Massachusetts Water Resources Authority

CSO Post-Construction Monitoring and Performance Assessment

Wastewater Advisory Committee

March 4, 2022

Presenters

MWRA Presenters & Technical Support

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Presentation Topics

1. Goals of MWRA CSO Program

2. CSO Post Construction Monitoring and Performance Assessment

   - Current and Forecasted Level of CSO Activation and Volumes and Comparison to LTCP Goals

   - Water Quality Assessment and Impact of Remaining CSO and Other Pollutant Sources

3. Further work on CSO currently not meeting LTCP goals

4. Completed and Further Work required by CSO Variances

5. Questions

What are the CSO Goals & How are they Measured

- Long-term levels of CSO control established in 2006
- Close or 25 year level of control for 30 CSO outfalls (40 closed or effectively closed).
- Activation Frequency & Volume Requirements under Typical Year rainfall for remaining 46 CSO Outfalls.
- Collection system modeling performed using Typical Year Rainfall to assess performance.

Exhibit B
to Second Stipulation

SUMMARY OF TYPICAL YEAR CSO ACTIVATION FREQUENCY AND VOLUME

OUTFALL	TYPICAL YEAR		REFERENCE (*)
	LONG TERM CONTROL PLAN 2005 (*)		
	Activation Frequency	Volume (MG)	
ALEWIFE BROOK[1]			
CAM001	5	0.19	5
CAM002	4	0.69	5
MWR003	5	0.98	5
CAM004	To be closed	N/A	5
CAM400	To be closed	N/A	5
CAM401A	5	1.61	5
CAM401B	7	2.15	5
SOM001A	3	1.67	5
SOM001	Closed	N/A	
SOM002A	Closed	N/A	
SOM003	Closed	N/A	
SOM004	Closed	N/A	
TOTAL		**7.29**	
UPPER MYSTIC RIVER			
SOM007A/MWR205A (Somerville Marginal)	3	3.48	
SOM007	Closed	N/A	
TOTAL		**3.48**	
MYSTIC / CHELSEA CONFLUENCE			
MWR205 (Somerville Marginal)	39	60.58	
BOS013	4	0.54	6
BOS014	0	0.00	6
BOS015	Closed	N/A	6
BOS017	1	0.02	9

Projects Completed as Part of the Long-Term Control Plan

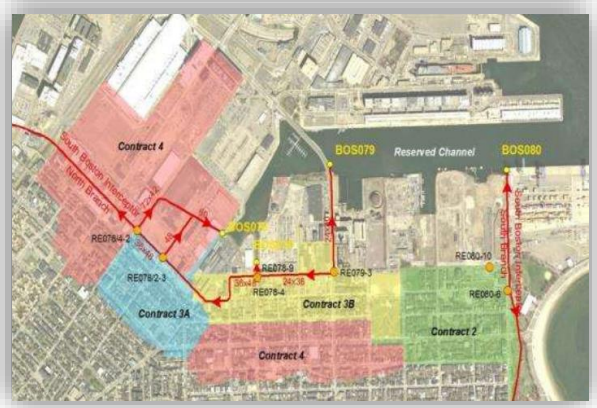
MWRA's implemented plan included a range of cost-effective projects targeted to site specific control including:

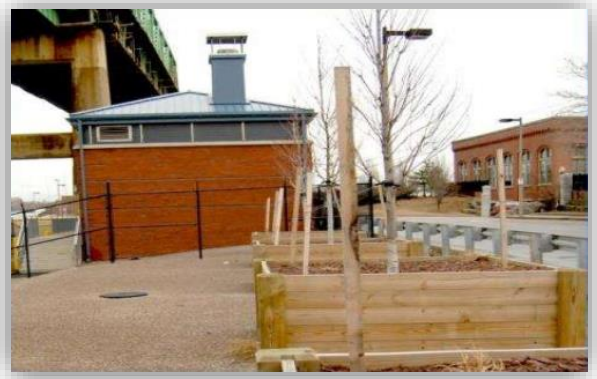
- System optimization
- Sewer separation
- Interceptor relief
- Detention treatment facilities
- Storage facilities
- Upgrades to existing facilities
- Outfall closure

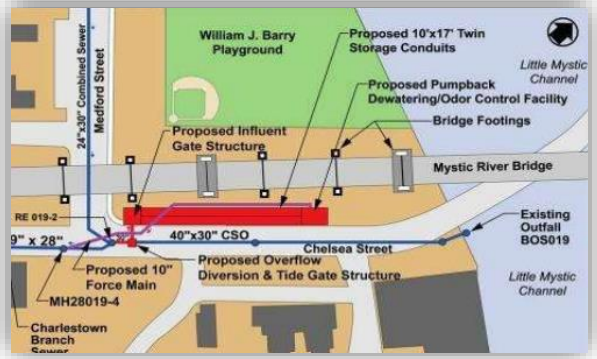
35 projects were constructed between 1988 to 2015

A Performance Assessment was required to be completed by December 2021

Total MWRA Program cost $911 million. Well over $1 Billion when adding CSO Community CSO spending



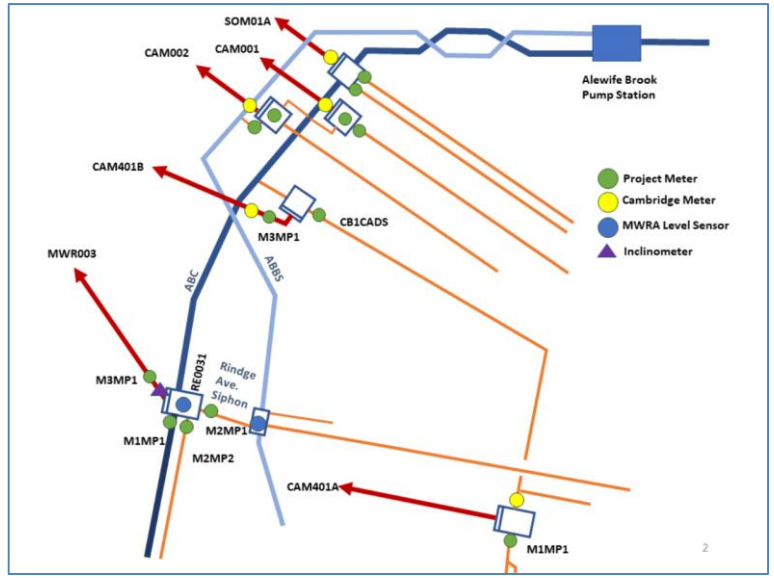




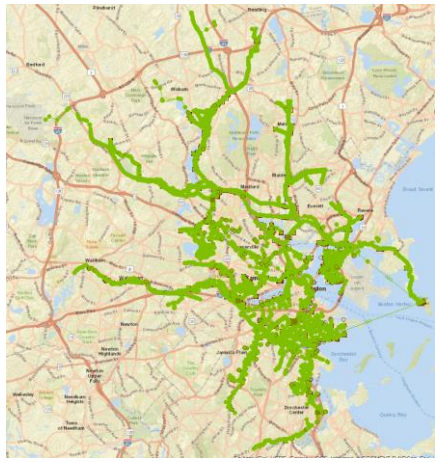
December 31, 2021 – Submitted CSO Post Construction Monitoring and Performance Assessment Report

Inspect all CSO regulators addressed in the LTCP

Collect meter data at active CSO regulators



Upgrade and improve calibration of hydraulic model using data collected

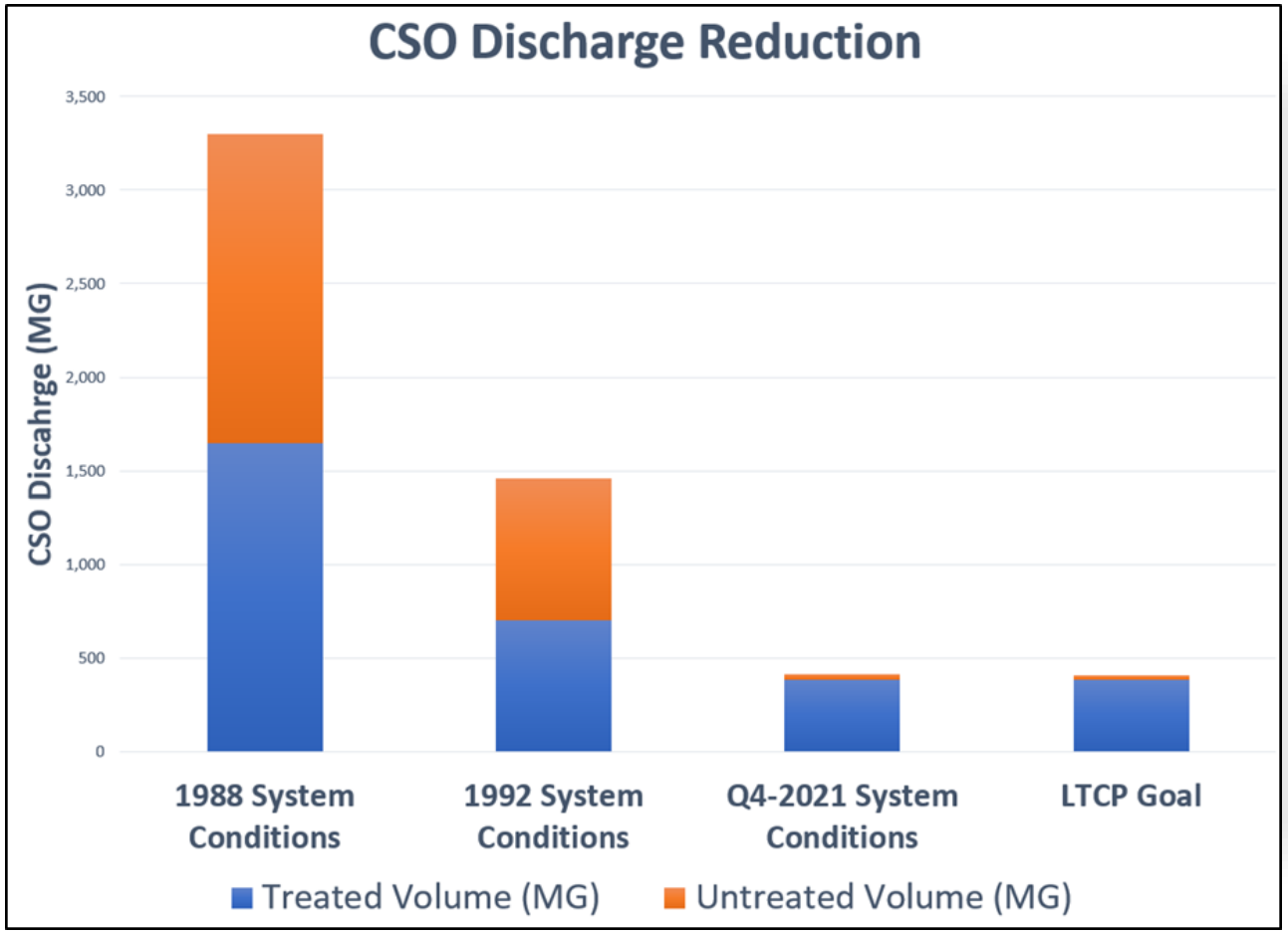


InfoWorks ICM Model

Developed and calibrated receiving water quality models and performed assessment

Overall Results of Performance Assessment

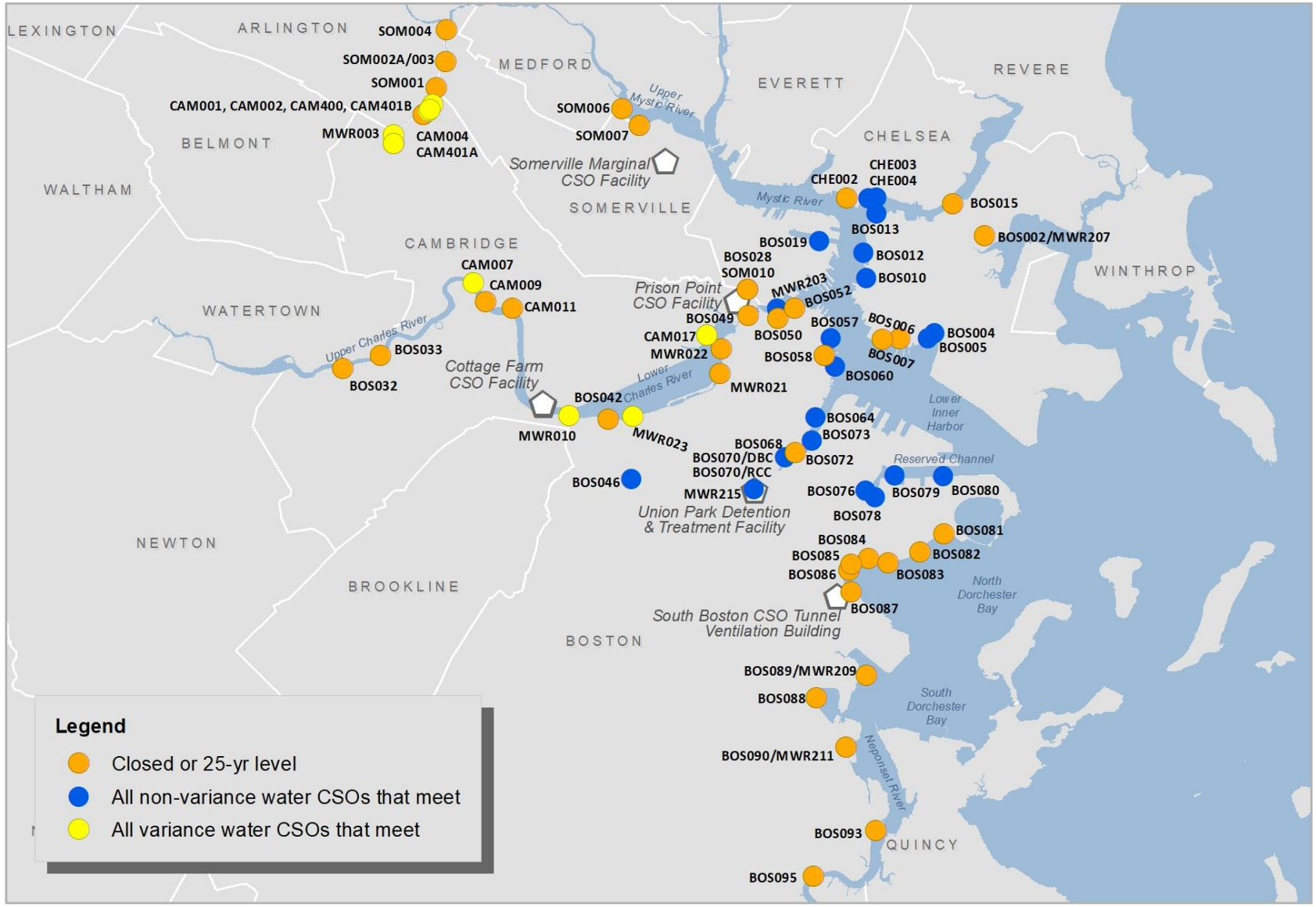
- Annual CSO volume system wide reduced by over 2.8 billion gallons, a reduction of 87%
- Very close to Program goal of 88% reduction
- Current 414 MG
  (384 treated / 30 untreated)
- LTCP Goal 404 MG
  (381 treated / 23 untreated)



CSO Performance Assessment Results for 86 Outfalls

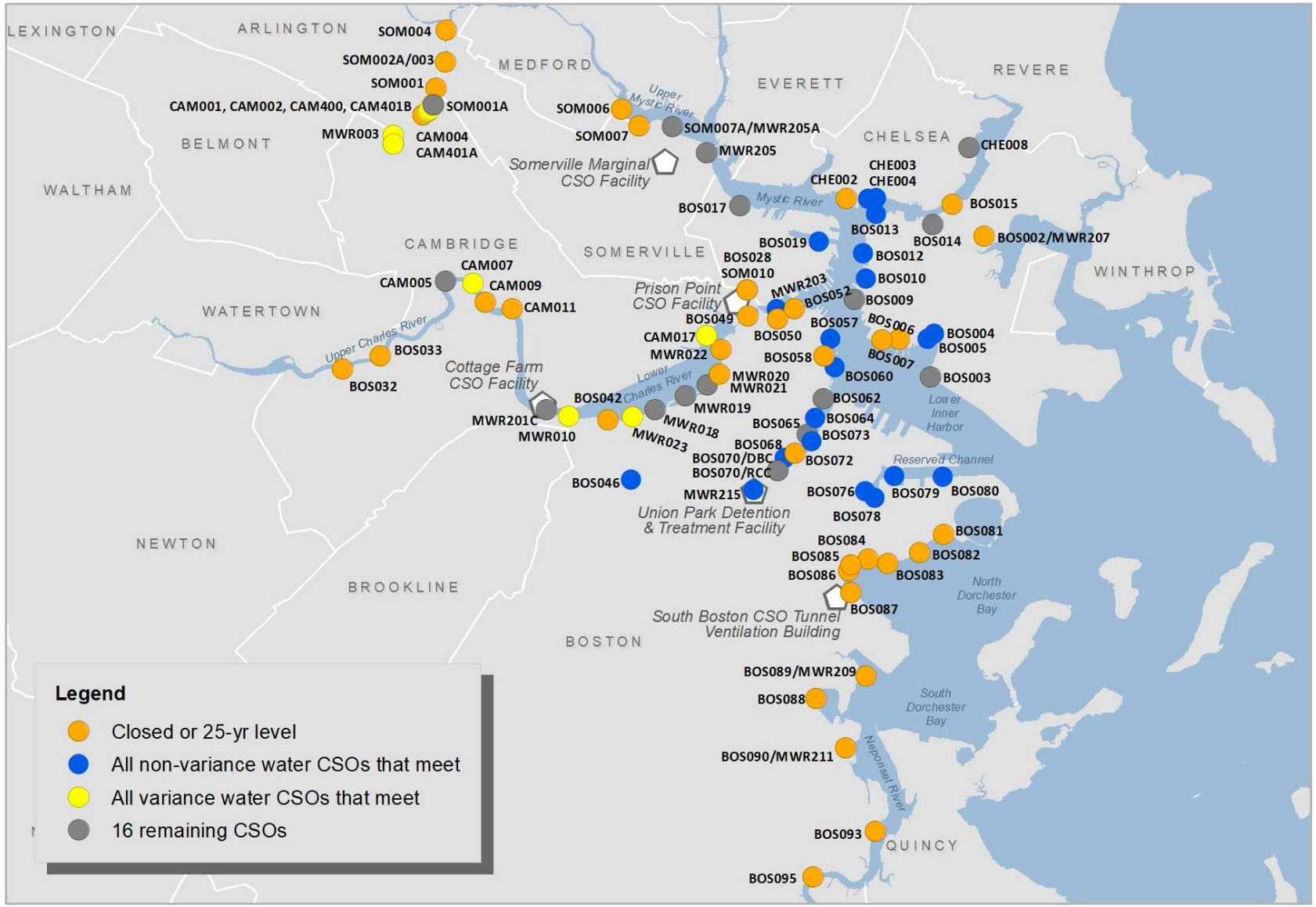
- 25 outfalls required to be closed, confirmed closed.
- 10 additional outfalls closed by CSO communities.
- 5 outfalls along South Boston Beaches "effectively eliminated."
- Totaling 40 outfalls closed or effectively eliminated.

CSO Performance Assessment Results for 86 Outfalls



- Of the 46 remaining CSOs, 30 outfalls meet the LTCP goals.
- 20 Outfalls within non-variance waters (blue dots).
- 10 Outfalls within variance waters (yellow dots).

CSO Performance Assessment Results for 86 Outfalls



- Although substantial reductions have been achieved 16 outfalls do not currently meet LTCP goals.
- Plans are in design or construction for 6 Outfalls, projected to meet within the next 3 years.
- Concept designs developed for 4 Outfalls.
- 6 Outfalls remain particularly challenging.

Typical Year Performance Q4-2021 Model Results

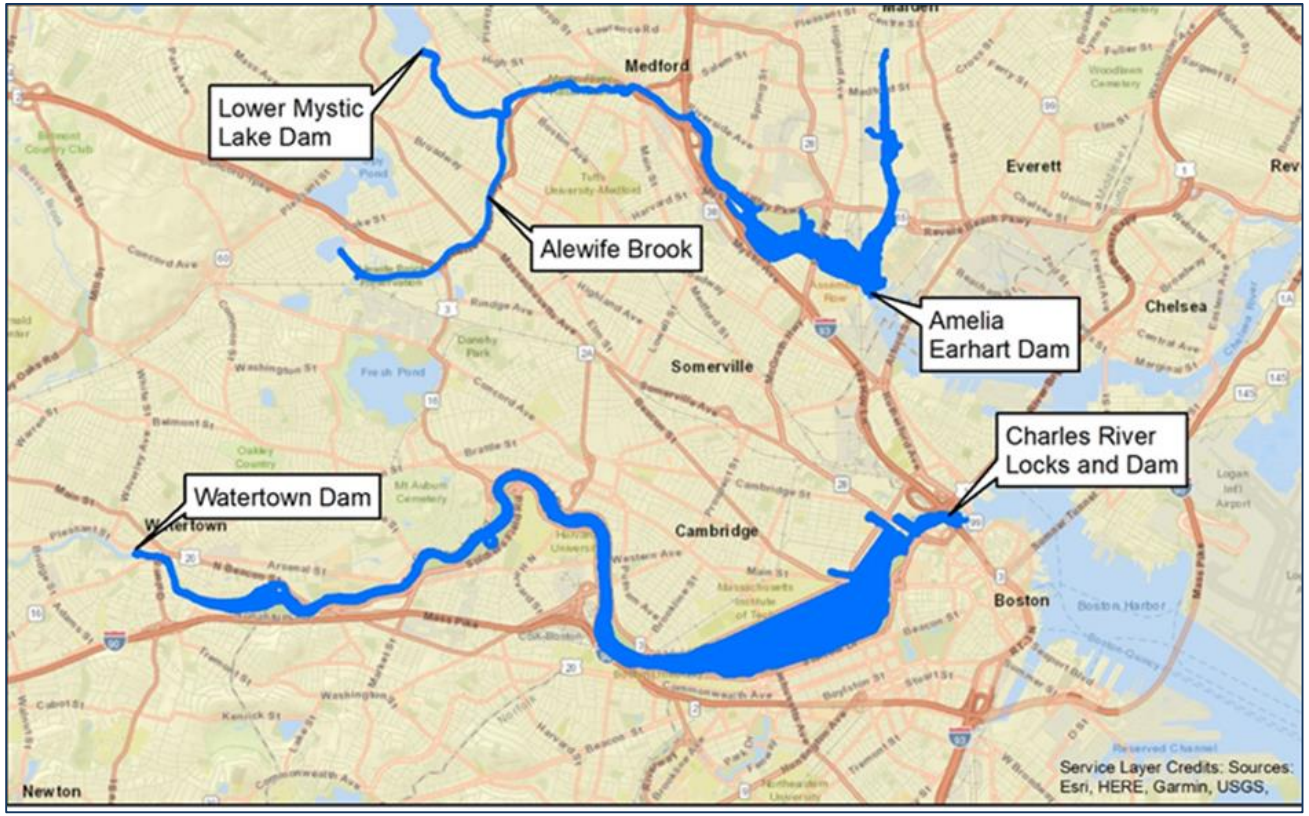
Outfall currently achieves LTCP activation and volume goals.			Outfall is forecast to achieve LTCP goals after Dec 2021.			
Outfall investigations continue for forecast of LTCP attainment potential.			Model prediction is greater than LTCP value.			
OUTFALL	1992 SYSTEM CONDITIONS [1]		Q4-2021 SYSTEM CONDITIONS		LONG TERM CONTROL PLAN [2]	
	Activation Frequency	Volume (MG)	Activation Frequency	Volume (MG)	Activation Frequency	Volume (MG)
ALEWIFE BROOK						
CAM001	5	0.15	1	0.02	5	0.19
CAM002	11	2.73	0	0.00	4	0.69
MWR003	6	0.67	3	0.61	5	0.98
CAM004	20	8.19	Closed	N/A	Closed	N/A
CAM400	13	0.93	Closed	N/A	Closed	N/A
CAM401A	18	2.12	5	0.66	5	1.61
CAM401B			4	0.50	7	2.15
SOM001A[8]	10	11.93	8	4.47	3	1.67
SOM001	0	0.00	Closed	N/A	Closed	N/A
SOM002	0	0.00	Closed	N/A	N/I[3]	N/I[3]
SOM002A	0	0.00	Closed	N/A	Closed	N/A
SOM003	0	0.00	Closed	N/A	Closed	N/A
SOM004	5	0.09	Closed	N/A	Closed	N/A
TOTAL		**26.81**		**6.26**		**7.29**
UPPER MYSTIC RIVER						
SOM007A/MWR205A[7]	9	7.61	5	4.50	3	3.48
SOM006	0	0.00	Closed	N/A	N/I[3]	N/I[3]
SOM007	3	0.06	Closed	N/A	Closed	N/A
TOTAL		**7.67**		**4.50**		**3.48**
MYSTIC/CHELSEA CONFLUENCE						
MWR205[7] (Somerville-Marginal CSO Facility)	33	120.37	30	99.71	39	60.58
BOS013*	36	4.40	8	0.27	4	0.54
BOS014[7]	20	4.91	8	1.44	0	0.00
BOS015	76	2.76	Closed	N/A	Closed	N/A
BOS017[8]	49	7.16	6	0.34	1	0.02
CHE002	49	2.51	Closed	N/A	4	0.22
CHE003	39	3.39	0	0.00	3	0.04
CHE004	44	18.11	2	0.08	3	0.32
CHE008[7]	35	22.35	6	1.94	0	0.00
TOTAL		**185.96**		**103.78**		**61.72**

- Complete account with reductions since 1992 provided in Performance Assessment.
- Grey shaded numbers are higher than LTCP Goals.
- Dark blue shaded outfalls meet. Light blue outfalls forecasted to meet.

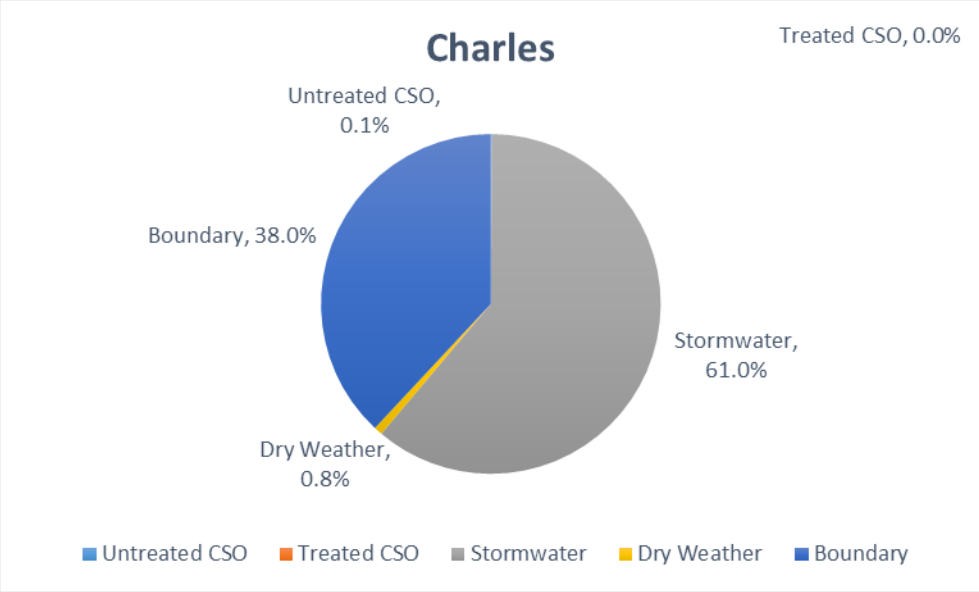
Receiving Water Models

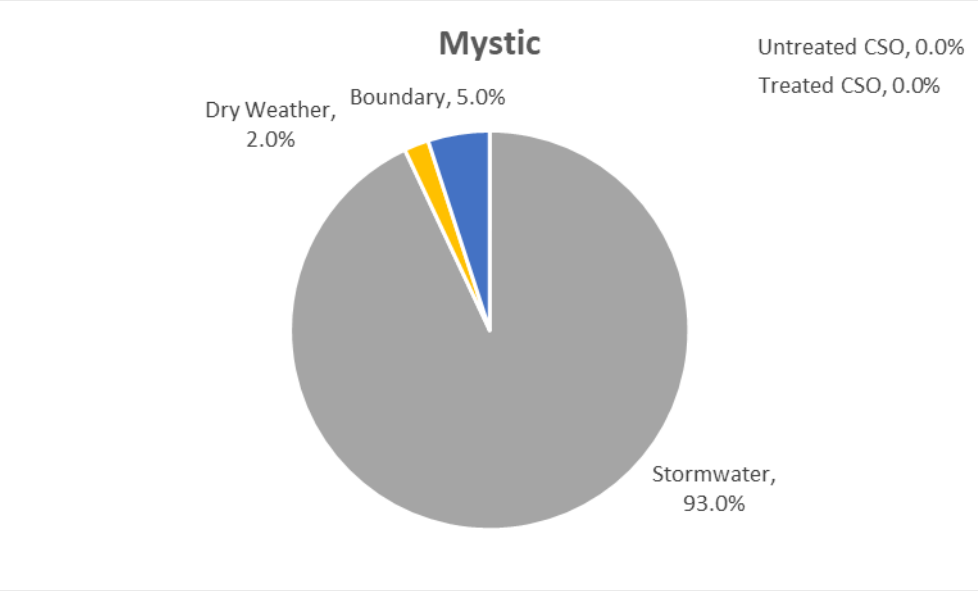
The Receiving Water Models allowed us to:

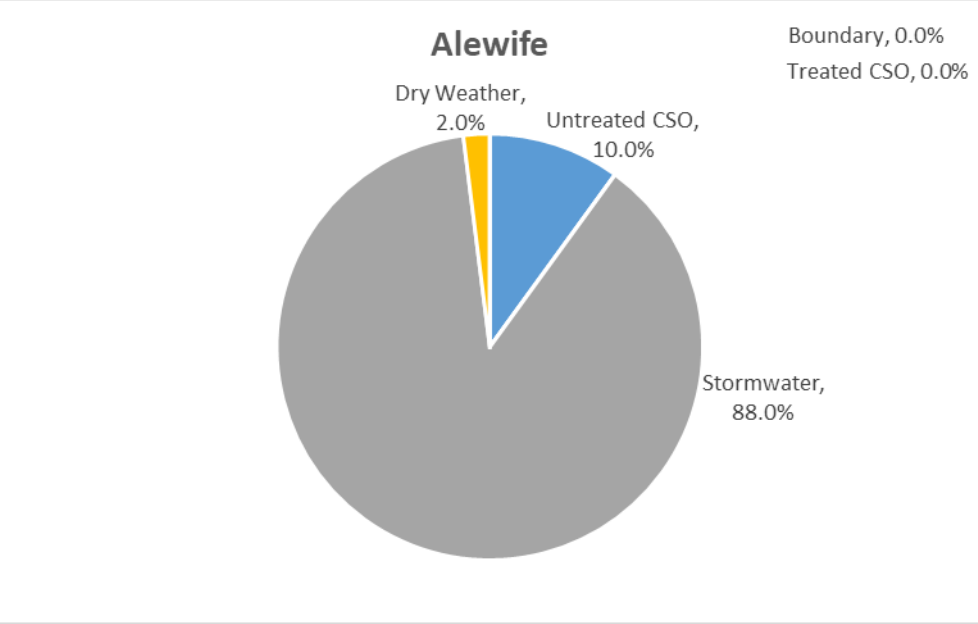
- ✓ separately evaluate the water quality impacts of SW, Boundary, CSO and other sources of bacteria
- ✓ track the movement of the discharges downstream
- ✓ understand water quality between sampling points
- ✓ generate WQ results for a Typical Year
- ✓ assess the amount of time there is an impact (exceedance of WQ standards)
- ✓ run various scenarios to assess water quality impacts of reduced CSO, cleaner stormwater, or other condition changes



Loads of bacteria from different sources







E.coli Loads	Charles	Mystic	Alewife
Untreated CSO	0.1%	NA	10.0%
Treated CSO	0.0%	0.0%	NA
Stormwater	61.0%	93.0%	88.0%
Dry Weather	0.8%	2.0%	2.0%
Boundary	38.0%	5.0%	NA

Charles River – Hours of Exceedance

	Percent Annual Compliance with *E. coli* Single Sample Maximum Criterion (235#/100mL)					
Q1-2021 Condition	**All Sources**	**Non-CSO Sources Only**	**Stormwater Only**	**Dry Weather Sources Only**	**Boundaries Only**	**CSOs Only**
Charles River	48%	48%	64%	100%	59%	99.9%

Charles River

- Non-CSO Sources of pollutant loading (stormwater, boundary, dry weather) result in >4,000 hours (over half the year) of *E. coli* exceedance in a typical year
- CSO Only contributes to 8 hours of *E. coli* exceedance in a typical year

Alewife Brook – Hours of Exceedance

	Percent Annual Compliance with *E. coli* Single Sample Maximum Criterion (235#/100mL)					
Q1-2021 Condition	**All Sources**	**Non-CSO Sources Only**	**Stormwater Only**	**Dry Weather Sources Only**	**Boundaries Only**	**CSOs Only**
Alewife Brook	45%	45%	48%	100%	100%	99.6%

Alewife Brook

- Non-CSO sources of pollutant loading (stormwater, boundary, dry weather) result in >4,500 hours (more than half the year) of *E. coli* exceedance in a typical year
- CSO Only contributes to 35 hours of *E. coli* exceedance in a typical year

Mystic River – Hours of Exceedance

	Percent Annual Compliance with *E. coli* Single Sample Maximum Criterion (235#/100mL)					
Q1-2021 Condition	**All Sources**	**Non-CSO Sources Only**	**Stormwater Only**	**Dry Weather Sources Only**	**Boundaries Only**	**CSOs Only**
Upper Mystic River	55%	55%	56%	100%	91%	97.9%

Upper Mystic River

- Non-CSO sources of pollutant loading (stormwater, boundary, dry weather) result in >3,500 hours of *E. coli* exceedance in a typical year
- CSO Only contributes to 184 hours of *E. coli* exceedance in the Upper Mystic in a typical year

What We Know About Water Quality

Non-Variance Waters

Mystic/Chelsea Confluence
Boston Harbor
Fort Point Channel
Reserved Channel

- Monitoring program since 1989
- Under all weather conditions
- Report Card (by MyRWA method):
  - Inner Harbor;
    - A to A+
  - Mystic/Chelsea Confluence
    - B to A+
  - Fort Point Channel
    - Head = D
    - Mouth = B+
    - At Inner Harbor = A

Variance Waters

Lower Charles/Charles Basin
Alewife Brook
Upper Mystic River Basin

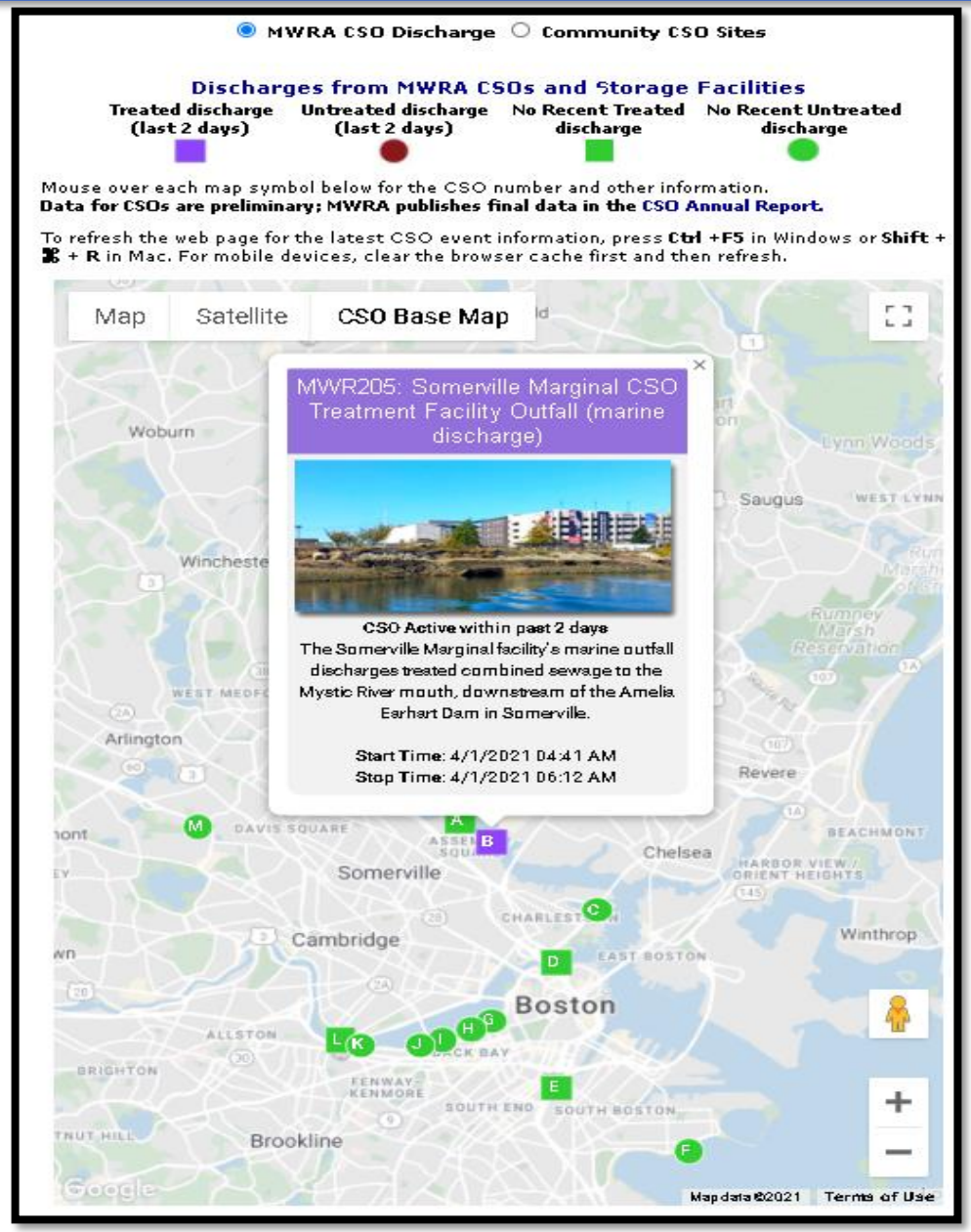
- Report Card (2020):
  - Mystic River (MyRWA method)
    - Main stem = B+
    - Alewife Brook = D
  - Charles River Basin (EPA method)
    - B-
- Original receiving water quality models updated
- Identifies bacterial contributions
- Distinguish CSO from Non-CSO/ Stormwater
- Upstream Boundary Sources

Water Quality Summary

- In the Charles River and Alewife Brook/Upper Mystic River, the annual percent attainment with *E. coli* criteria was driven by the non-CSO loads.
- Further reduction of CSOs to a level such that all CSOs to the Charles River and Alewife Brook/Upper Mystic River met the numerical targets for activation frequency and volume per the LTCP would not substantively change the percent attainment.
- Reductions in *E. coli* loading from stormwater would improve the annual percent attainment, but even with an order-of-magnitude reduction in *E. coli* counts in stormwater, non-CSO sources would still be the primary driver of non-attainment of the *E. coli* criteria.
- Even with all other sources of bacteria capped at the Water Quality Standard, CSO would have only a minor impact on non-compliance.

Public Notification of CSO Activations

- Real Time monitoring at all MWRA CSO outfalls
- Since July 2020, Rapid Notification of CSO discharges via text or email
- Subscriber based system
- Updated interactive web pages
- More to come under new 314 CMR 16 Sewage Notification Regulations



Continued CSO Efforts to Meet LTCP Goals

Motion filed and granted 3-year extension to court order, during which:

- MWRA will focus on 16 outfalls not meeting LTCP goals
- MWRA will submit annual progress reports
- Meet with EPA, DEP, CLF and the watershed associations
- Submit a supplement to the December 2021 Performance Assessment

Outfalls Forecast to Attain LTCP Goals After 2021

OUTFALL	LOCATION	SYSTEM IMPROVEMENT(S)	TO BE IMPLEMENTED BY	TENTATIVE SCHEDULED COMPLETION
MWR205	Somerville Marginal CSO Facility	Construct new connection from the facility influent conduit to the interceptor and replace tide gate.	MWRA	2024
SOM007A/ MWR205A				
BOS003	East Boston	Complete BWSC Sewer Separation Contract 3, including upgrade of interceptor connection at regulator RE003-12.	BWSC	2023
BOS009				
BOS014		Construct new interceptor connection		
CHE008	Chelsea Creek	Replace/upgrade interceptor connection	MWRA	2022

Outfalls With Conceptual Plans to Achieve LTCP Goals

OUTFALL	Q4-2021 SYSTEM CONDITIONS MODEL		LONG TERM CONTROL PLAN		OUTFALLS WITH MODELED CONCEPT DESIGNS PREDICTED TO ATTAIN LTCP GOALS
	Activation Frequency	Volume (MG)	Activation Frequency	Volume (MG)	
MYSTIC/CHELSEA CONFLUENCE					
BOS017	6	0.34	1	0.02	•MWRA has developed a concept design to construct modifications to the Sullivan Square siphon structure including adjustable stop logs upstream of each siphon barrel. MWRA is coordinating with BWSC on the feasibility and cost of this alternative.
FORT POINT CHANNEL					
BOS062	5	1.26	1	0.01	•MWRA is coordinating with BWSC on the feasibility and cost of an alternative to relieve the interceptor connection.
BOS065	1	0.62	1	0.06	•MWRA is coordinating with BWSC on the feasibility and cost of an alternative to raise the weir at the regulator.
BOS070/DBC	7	6.14	3	2.19	•MWRA is coordinating with BWSC on the feasibility and cost of an alternative to add a parallel relief pipe downstream of regulator RE070/7-2.

Outfalls with Significant Challenges to Achieve LTCP Goals

OUTFALL	Q4-2021 SYSTEM CONDITIONS MODEL		LONG TERM CONTROL PLAN		OUTFALLS PRESENTING SIGNIFICANT CHALLENGES
	Frequency	(MG)	Frequency	(MG)	
ALEWIFE BROOK					
SOM001A	8	4.47	3	1.67	·Potential mods include weir raising, interceptor connection relief, relining portions of the Alewife Brook Conduit (ABC) and Alewife Brook Branch Sewer (ABBS). · MWRA is coordinating with City of Somerville to review potential flood control measures which may provide a CSO reduction benefit.
CHARLES RIVER					
MWR201 (Cottage Farm)	2	9.1	2	6.3	·Evaluate upstream sewer separation and targeted groundwater infiltration removal. ·Further alternative development and evaluation with consideration of water quality benefits and cost to be considered beyond December 2021.
CAM005	8	0.74	3	0.84	·Coordinate with community to balance weir raising, outfall cleaning, and sewer separation. ·Further alternative development and evaluation with consideration of water quality benefits and cost to be considered beyond December 2021.
MWR018	2	1.12	0	0	·Evaluated alternatives including raising weirs, reducing head loss in the BMC, and redirecting upstream BWSC separate storm drains.
MWR019	2	0.48	0	0	·Further alternative development and evaluation with consideration of water quality benefits and cost to be considered beyond December 2021.
MWR020	2	0.48	0	0	

Next Steps

Approved Three-Year Extension

- Continue to support projects in design and construction expected to meet goals in next three years (6 CSO Outfalls)
- Further evaluate and move forward with design where modeled concepts meet goals (4 CSO Outfalls)
- Continue to investigate alternatives where meeting goals pose significant challenges (6 CSO Outfalls)

Variance Requirements

- Complete system optimization evaluations for remaining CSOs to Alewife Brook, Upper Mystic and Charles River (further weir raising, connection relief, etc.)
- Develop Updated CSO Control Plan
  - MWRA, Somerville and Cambridge required to prepare individual plans for their CSOs, but will coordinate given hydraulic interdependence
  - Public participation included
  - Draft Plan June 2023, Final Plan December 2023

For More Information

- Semiannual Progress Reports
- CSO Annual Discharge Estimates and Rainfall Analyses (April 30)
- Annual Water Quality Monitoring Summary Reports (July 15)
- Final PCCMR (December 2021)

All are posted on MWRA.com

https://www.mwra.com/03sewer/html/sewcso.htm

https://www.mwra.com/cso/pcmapa.html

MWRA CSO Performance Assessment