

**Receiving Water Modeling of Upper Mystic River/Alewife Brook and
Charles River Basin:
Work Plan for Stormwater and Combined Sewer Overflow Monitoring, 2019-2020**

(“Sampling Work Plan”)

June 6, 2019

Revised August 27, 2019

1. Introduction

The Massachusetts Water Resources Authority (MWRA) is in the final phase of its Combined Sewer Overflow (CSO) Long-Term Control Plan (LTCP), the Assessment phase. MWRA, in consultation with the Massachusetts Department of Environmental Protection (DEP) and the U.S. Environmental Protection Agency (EPA) will be updating receiving water quality models for the two regions with CSO Variances, the Charles River Basin and the Upper Mystic River/Alewife Brook.

To update these models, MWRA and the CSO communities of Cambridge and Somerville will gather current information. In particular, stormwater and CSO outfall quality data that reflect current conditions were identified as important components in development of an updated receiving water model. MWRA’s receiving water model work plan with consultant AECOM (*AECOM Receiving Water Model Work Plan*), was submitted to DEP/EPA on May 24 2019, and updated based on EPA and DEP comments on July 18, 2019. The *AECOM Receiving Water Model Work Plan* addresses other model inputs available from recent modeling work or existing data collection efforts completed by MWRA and the communities that are also important for model development.

This *Work Plan for Stormwater and Combined Sewer Overflow Monitoring* (the Sampling Work Plan) was submitted to EPA and DEP on June 6, 2019 and finalized on August 27, 2019 based on comments from EPA and DEP. This Sampling Work Plan describes how and where samples will be collected to support model development. It is based primarily on the CSO and stormwater outfall sampling locations and methods used to develop prior models of these waters between 1999-2002.

2. Purpose

This Sampling Work Plan is to guide the sampling of selected stormwater and CSO outfalls on the Upper Mystic River/Alewife Brook and Charles River Basin. The sampling will result in up-to-date bacteria counts of representative stormwater and untreated CSO effluent quality, reflecting current conditions, which will be used as baseline inputs for the receiving water quality model. AECOM will provide a *Monitoring Data Technical Memorandum* that will describe the sources of information and how these will be used for model development. AECOM will calibrate the model against in-stream water quality data, some of which will be collected during the same storms as the stormwater and CSO outfall samples.

As the MWRA in-stream water quality samples will be the benchmark for model calibration, it is equally important that the stormwater and CSO model inputs represent the current range of bacteria counts in the stormwater and CSO discharges. Once the model is calibrated, different bacterial concentrations

can be run as model scenarios, as detailed in the *AECOM Receiving Water Model Work Plan* (Section 5.4, Alternatives Simulations). The Receiving Water Model Work Plan includes review opportunities for DEP and EPA on the model calibration procedure, and identification of simulations to be performed.

This Sampling Work Plan primarily focuses on the Alewife Brook and Upper Mystic River. Boston Water and Sewer Commission (BWSC) has updated results for stormwater discharges to the Charles, and that information will be used to update the model. However, an additional two locations have been added for the Charles River representing Cambridge stormwater outfalls.

MWRA has updated this sampling work plan to address comments received by DEP and EPA. The sampling plan targets different land uses and includes sampling of stormwater discharges known to be affected by illicit sanitary sewer connections as well as sites where sanitary influences are limited. MWRA continues to review available data sources to determine data gaps, and adjustments may be made in consultation with EPA and DEP, if deemed necessary.

3. Sampling Locations

3.1. CSO locations

As was done in 2002¹, two key considerations are taken into account in determining which CSO regulators are most suitable for sampling: 1) the likelihood of a particular regulator to activate, given the rainfall characteristics needed to cause an overflow; and 2) access to the regulator structures.

Under the current conditions, SOM001A and CAM401A were selected as the most likely CSO locations that meet those two criteria. Table 1 below is a description of those two locations, followed by the number of activations measured from April 15 to December 31, 2018.²

Table 1. Proposed CSO sampling locations

Outfall #	Location	Description	# of Activations Measured 4/15/18 to 12/31/18
SOM001A	Located in grassy area adjacent to Alewife Brook, approximately 420 feet NE of the intersection of Route 16 and Massachusetts Ave.	Manhole above weir; outfall is 4 foot, 9 inch box culvert. Discharges into Alewife Brook.	14
CAM401A	Located on the edge of the parking lot in a grassy strip at 147 Sherman St., Cambridge.	Manhole between regulator and discharge conduit. Outfall is roughly 3,700 ft NE and discharges into the Alewife Brook W of the MBTA Alewife station.	18

¹ *Draft Work Plan for Alewife Brook Combined Sewer Overflow Monitoring, Fall 2002.*

² CSO discharge estimates and rainfall analyses for Calendar Year 2018, letter report to DEP and EPA dated April 30, 2019

The manhole at SOM001A contains metering equipment that belongs to the City of Somerville. MWRA staff met with Somerville engineering staff on 5/2/19 and discussed this issue. Somerville gave MWRA permission to sample at SOM001A as long as Somerville is given advance notice of any sampling activity.

For CAM401A, the sampling location will be at a regulator manhole, not at the outfall, to capture CSO quality, as stormwater enters the discharge conduit between the regulator and the outfall.

The two CSO Assessment semiannual reports released to date contain scattergraphs comparing activations to storm rainfall depth (inches) versus storm intensity (inches/hour) to aid in determining what kinds of storms result in activations at SOM001A and CAM401A. Attachments A and B are scattergraphs from the *Semiannual CSO Discharge Report No. 2* for SOM001A and CAM401A, respectively. Scattergraphs will continue to be reviewed to determine the storm characteristics that are most likely to result in an overflow event.

For the Charles River, MWRA has been collecting influent samples from the Cottage Farm and Prison Point CSO facilities since October 2017.

3.2. Stormwater locations

3.2.1. Alewife Brook and Mystic River

Four municipalities own storm drains that drain into the Upper Mystic River and Alewife Brook within the boundaries of the model: Cambridge, Somerville, Medford, and Arlington. The effects of other municipal storm drains (e.g., Belmont) are reflected in the boundary conditions established in the model.

MWRA has requested that Cambridge and Somerville assist with this program by collecting stormwater samples from specified storm drains in their systems, in coordination with MWRA. Several coordination meetings have been held with both municipalities and sampling locations have been selected with their assistance.

Cambridge will sample two locations on Alewife Brook using their staff and will send their samples to a contract laboratory rather than the MWRA laboratory for analysis.

Using the 1999-2002 sampling program as a guideline, Somerville agreed to sample the same five locations that were previously sampled. Three locations drain to the Alewife Brook, while the remaining two drain to the Mystic River. Somerville will utilize a contractor for sampling and will be sending the samples to the MWRA for analysis.

MWRA will sample Medford and Arlington storm drains (unlike Cambridge and Somerville, Medford and Arlington are not combined systems and therefore are not party to the CSO Variances or the CSO Assessment).

Medford gave MWRA permission to sample at the prior three locations sampled in 2002 (Meetinghouse Brook, Two Penny Brook, and Gravelly Creek). MWRA staff have visited each location and samples will be collected from manholes in the storm drain system. The Gravelly Creek location is slightly different from the previous program, as the manhole used in 1999-2002 was inaccessible. The new location is

several hundred yards downstream from the older location. All three locations drain into the Mystic River.

MWRA will sample two stormwater sites in Arlington. MWRA staff have evaluated locations provided by the town and have selected two locations where samples can be safely collected from manholes in the stormwater system. Both locations drain into the Alewife Brook. MWRA will provide sampling bottles and laboratory analysis for these sampling events (with the exception of Cambridge, who will receive their sampling bottles and analysis from their contract laboratory). The current target date for beginning this program is late summer 2019. Table 2a shows the locations proposed for sampling. Attachments C, D, E, and F show the stormwater sampling locations in Cambridge, Somerville, Medford, and Arlington respectively.

Table 2a. Stormwater sampling locations in Alewife/Mystic

MWRA Location Code	Community	Sampled by	Description	Influenced by illicit connections? <i>*(information to be verified with communities)</i>
MED1	Medford	MWRA	Daly Rd / Meetinghouse Brook	Yes
MED2	Medford	MWRA	Willis St / Two Penny Brook	Yes
MED4	Medford	MWRA	Salem St Circle / Gravelly Brook	Yes
CAMH	Cambridge	Cambridge	Harrison Ave	No
TBD	Cambridge	Cambridge	Cambridgepark Drive, inlet to the constructed wetland	No
SD07	Somerville	Somerville	Alewife Brook, 24-inch RCP	Yes
SD08	Somerville	Somerville	Former SOM002	Yes
SD09	Somerville	Somerville	Former SOM002A	Yes
SD21	Somerville	Somerville	Mystic River, 48-inch RCP	No
SD26	Somerville	Somerville	Ten Hills drainage area, former SOM007	No
ARL1	Arlington	MWRA	Waldo Park, upstream of outfall OF-372	TBD
ARL2	Arlington	MWRA	Lafayette St, upstream of OF-33	Low**

*With the exception of the Cambridge locations, the identification of whether or not illicit connections are impacting these storm drains is not certain. Communities provided their best estimation of whether or not these impacts are expected to be significant.

** Arlington uses a risk assessment methodology based on a number of factors such as land use, infrastructure age, MS4 sampling, etc, and MWRA staff have binned these categories to indicate whether there is a “High”, “Medium” or Low” risk of illicit contributions. An assessment of Outfall OF-372 has not been completed.

3.2.2. Charles River

As mentioned previously, BWSC has updated stormwater quality data, and is additionally planning to sample stormwater quality independently beginning this fall. BWSC has agreed to share this information with MWRA. Cambridge has proposed two locations draining to the Charles: DeWolfe Street and Broad Canal (Table 2b).

Table 2b. Stormwater sampling locations in Charles River

MWRA Location Code	Community	Sampled by	Description	Influenced by illicit connections? <i>(information to be verified with communities)</i>
TBD	Cambridge	Cambridge	DeWolfe St	No
TBD	Cambridge	Cambridge	Broad Canal	No

3.3. In-stream sampling locations

When CSO and stormwater samples are collected under this program, it is the goal of MWRA to collect routine water quality samples after storms per MWRA’s longstanding receiving water monitoring program. To the extent possible, MWRA will also collect instream samples concurrently with the CSO sampling. MWRA is examining the feasibility of collection in-stream samples at the same time as stormwater sampling if resources allow. In-stream samples will be used for model calibration.

4. General Sampling and Analysis Overview

4.1. Parameters

As the model is primarily focused on bacteria, samples will be analyzed for *E. coli* and *Enterococcus*. (Fecal coliform does not need to be analyzed as it is no longer an indicator species for the state water quality standards).

4.2. Sampling Event Coordination

Stormwater sampling by MWRA (in Arlington and Medford), Cambridge, and Somerville will be coordinated to sample in the same storms to the extent possible. MWRA will collect CSO samples during different storm events, separate from the stormwater sampling.

4.3. CSO sampling

The following is excerpted from the October 2002 *Draft Work Plan for Alewife Brook Combined Sewer Overflow Monitoring, Fall 2002*, and is applicable to the current program as well. The 2002 protocol is suggested as a starting point for the current program.

“Round 1 of wet-weather sampling will occur after flow has been established in the CSO, beginning at t = 0. Timing of this round may vary at each sampling location depending on the timing of the initial activation of the CSO, but will be taken within the first fifteen minutes of CSO activation (t = 15 minutes). Capturing samples at this time is important because this is most likely the period during which the highest levels of pollutants are being discharged.

Round 2 is then sampled during the sustained activation stage of the CSO, in which samples from this period are generally more representative of the average discharge concentration entering the receiving water. Timing of round 2 will depend on the characteristics of the storm, the expected duration of rainfall, and the expected duration of CSO activation. Round 2 may be typically sampled approximately one hour after the first round of sampling, designated as t = 60 minutes.

After each round of samples is collected, bottles will be placed in an iced cooler and delivered by a sample runner to the MWRA's Deer Island laboratory for analysis. It is anticipated that the short holding

time of the samples may require intermediate trips to the laboratory by multiple runners so that the samples are analyzed within the required eight-hour holding time.”³

The field sampling teams will note temperature, pH, total chlorine residual, color, and odor at the time of collection.

Several criteria were put into place in the October 2002 draft Work Plan to define a valid wet weather event for potential CSO sampling:

- If possible, at least two antecedent dry days.
- Predicted storm with at least 1.0 inch in a 12-hour period or a minimum predicted intensity of 0.25 inches/hour. With the updated meter data and scattergraphs available in the CSO Assessment semiannual reports, MWRA may revise this criterion.

It should be noted that in the fall 2002 program no CSO discharge occurred at the locations being sampled during the sampling events, therefore all samples were taken behind the overflow weir. While it is the goal of this program to collect samples representing actual discharges, in the event a discharge does not occur, the same practice will be followed. Due to the configuration of the CSO regulators, sampling behind the weir during a non-discharge event can only occur at SOM001A.

4.4. Stormwater sampling

The following is excerpted from the December 15, 1999 *Draft Results of Stormwater Monitoring for the Upper Mystic River, Fall 1999*. That report summarized MWRA efforts in Medford; Cambridge and Somerville did concurrent sampling, but no Work Plans or data reports were available to MWRA. Like the CSO sampling, this guidance is applicable to the current program.

“During each rainfall event, the sampling team takes five (5) grab samples at each of the three (3) monitoring locations in Medford (total of 15 samples per rainfall event). A typical sampling scenario includes an initial, background sample just prior to the beginning of rainfall, then two samples taken during the first two hours of the rainstorm with the intent of capturing the "first flush" through the drain. The subsequent two samples are taken thereafter every half-hour or hourly depending on the anticipated duration of the rainfall event, the size of the drainage basin, and the travel time from the upstream end of the basin to the monitoring location. The timing of collections for grab samples is dependent upon the expected duration of the rainfall event, but in all cases samples are taken at greater frequency during the early stages of the rainfall.”

Temperature, pH, total chlorine residual, color, and odor will be noted at the time of collection.

The minimum recommended threshold for rainfall for stormwater sampling was a total of 0.5 inches over a 24-hour period.⁴ There was no requirement for antecedent dry days. For this program, MWRA will target 2-day antecedent dry days if possible.

Note that Cambridge and Somerville took fewer samples than MWRA did in Medford in 1999-2002. The municipalities took three and two rounds of samples, respectively. MWRA has requested the

³ *Draft Work Plan for Alewife Brook Combined Sewer Overflow Monitoring, Fall 2002*

⁴ *Draft Results of Stormwater Monitoring for the Upper Mystic River, Fall 1999*

municipalities match, to the best of their abilities, the five samples per location that MWRA intends to take for each sampling event in both Arlington and Medford.

4.5. Sample Analysis

Samples from MWRA and Somerville sampling will be sent to MWRA's Deer Island Central Lab for analysis. G&L Labs (Quincy, MA) will analyze samples from Cambridge. Both labs have reviewed test procedures in order to maximize consistency and comparability. MWRA will transport the samples from Arlington, Medford, and Somerville from a centralized muster point to the Deer Island Central Lab. Cambridge will deliver their samples directly to G&L.