



Massachusetts Water Resources Authority

CSO Post-Construction Monitoring and Performance Assessment

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**Wastewater Advisory Committee
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CSO Post Construction Monitoring and Performance Assessment

MWRA has completed the first year of its three-year effort to verify attainment of the levels of CSO control in the Long-Term Control Plan.

Completed and ongoing work includes:

- Field inspections of CSO regulators
- Collection and analysis of rainfall data
- Collection and verification of overflow data at active regulators (increased the number of meter locations from 33 to 57 regulators)
- Quantification and validation of CSO discharge from the meter data
- Collection and evaluation of CSO facility and other operational data
- Update and calibration of the hydraulic model – now underway
- Evaluation of overflow condition in response to meter results – now underway



CSO Community Interaction

MWRA regularly coordinates with the CSO communities

- Held Kickoff meetings to discuss the MWRA Assessment Program
Requested information including (record drawings, regulator structure details, confirmation of regulator status [open or closed])

- Reviewed community installed metering equipment
 - Did the existing equipment meet the CSO program needs?
ADS replaced or supplemented equipment at CAM001, CAM002, SOM01A and CHE008

- Collecting community meter data monthly

- Integrating portions of the BWSC and Cambridge hydraulic models into the MWRA's updated hydraulic model

- Sharing verified meter activation results

- Meeting with the communities on the results presented in the Semiannual Report No. 1 and coordinate response to measured discharges



Regulator/System Inspections

What has been completed?

Inspections at 153 active and closed CSO regulators

How is the information for the inspection being used?

- Confirm CSO elimination or conversion to storm drain at 40 outfalls
- Design the metering program and installation
- Measure sediment depth in the structures (MWRA measured the sediment depths in the interceptors)
- Update the MWRA hydraulic model

What is being done now?

- AECOM is identifying additional inspection information needed for the model, including verification of hydraulic control measurements



RE106 closed regulator structure



Regulator Inspection

Regulator Inspections *Open Regulator*



Inspection of RE046-192 finds the regulator is open

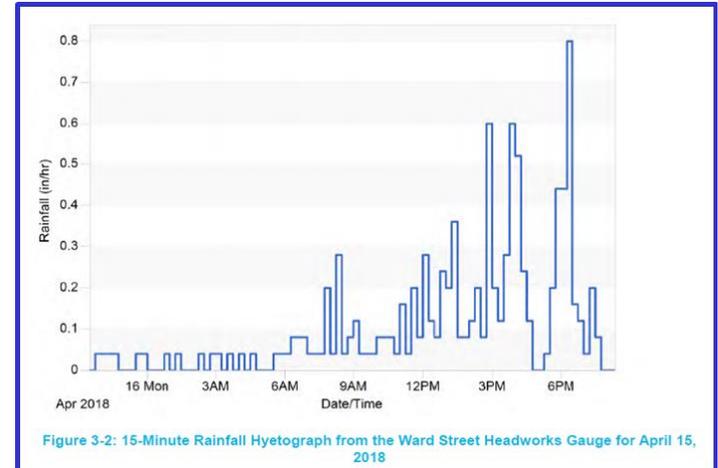




Rainfall Data

How is the rainfall data being used?

- Characterizing each storm for duration, total precipitation, average hourly intensity, peak hour intensity and storm recurrence interval
 - Compare storms to Typical Year
 - Understand the rainfall characteristics that contribute to CSO discharges



There were many more storms in 2018 than on average.

Twenty-three (23) rainfall events were measured in the period April 15 through June 30, 2018.

- Storm durations ranged from 0.25 to 25.5 hours
- Volume ranged from 0.01 to 2.43 inches
- Peak intensity was 0.68 in/hr

Most rainfall events were less than a 3-month storm, but several had high 15-minute intensities.

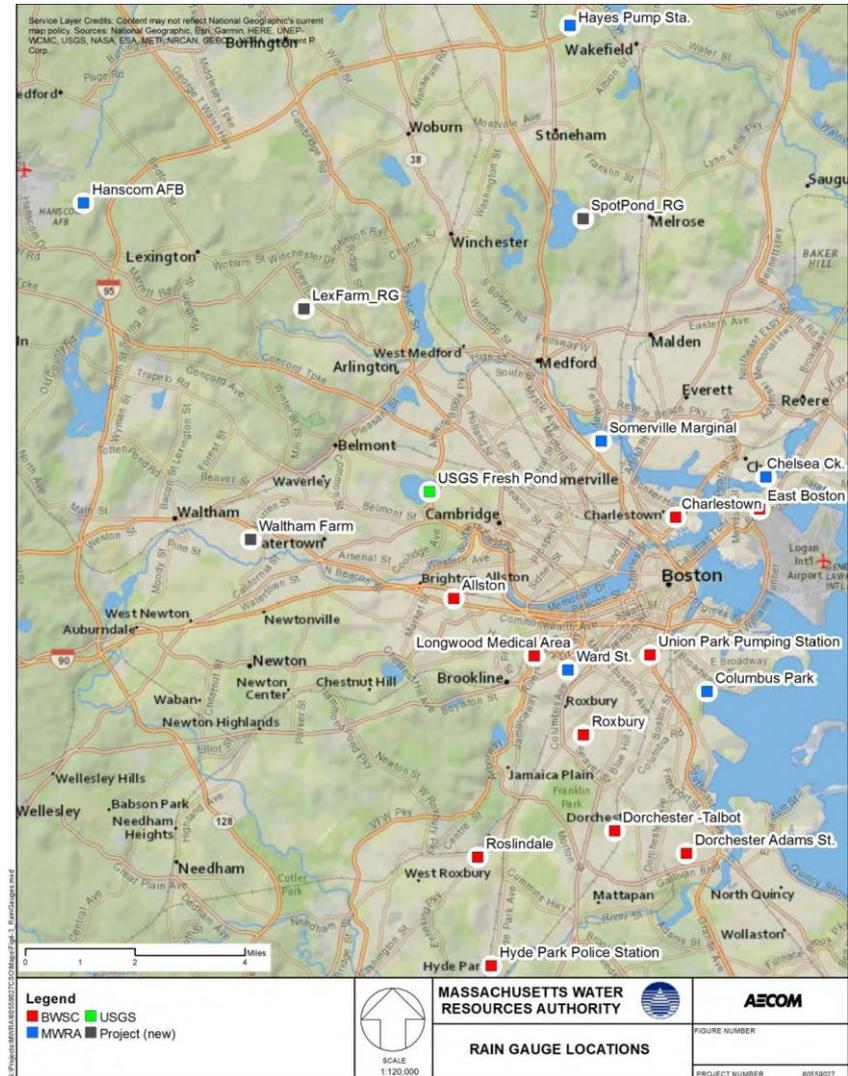
For 1-hour intensity, all storms fell within Typical Year characteristics.



Rainfall Data

How is the rainfall data being used (cont'd.)?

- Confirm metered CSO discharges (correlate measured discharges against rainfall)
- Investigate the impacts of short duration (<1 hour) peak intensities
- Conduct hydraulic model simulations (rainfall is an input) and model calibration





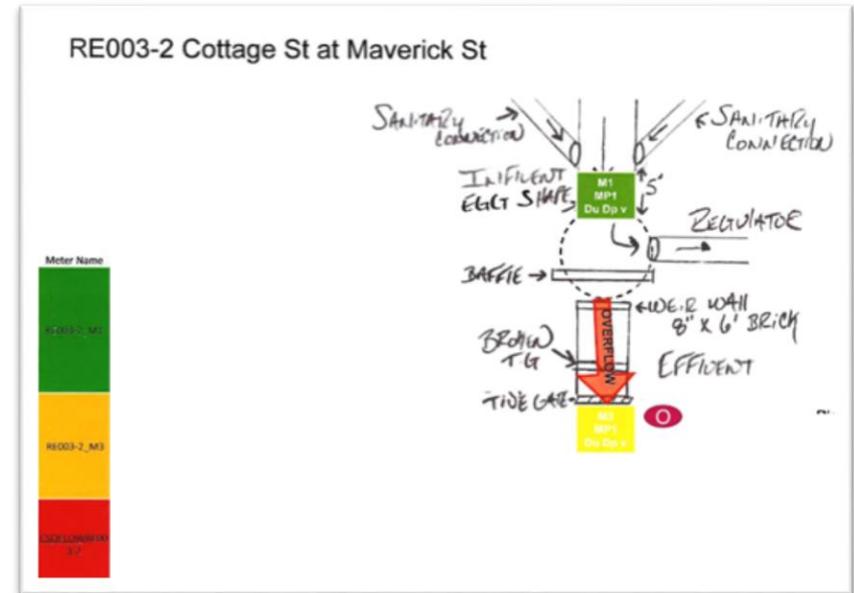
CSO Metering Program

Temporary CSO Meter Data

- Installed and collecting data since April 15, 2018
- Eighty (80) meters covering all 57 active CSO regulators are collecting data from 146 sensors, including flow sensors, level sensors and tide gate inclinometers.

Permanent Meter Data

- Thirty-two (32) interceptor meters in the combined sewer system
- MWRA CSO facilities, pumping stations and CSO storage facilities
- MWRA untreated outfalls MWR003 Alewife Brook, MWR205A (Upper Mystic River), and MWR018, MWR019 and MWR020 (Charles River Basin/Esplanade)
- Community CSO meters at 26 regulators maintained by BWSC, Cambridge, Chelsea and Somerville.





CSO Metering Program

Purpose:

Outfall	Regulator	ADS Meter Name	Description of Meter Location	Purpose of Meters			
				To identify if overflow activation occurred and for model calibration	For model calibration only	For calculating CSO volumes and model calibration	Trigger Meter ⁽¹⁾
Alewife Brook							
CAM001	RE011	RE011_M1	Influent Line #1	X			Yes
		RE011_M1(2)	DS of DWF Connection		X		
CAM002	RE021	RE021_M1	Cambridge Meter	X			Yes
		RE021_M1(2)	Cambridge Meter		X		
MWR003	RE-031	RE031_M1	Influent Line #1	X			Yes
		RE031_M2	Influent Line #2		X		
		RE031_M2(2)	Influent Line #3		X		
		RE031_M3	Overflow Line (DS of weir)+Inclinometer			X	
CAM401A	RE-401	RE401a_M1	Influent Line #1	X			Yes
		RE401_M3	DWF Line - Cambridge Owned		X		
CAM401B	RE-401B	RE401b_M3	Overflow line			X	N/A ⁽²⁾
CAM001A	RE-011A	RE011a_M1	Influent Line #1	X			Yes

1. Identify active or relatively inactive CSO outfalls
2. Calibrate the hydraulic model and verify model predictions
3. Quantify CSO discharges (duration and volume in each storm)
4. Improve the understanding of how rainfall conditions and system conditions contribute to CSO discharges



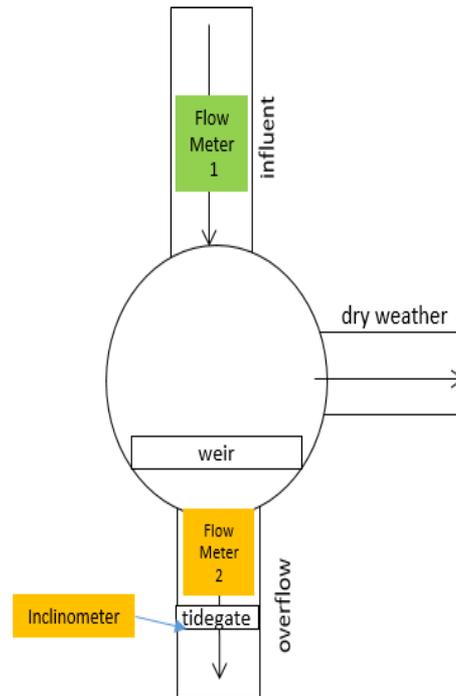
Temporary Metering

Temporary meters have been installed such that either permanent or temporary meters are collecting data at all 57 active regulators.

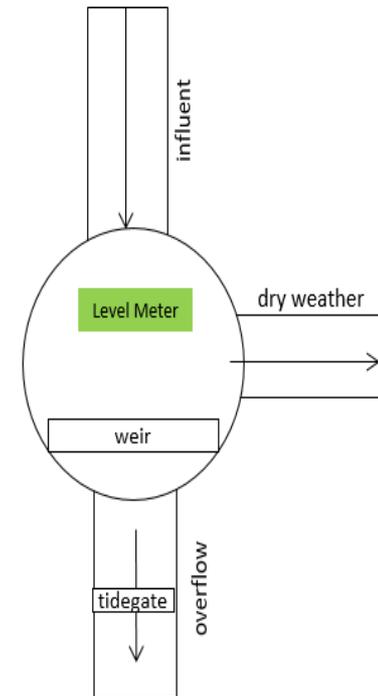
Each site is unique and is covered by one or more of the following:

- 81 meters
- 106 flow sensors
- 20 level sensors
- 16 tide gate inclinometers

Data is collected in 5-minute intervals and uploaded to the online database every 2 hours.



Typical Flow Measurement Setup



Typical Level Measurement Setup



CSO Metering Program

Field activities related to CSO metering include:

1. Site investigations (determine equipment type and placement)
2. Installation of the metering equipment
3. Calibration after installation (with direct measure or use of calibrated hand held equipment)
4. Checks on measurement and data transfer conditions; investigations into questionable data
5. Maintenance (clean sensors, replace battery)
6. Verify results/check calibration (direct measure or compare to other local meters)

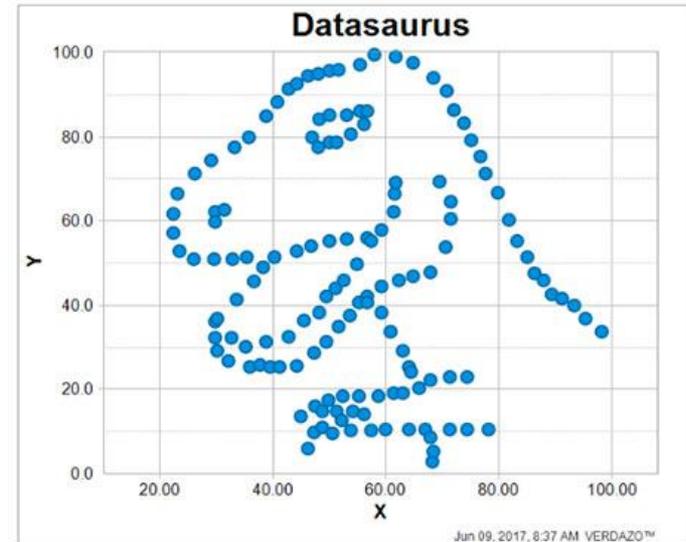




CSO Metering Program

Office activities related to CSO metering include:

1. Review of the meter data (verified by field staff)
2. Correlation to system conditions (CSO facility, headworks, interceptor capacity, other operations data)
3. Evaluation of overflow contributing factors (time since last rain, groundwater level)
4. Correlation to rainfall - scattergraphs plotting rain intensity/rainfall total against meter activity
 - Useful for determining if the meter data/CSO discharge makes sense





Meter Data Review

Collected Apr 15-Jun 30, 2018

Not consistent with historical model estimates

Outfalls where meter shows regulator activity not predicted by model:

- MWR023 (Charles River)
- BOS070 (Fort Point Channel)

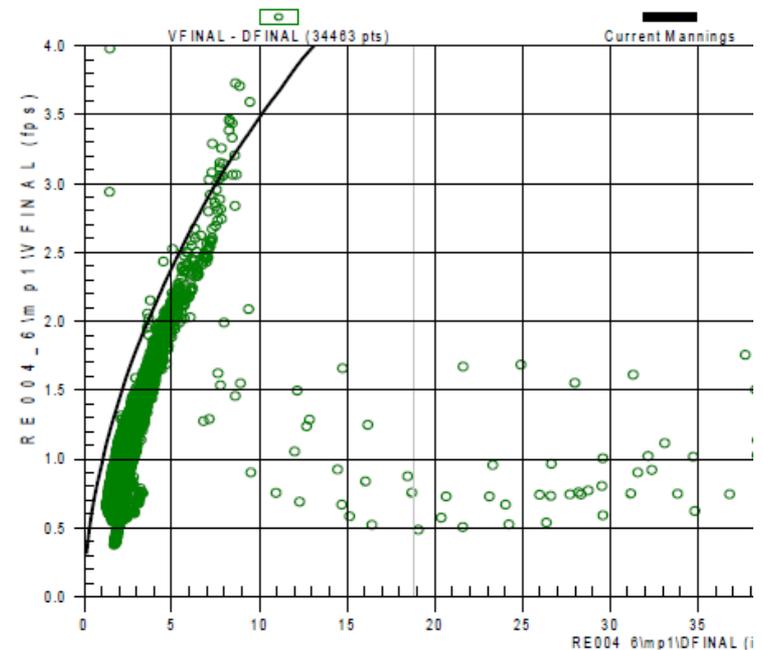
Outfalls where discharges vary from historical predictions:

- CAM005 (Charles River)
- SOM01A (Alewife Brook)
- CHE008 (Chelsea Creek)

Unreasonable Data

Where the data doesn't make sense.

- CAM001 (Alewife Brook)





Removal of Meters

Meter Removal Criteria

- Meters may be removed where used only for model calibration, once it is assessed that sufficient data have been obtained to calibrate the model.
- Meters may be removed where the meters show lack of overflow activity.
- *Meters may be removed where model predictions are consistent with the meter data across a range of storm characteristics (model predictions are verified and reliable).*

Locations where meters are being investigated for potential removal

Outfall	Regulator	Type of Install
MWR003	RE031	Full Meter Installation
BOS079	RE079-3	Level Only
MWR023	RE046-30	Full Meter Installation
MWR023	RE046-50	Level Only
MWR023	RE046-62A	Level Only
MWR023	RE046-192	Level Only



Model

Current modeling activities

- Model is being updated to incorporate field inspections (regulator inspections and sediment depths)
- Model calibration has begun - will use meter data for a minimum of three storm events covering a range of rainfall characteristics

Planned model uses

- Verify model predictions against validated meter data and field-measured discharges
- Perform storm simulations (all storms)
- Gain confidence in the MWRA's hydraulic model to verify achievement of the Long-Term Control Plans Typical Year levels of control by December 2020



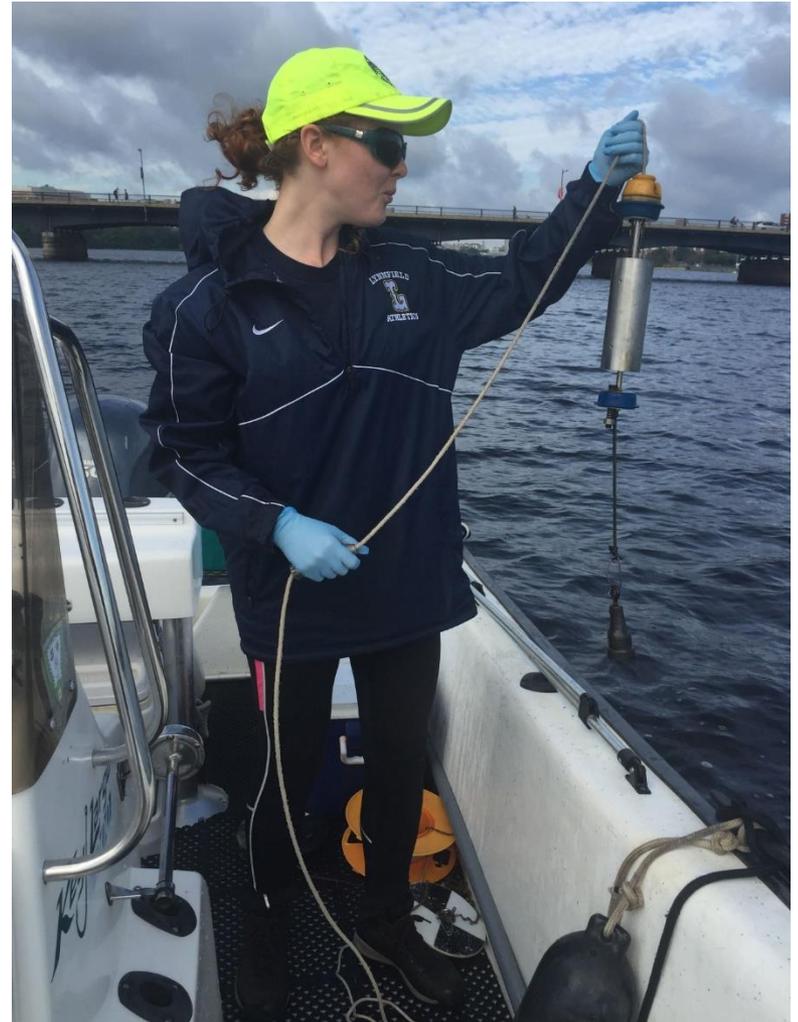


Receiving Water Quality Assessments

MWRA staff will continue to collect and test receiving water samples, with focus on the Charles and Alewife/Upper Mystic.

MWRA submitted its Draft Receiving Water Quality Assessment Plan to EPA and DEP on July 30, 2018.

MWRA is in discussions regarding EPA and DEP concerns with MWRA's WQ assessment approach.





Progress Toward The Second Semiannual Report - April 2019

Activities underway/planned to be conducted over the next several months:

- Continue to collect and analyze data from rainfall gauges and meters
- Continue to quantify and validate CSO discharges from the meter data
- Selectively remove temporary meters where sufficient data has been collected
- Update and calibrate the hydraulic model
- Continue to conduct receiving water quality monitoring in waters affected by CSO, with a focus on the storm impacts and recovery times in the variance waters (Charles River and Alewife Brook/Upper Mystic River).





MWRA CSO Performance Assessment



QUESTIONS?