed; in addition one of the remaining four motors is controlled by a VFD based upon dissolved oxygen levels



Aerator System Improvements Scope

- This project will be installing VFDs on two of the 100 HP motors on each train (total of 18)
- VFDs control the speed of the motors based upon oxygen demand requirements
- Reduction of speed significantly reduces KW demand (approx \$300,000/yr energy saving)
- Payback is approx 7.2 years factoring in cost of money, O&M costs, etc.
- NStar providing approx. \$800,000 through MOU agreement to partially offset initial capital outlay.



Typical Reactor Mixer
Motor/Gearbox





Union Park Pump Station/CSO Facility







Massachusetts Water Resources Authority

Renewal of Water Continuation Agreements

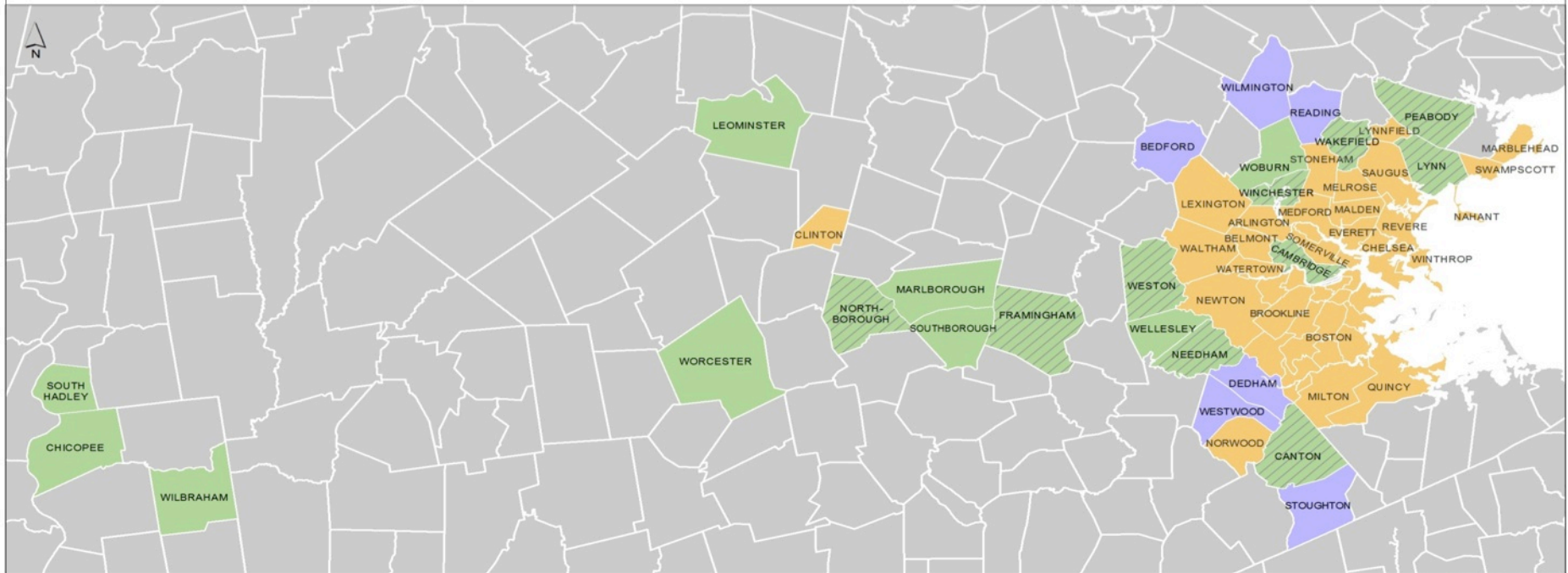
December 17, 2014



Water Supply Agreements: How We Got Here

MWRA Water Service Area

- Current Water Supply Agreement Renewals
- Communities Admitted into the MWRA
- Communities Joining MDC System Under Contracts
- MWRA Fully Served Communities Joining Pursuant to Acts of 1895 and 1943 (10-mile radius extended to 15-miles) and Special Acts





Contract Renewal Process

- A Regulation, *Continuation of Contract Water Supply*, prescribes process.
- A Supplementary Report is prepared for each community, and is basis of new Water Supply Agreement. Report includes:
 - Demand Analysis
 - Supply Analysis
 - Water Management Plan
 - Rates Info



Projections/Community Requests Incorporated into Contracts

Demand			
Community	Existing Contract Annual Maximum Withdrawal	Proposed Contract Annual Maximum Withdrawal	
		2015	2024
Cambridge	0 in typical year	0 in typical year	0 in typical year
Canton	700	355	460
Framingham - Scenario 1	3,172	2,416	2,836
Framingham - Scenario 2		2,416	1,679
LWSC	330	300	285
Needham	165	400	420
Northborough	353 (2005) 127 (2014)	325	342
Peabody	445	439	524
Weston	718	718	718
Winchester	610	610	610



Supplementary Report Looks Forward and Back

- Some Partials are increasing MWRA demand
 - Peabody, Needham, Northborough
- Some Partials decreasing MWRA demand
 - Canton
- More or less Status-Quo
 - Cambridge, LWSC, Weston Winchester
- Framingham ????



Contract Provisions

- Limits on MWRA withdrawals: provision to increase limits upon notification to MWRA in emergencies or unusual circumstances.
- Formal amendments by petition.
- Obligations of Communities:
 - Water Conservation (metering, leak detection, public info)
 - Contingency/Emergency Response Plans
 - Protection of Local Sources
 - Conservation based rates