



Massachusetts Water Resources Authority

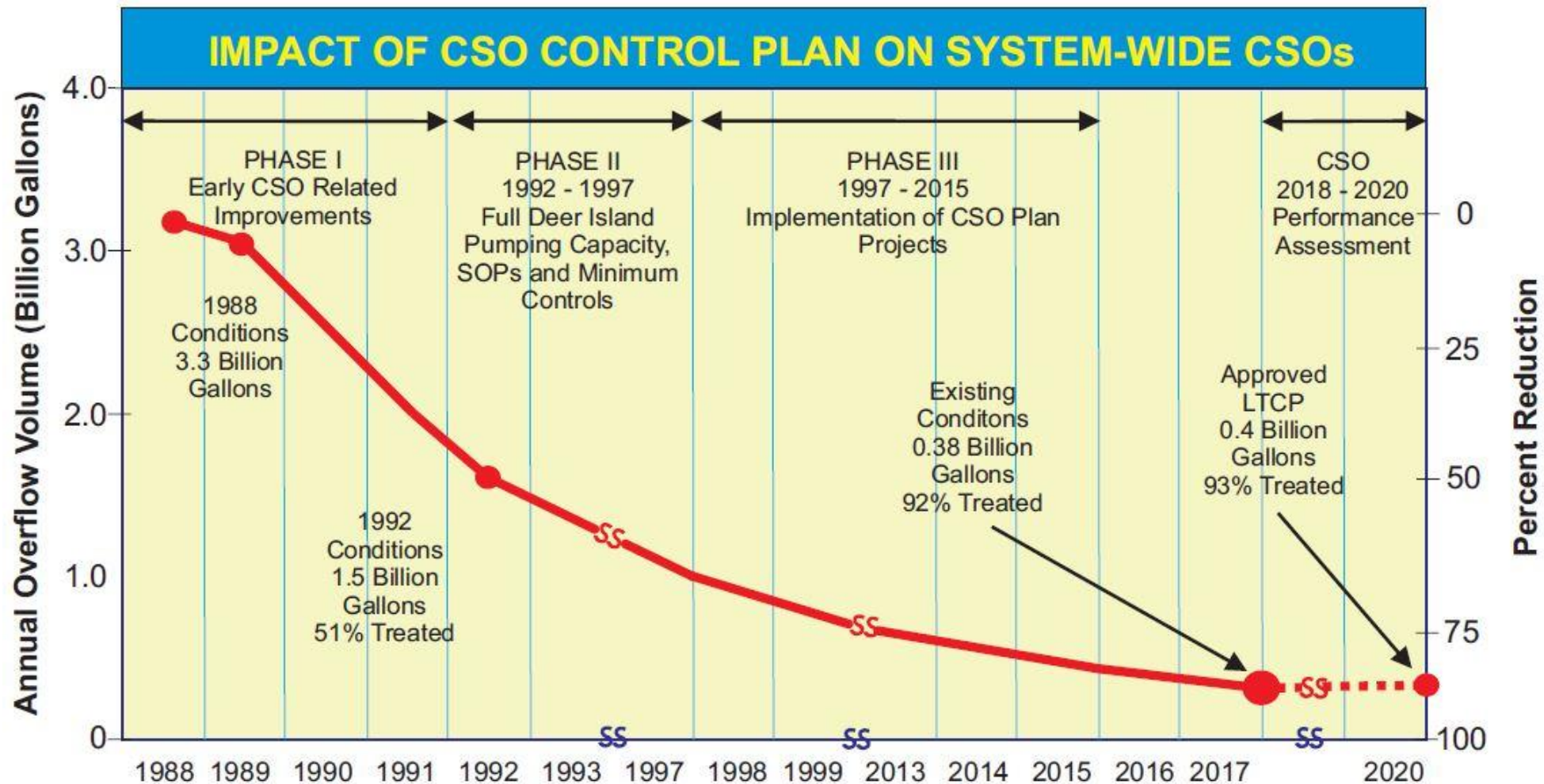
CSO Post-Construction Monitoring and Performance Assessment

**Public Briefing
May 31, 2019**



MWRA's Phased Approach to CSO Control

CSO Reduction 1988 to 2020





MWRA's CSO Control Plan

MWRA's Long-Term CSO Control Plan (LTCP) addressed discharges from 84 CSO outfalls to 14 receiving water segments in Boston Harbor and the Charles, Mystic and Neponset watersheds.

The LTCP includes 35 projects to bring CSOs into compliance with the Clean Water Act.

As of December 2015, the 35 projects were complete and operational.





Federal Court Compliance

182 CSO-related federal court milestones achieved thru Dec 2015

Completion of the last construction project in Boston Harbor Case in December 2015



Post-Construction Federal Court Milestones

- Jan 2018: Commence CSO post-construction monitoring and Performance assessment. Conduct in accordance with EPA's Combined Sewer Overflow (CSO) Policy.
- Dec 2020: Submit results of performance assessment to EPA and DEP demonstrating compliance with the levels of control, including frequency of CSO activation and volume of discharge specified in the Long-Term CSO Control Plan.



Federal Court Requirements for CSO Control

Close 27 of the 84 CSO outfalls.

- ✓ **All 27 outfalls – and 8 additional outfalls – are closed.**

Provide 25-year storm control at the 5 remaining outfalls along the South Boston beaches.

- ✓ **The South Boston CSO storage tunnel provides 5-year storm control for separate stormwater and 25-year storm control for CSO.**

Reduce annual (Typical Year) discharge frequency and volume to court-mandated levels at each of the 44 outfalls that remain active.

- ✓ **MWRA's CSO plan is fully implemented. An ongoing performance assessment (2018-2020) is intended to verify compliance through overflow metering and updated hydraulic modeling.**



SOM002 Weir Closed



Water Quality Standards and Required Levels of CSO Control

Water Quality Standards Classification	Receiving Water Segment	Required Level of CSO Control	CSO Control Status
Class B	Neponset River	CSO prohibited (25-year storm control for the South Boston beaches)	South Boston (North Dorchester Bay) storage tunnel captures CSO up to 25-year storm. All CSO outfalls to the other sensitive waters are now permanently closed.
Class SB	North Dorchester Bay South Dorchester Bay Constitution Beach		
Class B(cso)	Back Bay Fens	>95% compliance with Class B or SB ("fishable/swimmable")	All LTCP projects are complete and CSO discharges are greatly reduced. The ongoing performance assessment is intended to verify whether LTCP levels of control are attained.
Class SB(cso)	Mystic/Chelsea Confluence Boston Inner Harbor Fort Point Channel Reserved Channel	Must meet level of control for CSO activation and frequency in the approved Long-Term Control Plan (LTCP)	
Class B (CSO Variance)	Alewife Brook Upper Mystic River Charles River	Class B standards sustained with temporary authorizations for CSO discharges as the LTCP is implemented and verified (1998-2020)	All LTCP projects are complete and CSO discharges are greatly reduced. The ongoing performance assessment is intended to verify whether LTCP levels of control are attained and to support long-term WQS designations.



Ongoing CSO Post-Construction Monitoring and Performance Assessment (Contract 7572)

- Evaluate CSO activations and volumes relative to the Long Term Control Plan.
- Evaluate impacts of remaining CSO discharge..

Massachusetts Water Resources Authority



Combined Sewer Overflow Control Plan

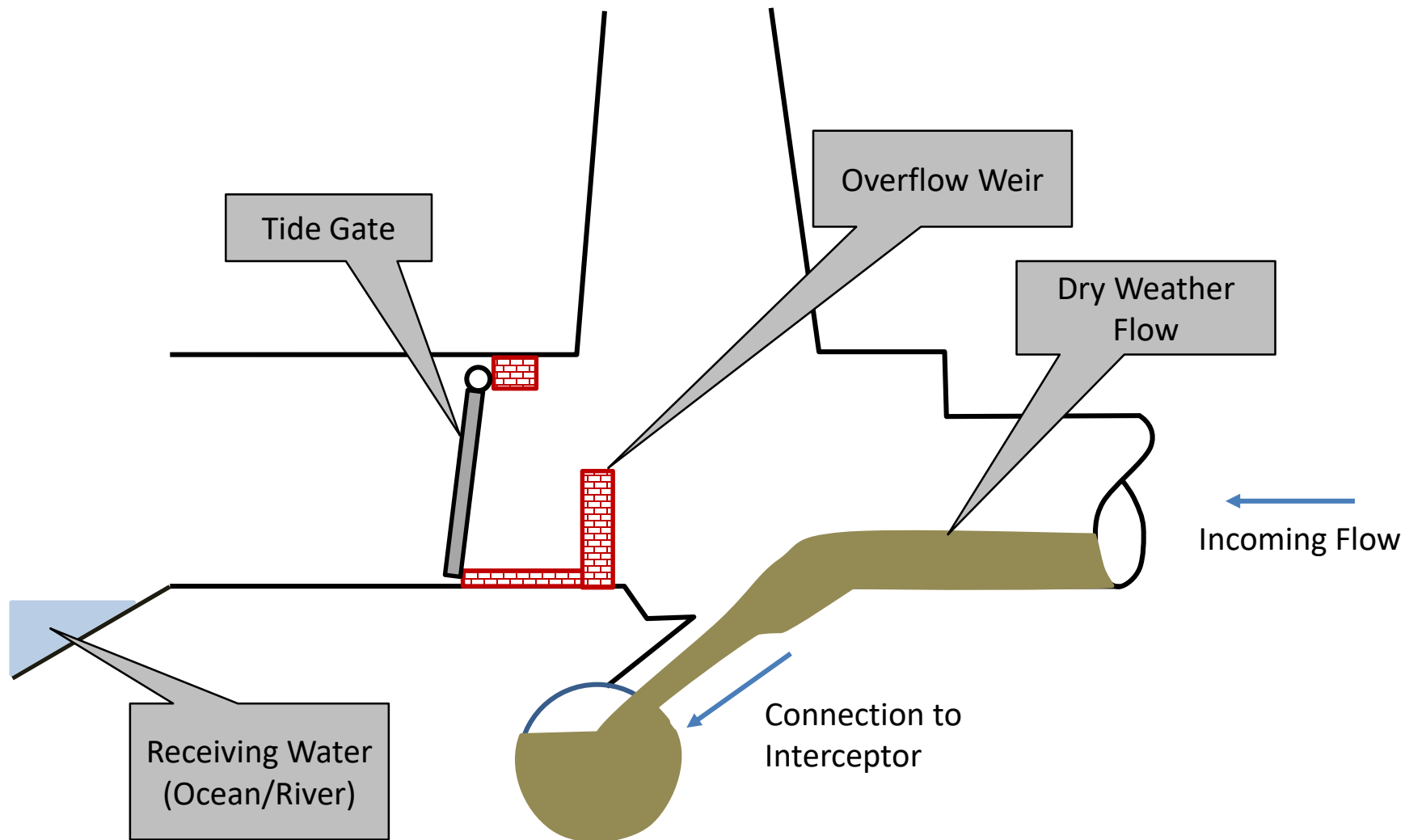
CSO Post Construction Compliance Monitoring Program Scope of Work



May 1, 2017

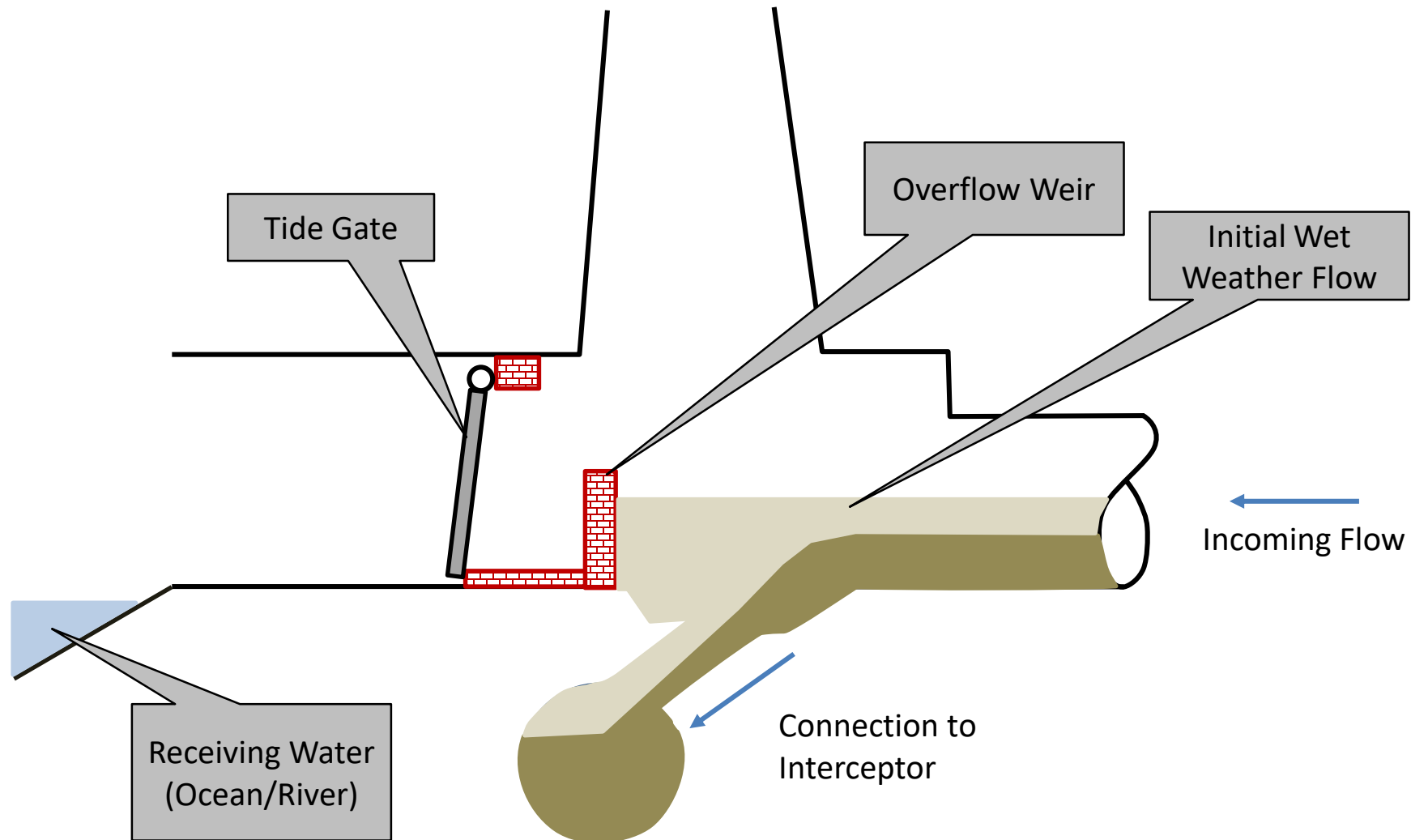


Dry Weather – All Incoming Flow Diverted to Interceptor



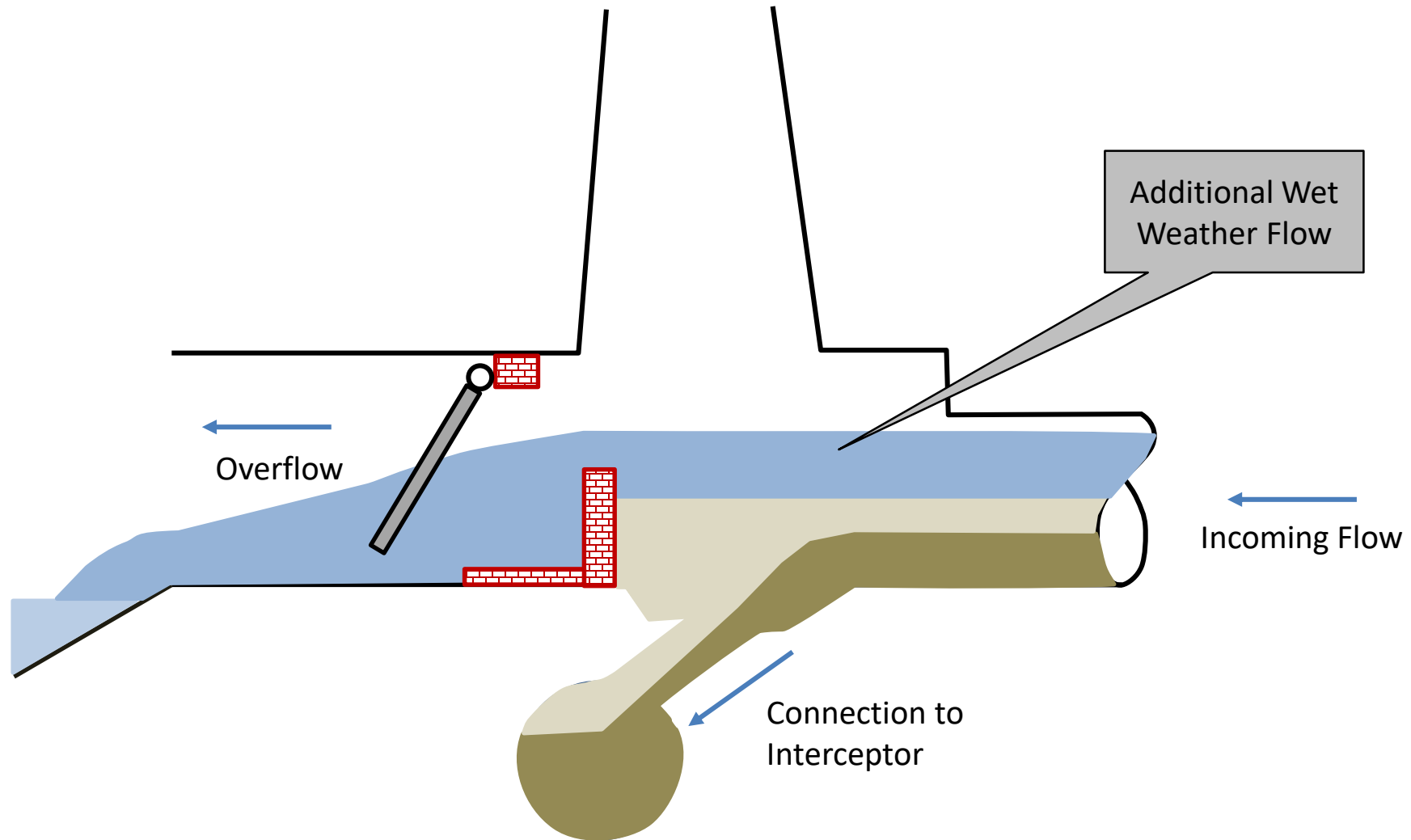


Start of Wet Weather Flow – All Incoming Flow Diverted to Interceptor, Weir Prevents Overflow



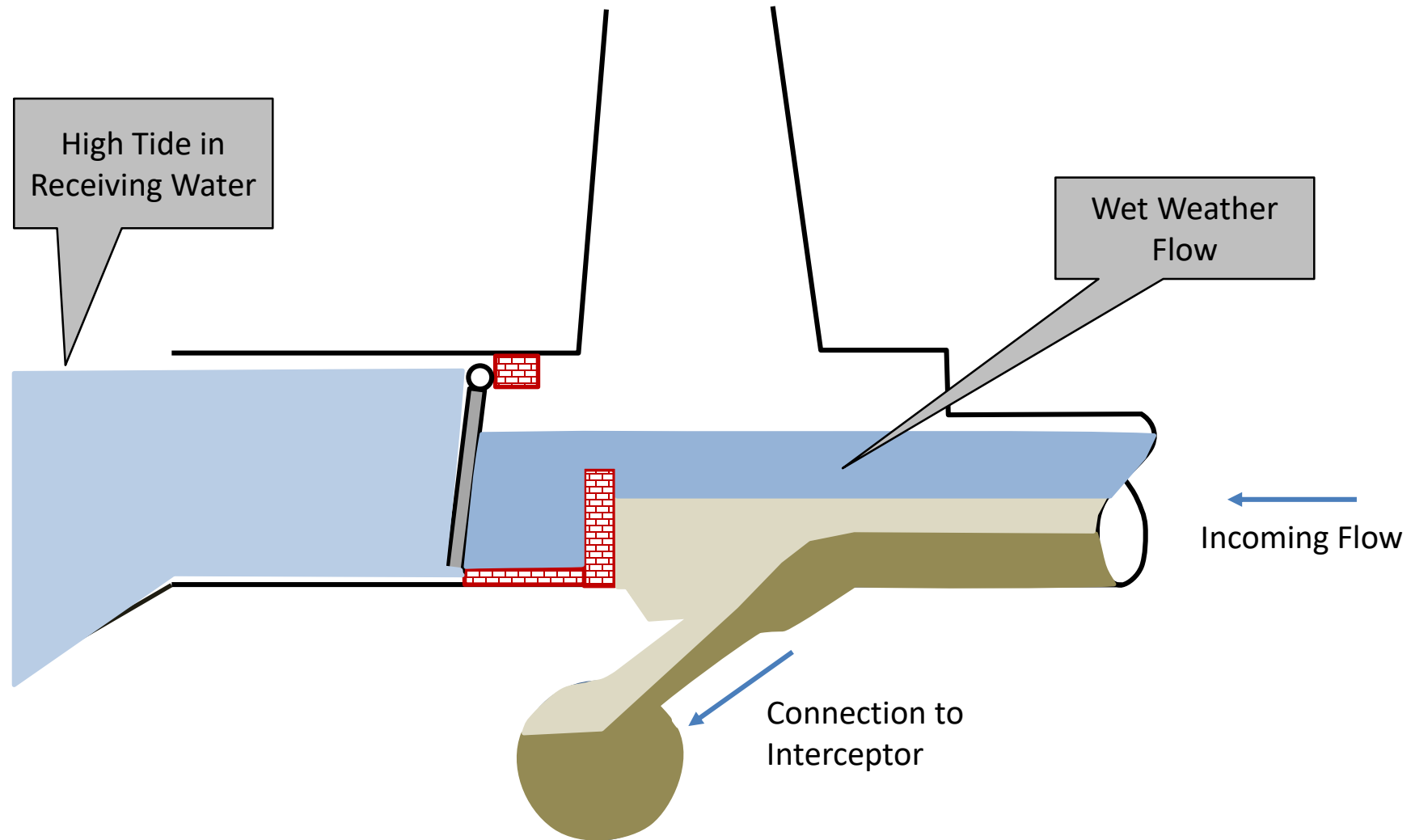


Additional Wet Weather Flow – Water Level Exceeds Weir, Tide Gate Opens, Overflow Occurs



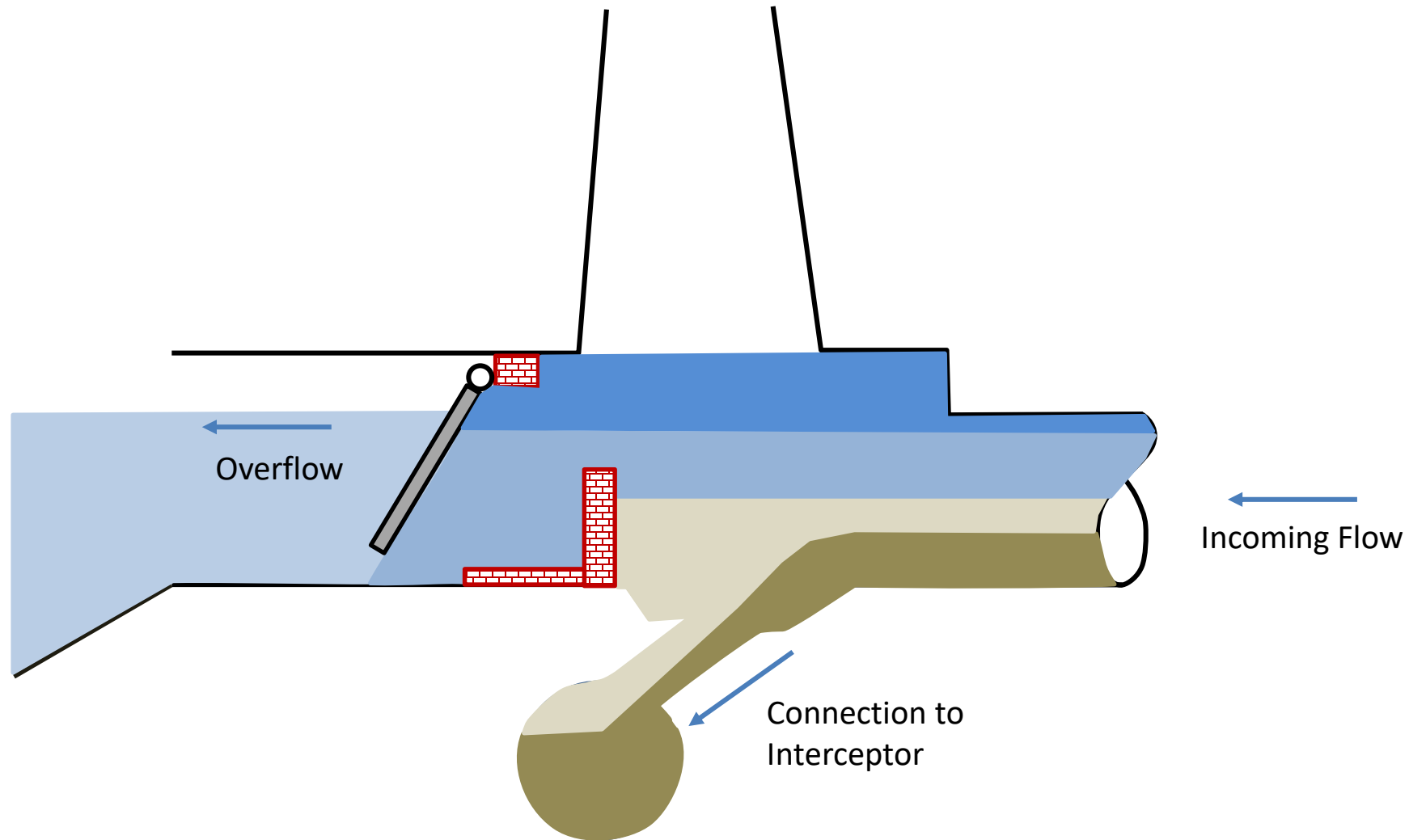


Wet Weather Flow at High Tide – Tide Level Prevents Discharge





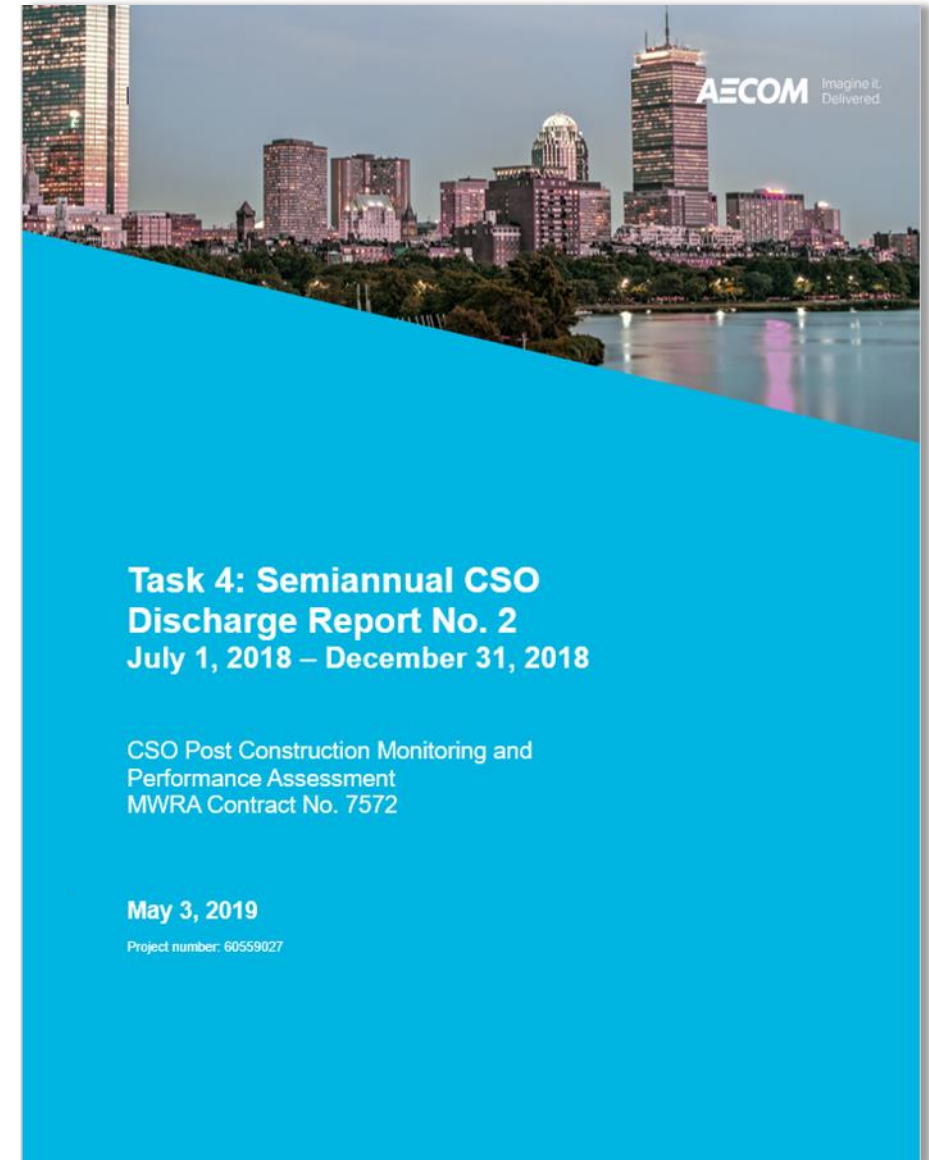
Continued Wet Weather Flow at High Tide – Higher Water Level in Regulator Discharges against the Tide





Scope of Work

- Inspections
- Overflow and wastewater system metering
- Rainfall Data Collection
- Quantification and validation of CSO discharges
- Site-specific CSO discharge investigations
- Hydraulic model updates and improved calibration
- Receiving Water Modeling
- Continued coordination with CSO Communities





Regulator Inspections

- Inspected approximately 200 closed and active CSO regulators
- Inspection results

Location	Result
RE046-54	Changed to open
RE046-80	Changed to closed
RE-046-110	Changed to closed
BOS078	Split into RE078-1 and RE-078-2

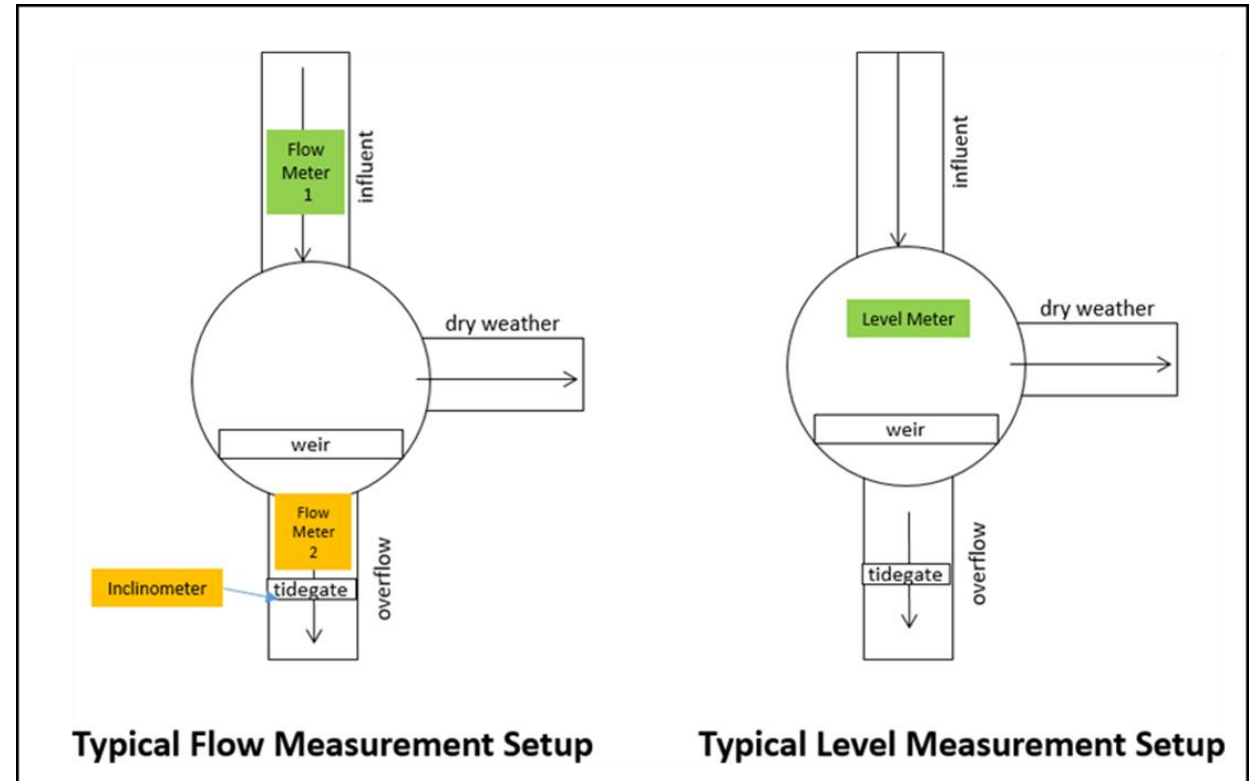
- Regulator inspection program supports
 - Model updates and calibration
 - Meter installation design
 - Additional inspections supporting site-specific investigations





CSO Metering Program – Temporary Meters

- Eighty (80) meters covering all 57 active CSO regulators were installed to collect data from 142 sensors
 - 106 Depth and velocity sensors
 - 20 Level sensors
 - 16 Inclometers installed on tide gates
- Installed by April 15, 2018





CSO Metering Program – Existing Meters

- Thirty-two (32) interceptor flow meters in the combined sewer system
- Operational records at MWRA CSO facilities, pumping stations and CSO storage facilities
- Level sensors at MWRA untreated CSO discharges
- Community CSO meters at 26 regulators maintained by BWSC, Cambridge, Chelsea and Somerville



CSO Metering Program Objectives

- Verify active and inactive CSO outfalls
- Calibrate the hydraulic model and verify model predictions
- Quantify CSO discharges
- Improve the understanding of how rainfall and system conditions impact CSO discharges



CSO Metering Installation and Maintenance

1. Calibrate upon installation
2. Check measurement and data transfer conditions
3. Maintain equipment (clean sensors, replace battery)
4. Verify results/check calibration (direct measure or compare to other local meters)

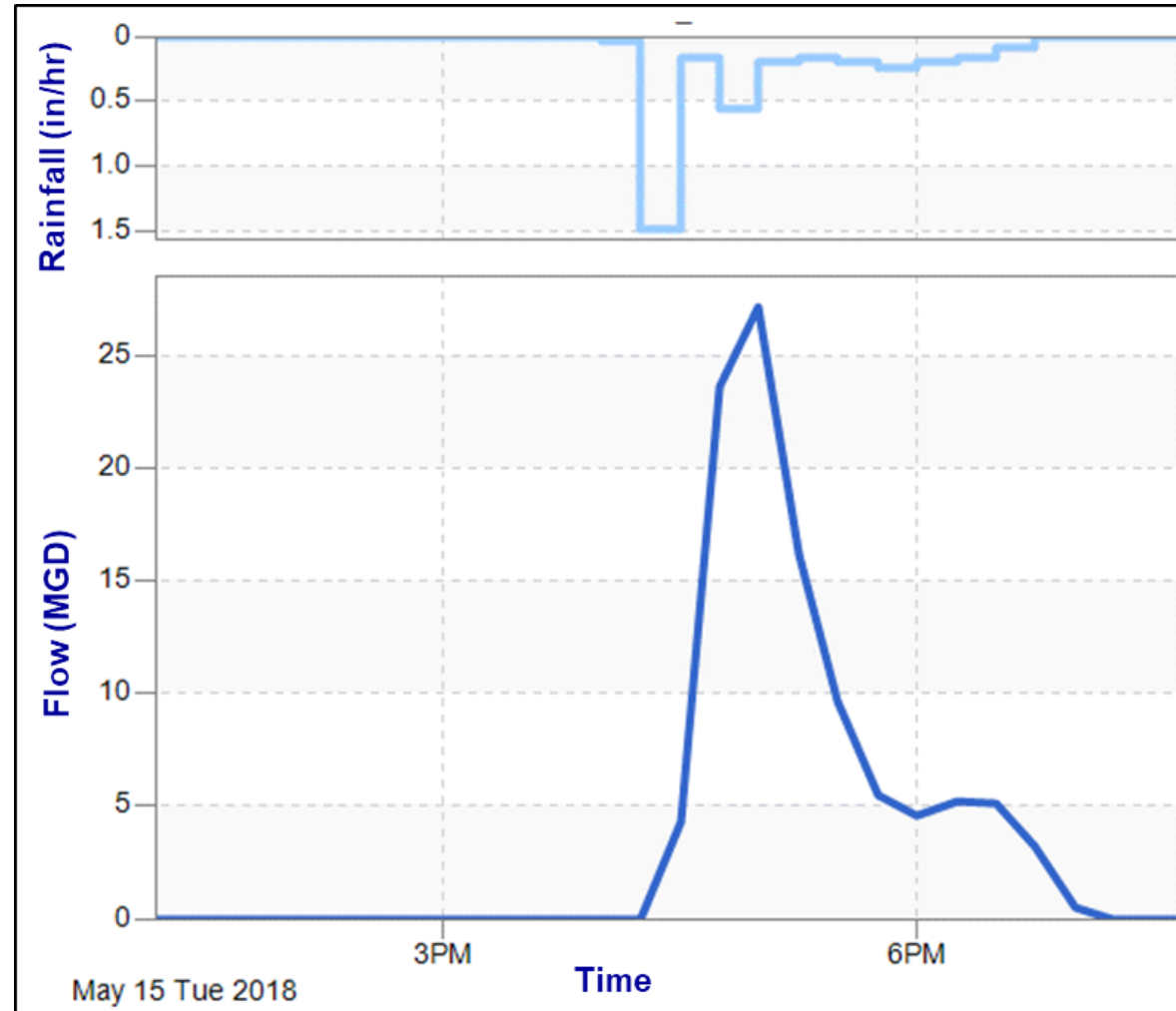




Meter Data Verification

Trust by verifying

- Review data against rainfall and system conditions
- Where data are questionable:
 - ✓ Check against other meter data
 - ✓ Determine cause:
 - Damaged sensors
 - Obstructed sensors
 - System obstruction





CSO Metering Data Review and Analysis

Ensure that meter data/CSO discharges make sense

1. Review meter data
2. Correlate to operations data
3. Correlate to rainfall - scattergraphs plotting rain intensity/rainfall total against meter activity
4. Evaluate other factors
 - Time since last rain
 - Groundwater level

STORMS		
DATE & TIME ¹		
4/15/18 14:45	4/25/18 5:15	4/27/18 10:1
DURATION (HRS) ¹		
38.75	27	19.5
TOTAL RAINFALL (IN) ²		
2.43	1.07	0.42
PEAK 1-HR INTENSITY (IN/HR) ²		
0.47	0.29	0.15
1-HR STORM RECURRENCE ²		
<3m	<3m	<3m
24-HR STORM RECURRENCE ²		
6m	<3m	<3m



Rainfall Data Collection and Use

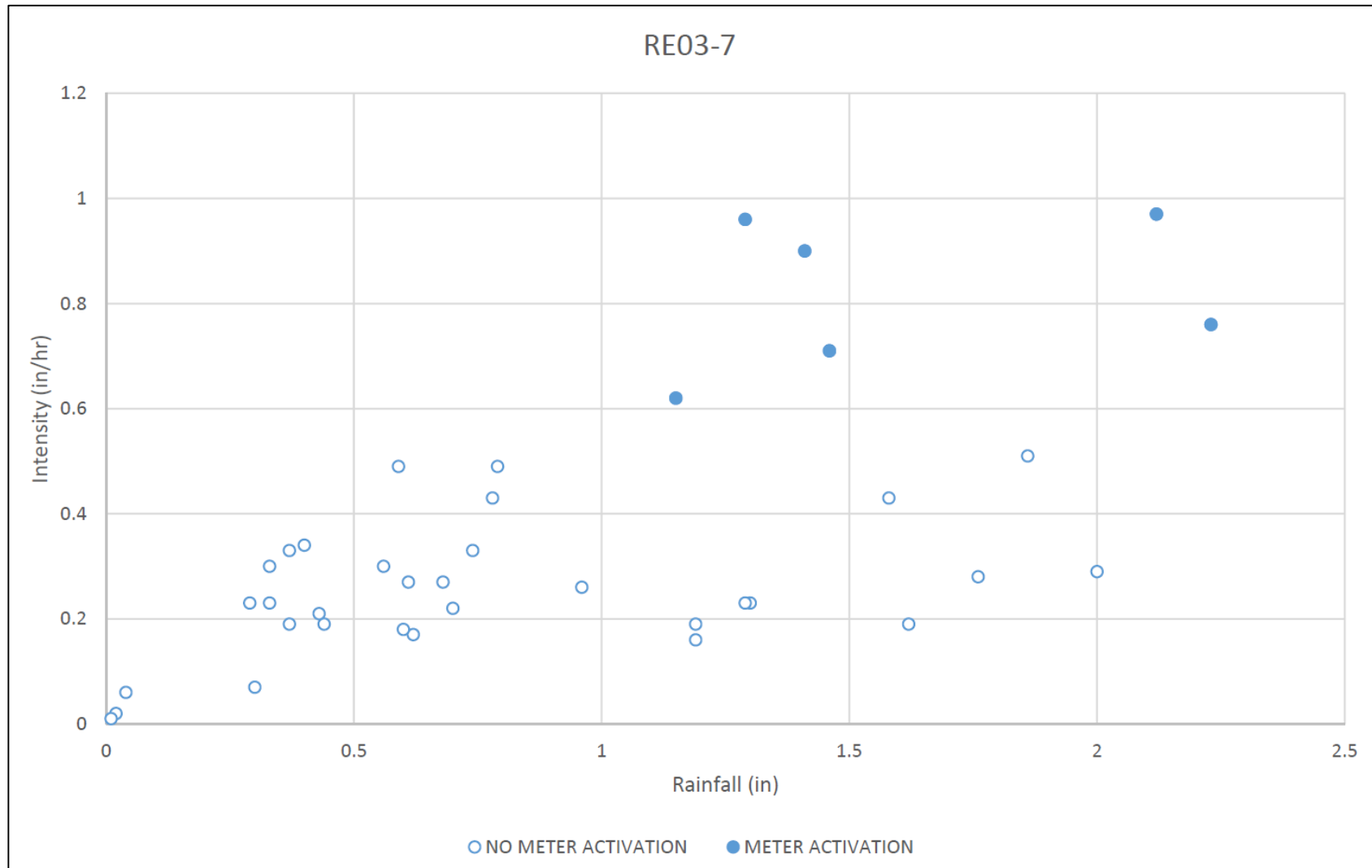
2018 was a very wet year - not good for CSO impacts, but advantageous for CSO monitoring and hydraulic model calibration.

	Number of Storms	Total Precipitation (inches)	No. of Storms Rainfall Depth >0.5 inch	No. of Storms Peak Intensity >0.4 in/hr
Typical Year	93	46.8	30	9
2018 Rainfall	103	54.3	40	14



CSO Discharge Validation – RE03-7

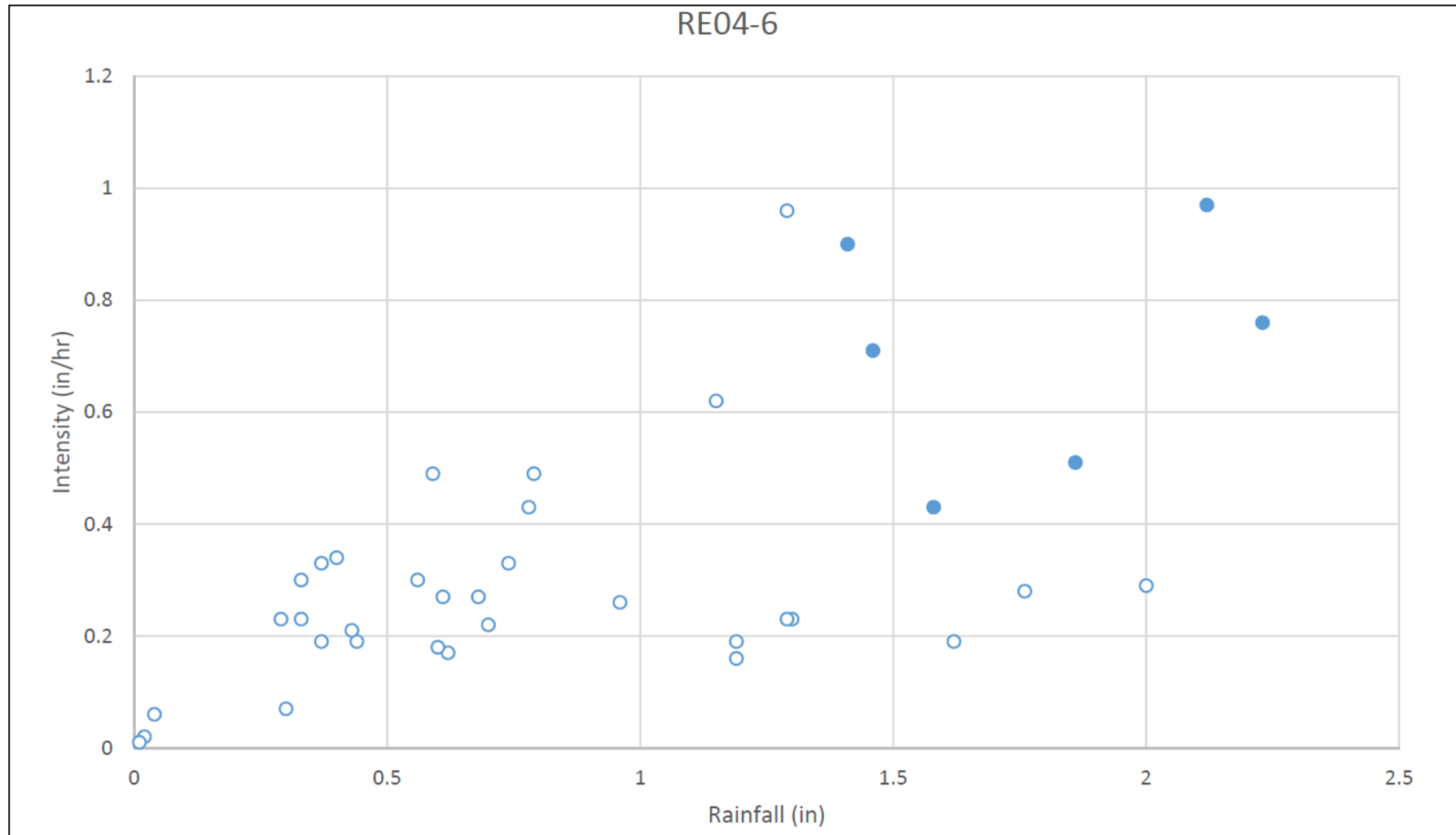
Strong correlation to peak rainfall intensity (>0.4 inch/hour)





CSO Discharge Validation – RE04-6

Strong correlation to rainfall intensity and volume (>0.6 inch/hour and >1.4 inches)





Temporary Metering 2018-2019

- 57 temporary meters were in place by April 15, 2018 – Feb 28, 2019
- 21 temporary meters were taken out of service on March 1, 2019
- Temporary meters at the remaining 36 locations will be kept in place until June 30, 2019. These locations include:
 - Regulators associated with outfalls to the Charles River and Alewife Brook and Upper Mystic River
 - Regulators where site-specific investigations may lead to regulator adjustments



Comparison of Meter Results to Past Model Predictions

Metered discharges were greater than model predictions at 16 of 72 overflow (regulator) locations.

Outfall	Regulator	Existing Permanent Meter(s)	Temporary Meter(s)	Meter Results vs. Model Predictions Apr 15-Jun 30, 2018
ALEWIFE BROOK				
CAM001	RE011	Existing Cambridge Meter	Yes	Metered discharges are in line with model predictions.
CAM002	RE021*	Existing Cambridge Meter	Yes	Metered discharges are greater than model
MWR003	RE-031	Existing MWRA Meter	Yes	Metered discharges are in line with model predictions.
CAM004	CLOSED	No	No	
CAM400	CLOSED	No	No	
CAM401A (1)	RE-401*	Existing Cambridge Meter	Yes	Metered discharges are in line with model predictions.
CAM401B	RE-401B*	Existing MWRA Meter	Yes	Metered discharges are in line with model predictions.
SOM001A	RE-01A*	Existing Somerville Meter	Yes	Metered discharges are greater than model



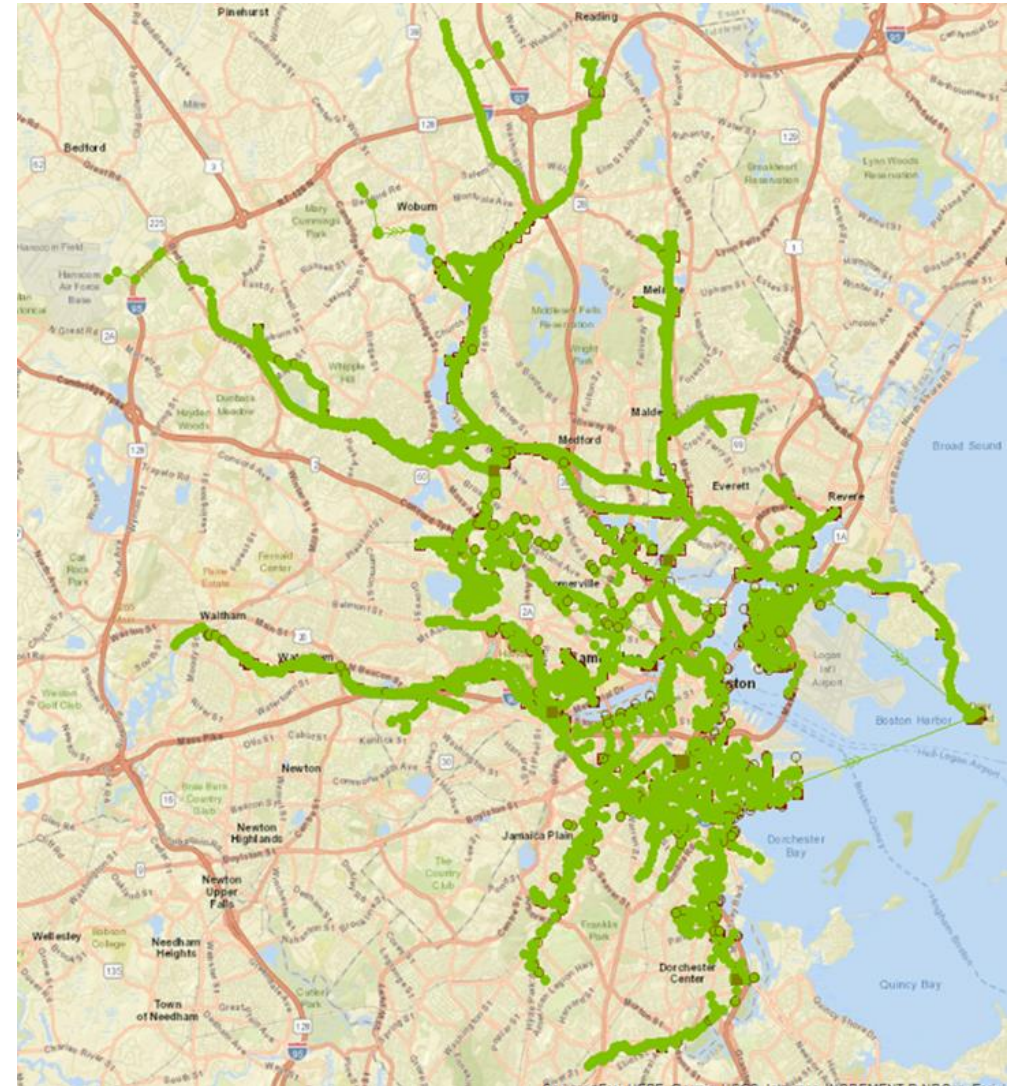
MWRA's Hydraulic Model – Updates and Improved Calibration

Current hydraulic model activities

- Model is being updated to incorporate field inspections, sediment inspections and additional community information.
- Model calibration is underway

Planned hydraulic model uses

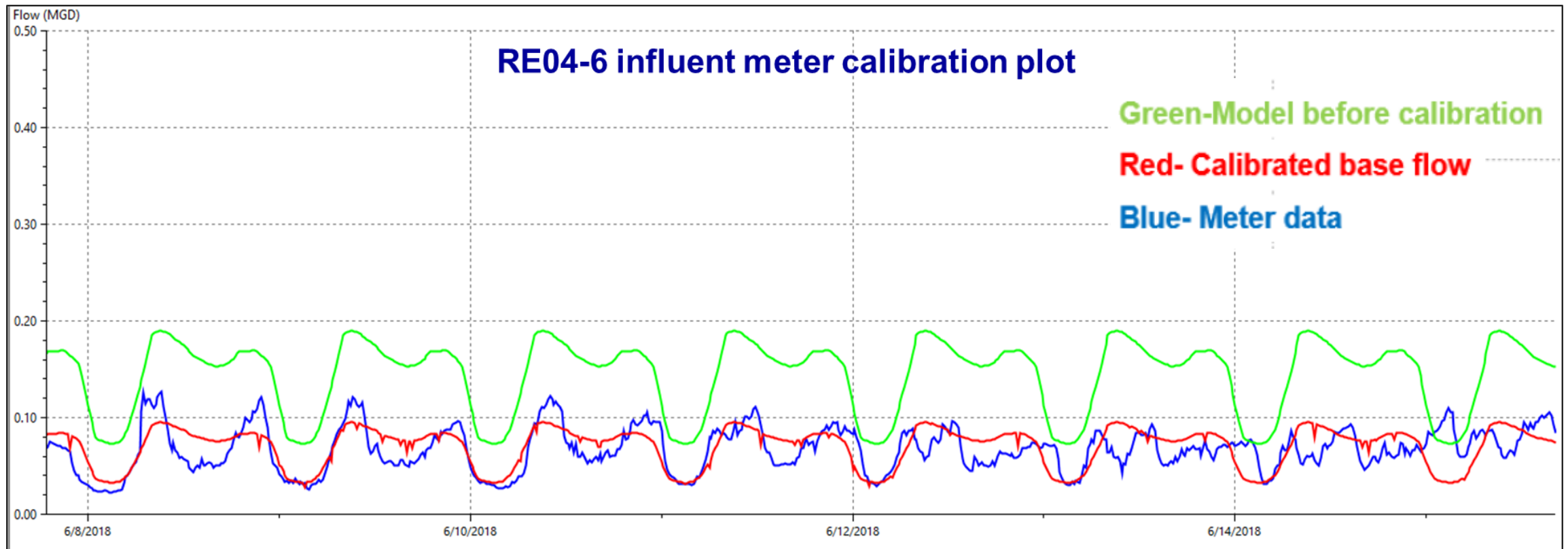
- Verify model predictions against verified meter data and validated field-measured discharges
- Perform storm simulations
- Assess attainment of the Long-Term Control Plan levels of control (Typical Year)





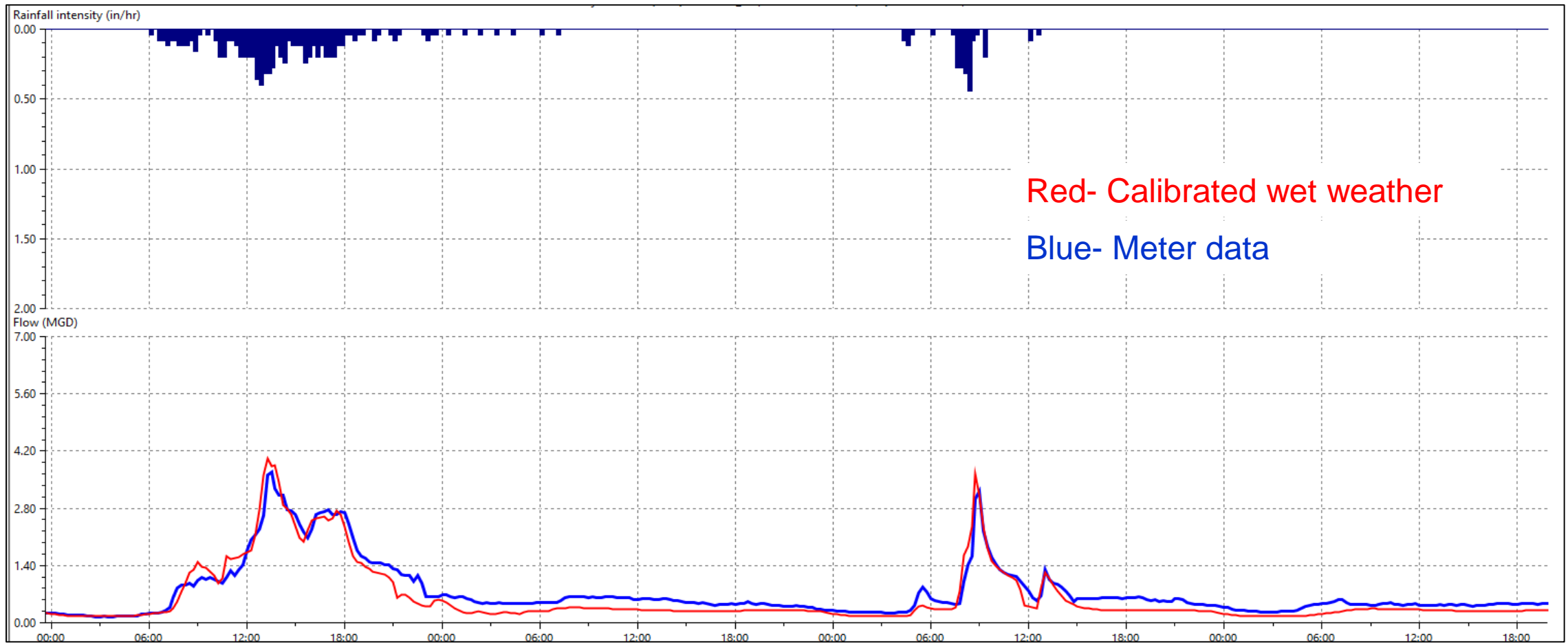
Dry Weather Hydraulic Model Calibration

- Model is being calibrated with meter data Apr 15 – Sep 30, 2018.
- Model results will then be verified with meter data Oct 1 – Dec 31, 2018.





Wet Weather Hydraulic Model Calibration



RE003-12 influent meter calibration plot



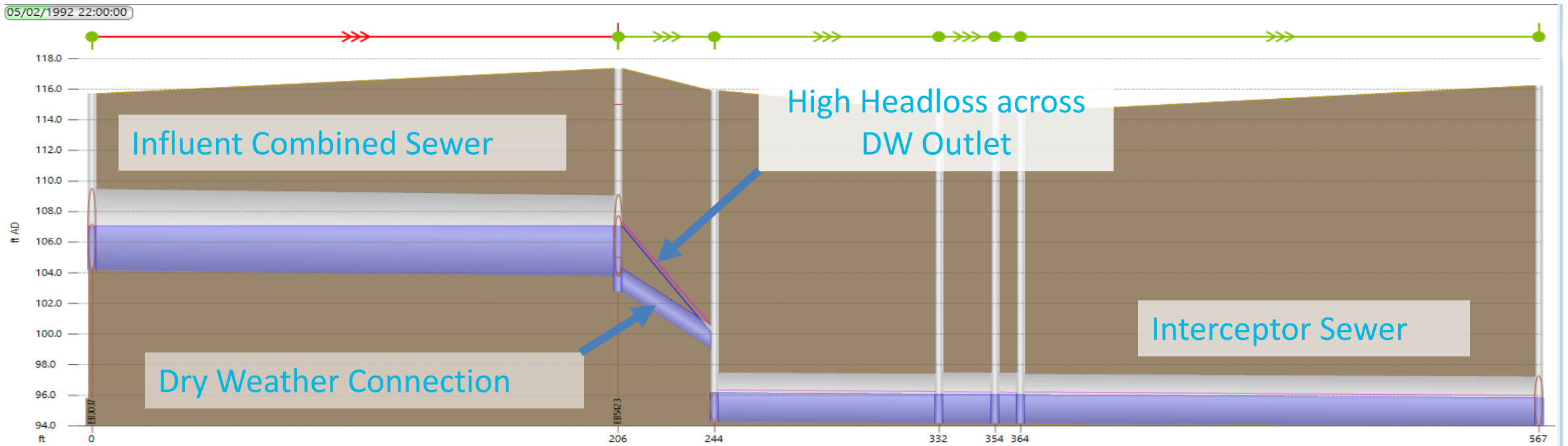
Site-Specific Overflow Activity Investigation Locations

20 of the 44 remaining CSO outfalls have one or more CSO regulators where detailed investigations are underway.

Receiving Water	Outfall
Alewife Brook	SOM001A
	CAM401A
Upper Mystic River	MWR205A/ SOM007A
Mystic/Chelsea Confluence	MWR205 (Somerville Marginal)
	BOS013
	BOS014
	BOS017
	CHE004
	CHE008
Upper Inner Harbor	BOS009
	BOS010
	BOS012
	BOS019
	BOS057
	BOS060
Lower Inner Harbor	BOS003
Fort Point Channel	BOS062
	BOS064
	BOS065
	BOS070
Upper Charles River	CAM005
Lower Charles River	CAM017
	MWR201 (Cottage Farm)
	MWR018
	MWR019
	MWR020
Back Bay Fens	MWR023
	BOS046



Dry Weather Connection Capacity





Site Specific Overflow Activity Investigations: SOM01A

Higher activation and volumes compared to LTCP

Subjects of investigation:

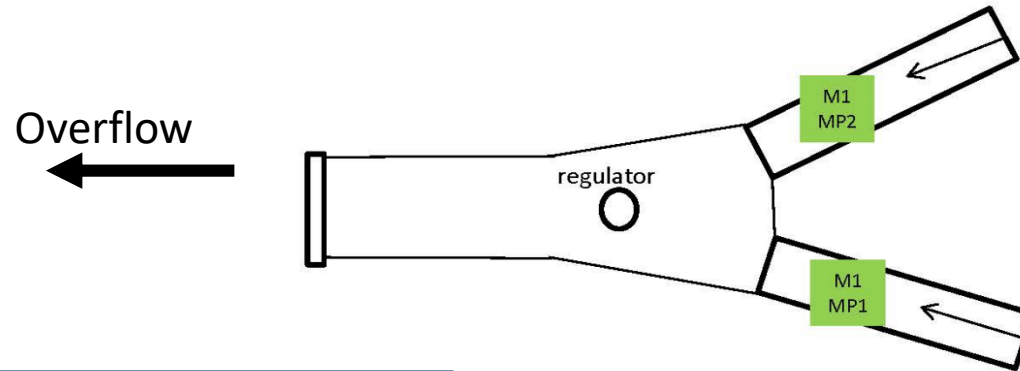
- Hydraulics of the orifice connection
(Connection enlarged in March 2019)
- Weir elevation
- Additional influent flow
- Downstream conditions



Connection to interceptor at SOM01A



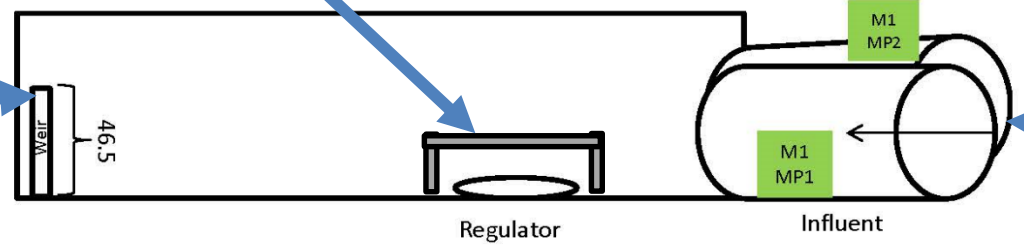
Site Specific Overflow Activity Investigations: SOM01A



Plan View

Drop Connection to the interceptor
24" diameter orifice plate over 32" by
32" opening

Weir elevation
2 inches lower than final
intended level



Section View

Metered inflow
higher than model
predicts



Continuing Work

- Collect rainfall data
- Collect Meter data (36 temporary meter locations)

Applying Data

- Hydraulic model upgrades and calibration
- Site-specific overflow activity investigations



Water Quality Assessment Activities

AECOM Services (WQ Modeling)

- Update and calibrate receiving water quality models
- Assess updated water quality conditions, including remaining CSO impacts
- Run model simulations of CSO control scenarios

MWRA In-House Activities (WQ Data Collection)

- Continue in-stream sampling, with emphasis in Charles and Alewife/Upper Mystic
- Conduct updated CSO and stormwater sampling
- Coordinate data and data collection with communities



For More Information

- Semiannual Progress Reports on the CSO Performance Assessment
- CSO Annual Discharge Estimates and Rainfall Analyses (April 30)
- Annual Water Quality Monitoring Summary Reports (July 15)

All are posted on MWRA.com



MWRA CSO Performance Assessment

