AECOM

Odor Sampling and Evaluation of the MWRA Collection System and CSO Outfalls Along the Alewife Brook, Upper Mystic River, and Charles River

June 2, 2025

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1. Introduction

Exhibit A Item 4 in both the *2024 Final Determination to Adopt a Water Quality Standards Variance for Combined Sewer Overflow Discharges to Alewife Brook/Upper Mystic River Basin* (Alewife Variance) and the *2024 Final Determination to Adopt a Water Quality Standards Variance for Combined Sewer Overflow Discharges to Lower Charles River/Charles Basin* (Charles River Variance) required MWRA to conduct an evaluation of odors potentially associated with the CSO outfalls tributary to the waterbodies covered by the two Variances (the variance waters). Specifically, the Alewife and Charles River Variances required MWRA to "complete an evaluation of odors emanating from the collection system in the vicinity of CSO structures, identify potential best management practices (BMPs) for reducing odors near CSO structures, and submit a written report to MassDEP"[1]. The Variances also required MWRA to "implement the most feasible BMPs identified by the evaluation"[2].

This report presents the findings of the odor assessment conducted by the MWRA in accordance with the Variance requirements, and is organized into the following chapters:

- Chapter 1: Introduction
- Chapter 2: Potential Sources of Odors in Sewer Collection Systems
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- Chapter 4: Preparation for Site Investigations
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2. Potential Sources of Odors in Sewer Collection Systems

Gases exist within sewer systems and at times can emanate from the system into public areas causing an unpleasant odor. Hydrogen sulfide (H_2S) is typically the primary source of nuisance odor in collection systems, although a number of other compounds found in wastewater can also contribute to unpleasant odor (Table 2-1). H_2S forms during anaerobic decomposition of organic matter containing sulfur, when sulfate reducing bacteria (SRB) use the oxygen from the sulfate that is present in the wastewater. Since H_2S does not dissolve well in water, it can enter the atmosphere whenever the sewage flow is in contact with open air, such as in a pipe that is not flowing full.

Table 2-1. Odorous Compounds in Sewers[3]

Compound	Odor Quality
Amines	Fishy
Ammonia	Ammoniacal
Diamines	Decayed flesh
Hydrogen Sulfide	Rotten eggs
Mercaptans	Skunk
Organic Sulfides	Rotten Cabbage
Skatole	Fecal

[1] *2024 Final Determination to Adopt a Water Quality Standards Variance for Combined Sewer Overflow Discharges to Alewife Brook/Upper Mystic River Basin*, and *2024 Final Determination to Adopt a Water Quality Standards Variance for Combined Sewer Overflow Discharges to Lower Charles River/Charles Basin* Exhibit A, Item 4.
[2] Ibid.
[3] From Table 7-3, Metcalf & Eddy, Inc. 1981. *Wastewater Engineering Collection and Pumping of Wastewater*

Locations in sewage collection systems that tend to be prone to odor releases include the following:

- Locations where the flow is turbulent, such as where flow from two pipes comes together in a manhole, sudden pipe size changes, bends, pipe slope changes or where flow drops into a pump station wetwell.
- Locations where the air pressure within the sewer can increase. As sewage flows in a partially-full sewer, friction between the water surface and the air above the flow tends to "drag" the air along in the direction of the flow. If the flow velocity suddenly drops (which may happen, for example, if the slope of the pipe becomes flatter), the downstream movement of air would also slow down, potentially resulting in an increase in air pressure. Another common example would be at inverted siphons (such as where a sewer has to dip down to get under a brook, then come back up on the other side of the brook). The section of pipe under the brook, in this example, would always be full of sewage, so the air being pulled along the sewer upstream of the inverted siphon has nowhere to go. For this reason, inverted siphons are typically provided with vents, to minimize the buildup of air pressure in the upstream sewer.
- Locations with stagnant flow or solids buildup. These locations foster the anaerobic conditions that encourage the generation of H_2S from the anaerobic decomposition of organic matter containing sulfur.

Siphon structures are at particular risk for generating odors as during dry weather, organic material can settle out of the water, increasing the likelihood that H_2S could be produced, then during wet weather, increased velocity and turbulence at both ends of the siphon could release odorous gases to the atmosphere.

3. Review of Odor Complaints

Odor complaints can be submitted by residents to the Cities of Boston, Cambridge, and Somerville through the respective city websites and 311 hotlines. MWRA requested odor complaints for the last five years from these three communities to assess if complaints were submitted near variance water CSO outfalls that could be attributed to the sewer system. Data were received from the Boston Public Health Commission (BPHC) and the Cities of Cambridge and Somerville.

The BPHC conducted a review of their complaints and found 19 complaints about "Outdoor Air Quality, Odors" from January 1, 2020, to through March of 2025. The review noted that the majority of the complaints were related to specific businesses, construction sites, or chemical odors from business activities. Four of the complaints were identified as possibly being related to the sewer collection system. Table 3-1 provides a list of these complaints. The location of each of these complaints was reviewed and none were found to be located close to CSO outfalls tributary to the variance waters.

Table 3-1. Boston Public Health Commission Odor Complaints

Date of Complaint	Address	Complaint Description
December 2020	Near 725 Harrison Avenue	Complaint of 'steam from a manhole" at 725 Harrison Avenue.
April 2021	25 Peterborough Street	"Sewage type odor" complaint tracked to hydrogen sulfide from peat layer in construction excavation adjacent.
March 2023	80 West Broadway, SB	Odors from sewer re-lining project.
April 2023	3 Parley Vale, JP	Issue of sewage overflow from a pipe (this is an ongoing project).

A total of six odor complaints in Somerville were in the vicinity of Alewife Brook and the Mystic River, with three complaints linked to each of the respective receiving waters as summarized in Table 3-2. One odor complaint from 2020 described an odor that appeared to be originating from the Alewife Brook. The status of each of the odor complaints is closed, indicating that the complaint has been investigated by the party responsible and resolved with no further action needed.

Table 3-2. City of Somerville Odor Complaints Located Near the Alewife Brook and Mystic River

Date of Complaint	Address	Complaint Description	Status
11/2/2017 10:51	42 Garrison Ave	Constituent reported the catch basin in front of his property smells very bad and it has been like that for about a month. He would like someone to check on this issue and see if anything can be done to improve the situation, please. 42-44 Garrison Ave. Thanks for your assistance!	Closed
7/25/2019 14:51	87 Wheatland Street	Please clean out, it has a very bad smell coming from it.	Closed
9/1/2020 14:54	71 Victoria Street	Report of bad odor in the area of 71 Victoria St. Resident does not believe it is coming from the sewer system but from Alewife Brook. Needs to be investigated.	Closed
9/7/2021 13:36	449 Canal Street	Constituent reports a bad odor coming from the catchbasin at 449 Canal Street.	Closed
6/27/2022 14:22	145 Middlesex Ave	Called to report sewage smell outside of Trader Joe's. Informed that nearby sewer cleaning projects are likely the result.	Closed
8/14/2023 15:38	1246 Broadway	Bad water smell throughout building.	Closed

Cambridge provided an extensive list of odor maintenance logs for the areas tributary to the Charlies River and Alewife Brook. These logs include the dates of odor maintenance conducted in their system at storm inlets. These data could not be directly linked to variance water CSO locations.

While odor complaints are generally submitted to the respective communities, the MWRA has also responded to odor complaints along Alewife brook. For example, in 2022 a representative from Save the Alewife Brook reported to MWRA operations that an odor was present at the upstream end of one of the Alewife Brook sewer interceptor siphons. In response, MWRA operations inspected the structure and applied a silicon seal on the manhole cover to prevent odors from escaping, see Figure 3-1. Following these actions, Save the Alewife Brook reported that “this solution worked” and the odor was no longer present[4].

Figure 3-1. Example of a Silicon Seal on the Manhole Cover to Prevent Odors from Escaping

[4] About that Disgusting Smell. – Save the Alewife Brook, November 11, 2022.

4. Preparation for Site Investigations

To prepare for the site investigations, the sampling locations and sampling procedures needed to be developed. The process for developing the locations and procedures is described in the following sections.

4.1. Sampling Locations

Odor sampling locations included each of the MWRA-owned CSO structures that discharge to variance waters, and locations along MWRA interceptors adjacent to the receiving waters where potentially turbulent flow could occur including the upstream and downstream ends of siphons. Figure 4-1 presents a location plan for each of the locations where odor samples were measured as part of the field investigations. Each of the MWRA-owned CSO outfalls is shown in Figure 4-1 with a green triangle. Additional sampling locations included the following:

- Three locations along the Alewife Brook where there are interconnections between the Alewife Brook Conduit (ABC) and the Alewife Brook Branch Sewer (ABBS).
- The upstream and downstream ends of the three siphons located along the Alewife interceptors (the ABC Siphon near the MBTA garage, the siphon under the Alewife Brook just downstream of the MWR003 regulator, and the ABC siphon further downstream near Mass Ave).
- The Alewife Brook Pump Station, Somerville Marginal CSO Facility, Cottage Farm CSO Facility and the Fens Gatehouse just upstream of outfall MWR023.

Additional information on these locations is presented in Table 4-1. Site plans with additional details on each sampling location are included in Appendix C.

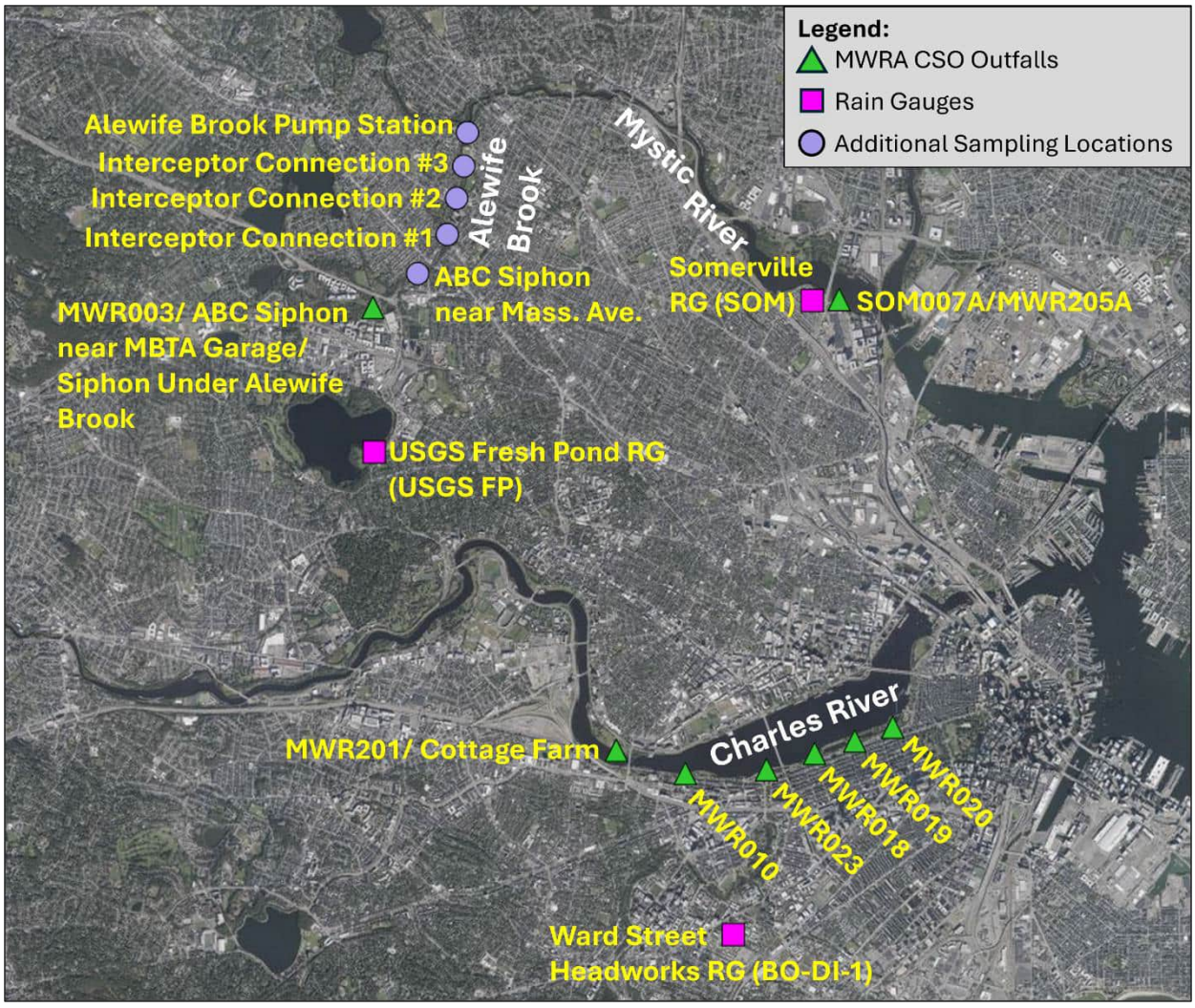

Figure 4-1. Sampling Location Plan

Table 4-1. Sampling Locations

Name	Sampling Location Description	Address
Alewife Brook		
Alewife Brook Pump Station	1) North Side of pump station near grates 2) South side of pump station	392 Alewife Brook Parkway, Somerville, MA 02144
ABC and ABBS Interceptor Connection #3 Sta. 83+55(1)	1) Manhole is located in the sidewalk across the street from Stop and Shop	105 Alewife Brook Parkway, Somerville, MA 02144
ABC and ABBS Interceptor Connection #2 Manhole at Sta. 70+71(1)	1) Across the street from 45 Alewife Brook Parkway, Cambridge, MA 02140	Alewife Brook Parkway, Cambridge, MA
ABC and ABBS Interceptor Connection #1 Manhole at Sta. 63+63(1)	1) Across the street from 25 Alewife Brook Parkway, Cambridge, MA 02140 between the bike path and Alewife Brook	25 Alewife Brook Parkway, Cambridge, MA
ABC Siphon Structure near Mass. Ave. Sta. 53+00 (upstream) Sta. 55+72 (downstream)(1)	1) Siphon Head House Sta. 53+00 (Arlington) – Near Eversource Valve chamber. 2) Siphon Vent Sta. 55+72 (Cambridge)	Boulevard Road, near the intersection of Mass. Ave. and Alewife Brook Parkway Arlington, MA.
MWR003 Outfall and Regulator	1) At the regulator structure 2) Where the outfall meets the shoreline	Alewife Station Access Road, Arlington, MA
ABC Siphon near MBTA garage	1) Siphon Head House Sta. 2+92(2) 2) Downstream End of Siphon Sta. 2+21(2)	Alewife Station Access Road, Arlington, MA
Siphon Under Alewife Brook Sta. 34+26(1)	1) In the wooded area adjacent to the bike path on the Arlington side of the brook.	Alewife Station Access Road, Arlington, MA
Charles River		
Cottage Farm CSO Facility (MWR201)	1) North Charles Relief Sewer (NCRS) diversion chamber 2) South Charles Relief Sewer (SCRS) diversion chamber 3) Where the outfall meets the shoreline	Magazine Beach 668 Memorial Drive, Cambridge, MA
MWR010 Outfall and Regulators (RE037 and RE036-9)	1) At the grates where the overflow line drops below Storrow Drive 2) Two regulator structures (measurements taken from the curb) 3) Where outfall meets the shoreline.	Commonwealth Ave and St Mary's Street, Boston, MA
MWR023 Outfall and Fens Gatehouse	1) Outside of Fens Gatehouse	Storrow Drive Boston, MA
MWR018 Outfall and Regulator	1) At the regulator structure 2) Where the outfall meets the shoreline	Storrow Drive Boston, MA
MWR019 Outfall and Regulator	1) At the regulator structure 2) Where the outfall meets the shoreline	Storrow Drive Boston, MA
MWR020 Outfall and Regulator	1) At regulator structure 2) Where the outfall meets the shoreline	Storrow Drive Boston, MA
Mystic River		
MWR205A/SOM007A Outfall and Regulator	1) At the weir structure for MWR205A 2) Where the outfall meets the shoreline	Fellsway and Grand Union Boulevard Somervile, MA

Notes: 1: North Metropolitan Sewerage District, Alewife Brook Conduit Contract No. 154. Sheets 6, 11, 12, and 13
2: MWRA GIS

4.2 Dry and Wet Weather Sampling

The sampling program targeted taking samples under both dry and wet weather conditions. Dry weather was defined as a period when no rainfall or only trace amounts occurred in the period of approximately 36 hours prior to the sampling event. Wet weather was defined as having a period of rain prior to or during the sampling with the goal of collecting samples when CSOs were active.

In order to prepare for wet weather activations, the rainfall conditions under which CSO activations historically occurred were reviewed. Data were reviewed for the 2020 through March 9th, 2025 period for the MWRA outfalls where field sampling was planned (MWR003 for Alewife Brook, SOM007A/MWR205A for the Mystic River, and Cottage Farm (MWR201), MWR010, MWR023, MWR018, MWR019, and MWR020 for the Charles River). Overflow data was then correlated with the rainfall associated with the activation, the summary is presented in Table 4-2 below. The information in Table 4-2 was used in monitoring rainfall forecasts to assess whether the predicted rainfall was likely to trigger a CSO activation.

Table 4-2. Summary of Historical CSO Activations and Associated Rainfall from January 2020 to March 9, 2025, at CSO Sampling Locations

Outfall	Receiving Water	Number of Activations	Rain Gage	Average Rainfall Depth that Caused an Activation (in.)	Average Peak Rainfall Intensity (in/hr) that Caused an Activation
MWR003	Alewife Brook	9	USGS Fresh Pond	2.89	0.95
SOM007A/ MWR205A	Mystic River	51	Somerville	1.83	0.39
Cottage Farm (MWR201)	Charles River	21	USGS Fresh Pond	2.34	0.75
MWR010(1)	Charles River	0	Ward St (BO-DI-1)	-	-
MWR018	Charles River	9	Ward St (BO-DI-1)	3.03	1.19
MWR019	Charles River	8	Ward St (BO-DI-1)	3.21	1.21
MWR020	Charles River	8	Ward St (BO-DI-1)	3.21	1.21
MWR023	Charles River	13	Ward St (BO-DI-1)	2.53	1.00

(1) MWR010 did not activate during this period.

4.3 Odor Sampling Project Operating Procedure

The Project Operating Procedure (POP) outlined the approach related to monitoring, data evaluation, and assessment for H_2S gas and odor intensity used for this study. This procedure, which can be found in Appendix D, provides detailed instructions for operation, calibration, maintenance, and troubleshooting of the Jerome® 631-X H_2S Analyzer which is the sensor that was used to measure the presence of H_2S. Additionally, the POP covers the procedures for performing observational monitoring of odor intensity, visible floatables, and relevant weather conditions at each of the designated CSO outfall locations, taking into consideration site-specific challenges and environmental factors to support consistent sampling. Other key sections include health and safety plans, data records and management, and general considerations to be taken throughout the sampling program.

As discussed in Sections 4.1 and 4.2 above, observational and H_2S sampling was intended to be performed during both dry weather and wet weather conditions at the sampling locations identified. Dry weather sampling was intended to understand baseline conditions. Wet weather sampling was intended to understand conditions at these locations when higher flows were present in the collection system due to stormwater runoff and if possible, when CSOs were active. Wet weather sampling was to be scheduled based on forecasted rainfall depth and intensity using weather conditions in accordance with Table 4.2.

The dry and wet weather monitoring procedure (Section 6.2 of the POP) is summarized below, and example Field Data Sheets can be found in Appendices A and B:

1. Prepare the instrumentation at the start of each monitoring event (dry and wet weather)
2. Evaluate the monitoring location for safety hazards; establish and document safe measurement locations.
3. Determine relevant weather conditions, including wind speed and wind direction.
4. Perform hand-held H_2S monitoring at a minimum of three locations near each identified sampling site (2 downwind and 1 upwind) using the Jerome 631-X H_2S Analyzer. This analyzer can measure concentrations as low as 0.001 ppm, with a resolution of 0.003 ppm. The accuracy across different concentration ranges is presented in Table 3 of the POP. Hydrogen sulfide becomes detectable by smell at concentrations between 0.005 ppm and 0.008 ppm. Thus, this instrument should be capable of detecting H_2S before it reaches the threshold of smell.
5. Perform observational odor monitoring at a minimum of 3 locations near each identified sampling site (2 downwind and 1 upwind). Record odor based on the Odor Observation Scale in Table 4 of the POP.
6. Perform observational monitoring of outflow for floatables.
7. Once sampling is complete, confirm relevant H_2S, odor and visual observations have been recorded on the Field Data Sheet.
8. Perform sampling at additional locations, as needed by repeating steps 1-7 for each sampling location.

4.3.1 Multi-Faceted Sampling Approach

In order to measure for the presence of H_2S, a minimum of two downwind and one upwind measurements were taken at each identified sampling site in accordance with the POP. Sampling at additional locations was performed as needed based on field observations and MWRA request. An example of recording multiple H_2S samples at a pre-identified location is shown in Figure 4-2 below where highlighted letters a-d represent individual H_2S samples. Samples a, b, and c represent the upwind and downwind H_2S recordings, while sample d was added to most sampling sites to represent the closest H_2S recording to the sewer system. Sample d was collected without opening collection system structures as the sensor nozzle was placed directly above manhole cover pick holes where odors could escape (see Figure 4-3). Appendix C provides the specific sample locations for each sampling site and Appendices A and B provide the corresponding measurements recorded at these locations during both dry and wet weather sampling.

Figure 4-2. Locations for the H_2S Samples Taken at ABC & ABBS Interceptor Connection #1 (Sta. 63+63) Along the Alewife Brook Parkway; a = upwind, b and c = downwind, d = structure

Figure 4-3. Handheld H_2S Meter Sample Taken at ABC & ABBS Interceptor Connection #1 (Sta. 63+63) on 3/19/25 Along the Alewife Brook Parkway

5. Sampling Events and Results

Dry weather sampling was conducted on March 19, 2025 along Alewife Brook and Mystic River, and on March 26, 2025 along the Charles River. Wet weather sampling took place on May 6, 2025 at the sampling locations along Alewife Brook and the Mystic River. Each of the site visits was attended by two AECOM staff and MWRA staff. During the site visits, an external assessment of the regulator and outfall was conducted to assess the general condition including the presence of cracks and evidence of sediment build up at the outfall (no confined space entry). Observations of odors (if present) were recorded, and levels of hydrogen sulfide were measured with a handheld meter.

5.1 Review of Rainfall Events and CSO Activations During the Sampling Period

Monitoring rainfall for the field investigation period began on March 10, 2025 and ended on May 6, 2025. Rainfall data was collected and reviewed from three rain gauges located near the CSO outfalls where sampling occurred. Tables 5-1 through 5-3 show the rainfall characteristics for each event during the monitoring period for the Ward Street Headworks (BO-DI-1), USGS Fresh Pond (USGS), and Somerville (SOM) rain gauges, respectively. Individual rain events were defined by a 12-hour inter-event time. Rainfall data was reviewed for data gaps but was not subject to more detailed QAQC.

Table 5-1. Summary of Storm Events at Ward Street Headworks Rain Gauge (BO-DI-1) for March 10, 2025, to May 6, 2025

Event	Date & Start Time	Duration (hr)	Volume (in)	Average Intensity (in/hr)	Peak 1hr Intensity (in/hr)	Peak 24hr Intensity (in/hr)	Peak 48hr Intensity (in/hr)	Atlas-14 Recurrence Interval [1]		
								1-hr	24-hr	48-hr
1	3/16/25 23:15	17.75	1.65	0.09	0.57	0.07	0.03	6m	6m	N/A
2	3/20/25 5:30	0.25	0.01	0.04	0.01	0.00	0.00	<3m	<3m	N/A
3	3/21/25 0:45	7.50	0.41	0.05	0.12	0.02	0.01	<3m	<3m	N/A
4	3/24/25 9:15	9.00	0.84	0.09	0.28	0.04	0.02	<3m	<3m	N/A
5	3/25/25 10:00	0.25	0.01	0.04	0.01	0.00	0.00	<3m	<3m	N/A
6	3/29/25 3:15	12.75	0.05	0.00	0.02	0.00	0.00	<3m	<3m	N/A
7	3/31/25 4:45	0.25	0.01	0.04	0.01	0.00	0.00	<3m	<3m	N/A
8	3/31/25 23:00	4.00	0.63	0.16	0.39	0.03	0.01	3m	<3m	N/A
9	4/2/25 21:45	13.00	0.26	0.02	0.08	0.01	0.01	<3m	<3m	N/A
10	4/5/25 13:15	22.00	0.79	0.04	0.15	0.03	0.02	<3m	<3m	N/A
11	4/7/25 5:00	30.50	0.18	0.01	0.05	0.01	0.00	<3m	<3m	<3m
12	4/11/25 1:30	4.50	0.14	0.03	0.05	0.01	0.00	<3m	<3m	N/A
13	4/11/25 20:45	14.00	0.48	0.03	0.10	0.02	0.01	<3m	<3m	N/A
14	4/13/25 17:00	2.00	0.03	0.02	0.02	0.00	0.00	<3m	<3m	N/A
15	4/15/25 8:00	10.00	0.13	0.01	0.10	0.01	0.00	<3m	<3m	N/A
16	4/22/25 2:00	2.50	0.3	0.12	0.23	0.01	0.01	<3m	<3m	N/A
17	4/25/25 7:15	2.50	0.08	0.03	0.04	0.00	0.00	<3m	<3m	N/A
18	4/26/25 6:00	11.25	0.62	0.06	0.26	0.03	0.01	<3m	<3m	N/A
19	5/2/25 3:45	1.25	0.21	0.17	0.19	0.01	0.00	<3m	<3m	N/A
20	5/3/25 19:15	0.50	0.05	0.10	0.05	0.00	0.00	<3m	<3m	N/A
21	5/4/25 18:45	51.50	0.90	0.02	0.21	0.02	0.02	<3m	<3m	3m

(1) Recurrence intervals given in ranges of less than 3 months (<3m), 3-months, (3m), 3-6 months (3-6m), 6 months (6m), 6 months-1 year (6m-1y), 1 year (1y), 1 to 2 years (1y-2y) or the nearest 6-month interval for recurrence intervals >2 years, based on Atlas 14.

Table 5-2.Summary of Storm Events at USGS Fresh Pond Rain Gauge for March 10, 2025, to May 6, 2025

Event	Date & Start Time	Duration (hr)	Volume (in)	Average Intensity (in/hr)	Peak 1hr Intensity (in/hr)	Peak 24hr Intensity (in/hr)	Peak 48hr Intensity (in/hr)	Atlas-14 Recurrence Interval[1]		
								1-hr	24-hr	48-hr
1	3/17/25 1:15	15.25	1.28	0.08	0.55	0.05	0.03	6m	3m	N/A
2	3/21/25 1:15	6.75	0.24	0.04	0.09	0.01	0.01	<3m	<3m	N/A
3	3/24/25 9:30	8.50	0.72	0.08	0.23	0.03	0.02	<3m	<3m	N/A
4	3/29/25 4:15	0.25	0.01	0.04	0.01	0.00	0.00	<3m	<3m	N/A
5	3/31/25 23:15	3.50	0.62	0.18	0.36	0.03	0.01	3m	<3m	N/A
6	4/2/25 22:15	12.25	0.26	0.02	0.12	0.01	0.01	<3m	<3m	N/A
7	4/5/25 13:15	22.75	0.52	0.02	0.15	0.02	0.01	<3m	<3m	N/A
8	4/11/25 2:30	1.25	0.03	0.02	0.02	0.00	0.00	<3m	<3m	N/A
9	4/12/25 14:00	1.00	0.03	0.03	0.03	0.00	0.00	<3m	<3m	N/A
-	4/22/25 2:30	22.50	USGS Fresh Pond RG Data Unavailable – No Data Recorded [2]							
10	4/25/25 9:45	0.25	0.01	0.04	0.01	0.00	0.00	<3m	<3m	N/A
11	4/26/25 6:00	14.25	0.42	0.03	0.20	0.02	0.01	<3m	<3m	N/A
12	4/27/25 10:15	0.25	0.01	0.04	0.01	0.00	0.00	<3m	<3m	N/A
13	5/2/25 4:00	1.00	0.18	0.18	0.18	0.01	0.00	<3m	<3m	N/A
14	5/3/25 17:00	0.25	0.02	0.08	0.02	0.00	0.00	<3m	<3m	N/A
15	5/4/25 13:15	19.00	0.76	0.04	0.23	0.03	0.02	<3m	<3m	N/A
16	5/5/25 22:30	21.00	0.18	0.01	0.06	0.01	0.00	<3m	<3m	N/A

(1) Recurrence intervals given in ranges of less than 3 months (<3m), 3-months, (3m), 3-6 months (3-6m), 6 months (6m), 6 months-1 year (6m-1y), 1 year (1y), 1 to 2 years (1y-2y) or the nearest 6-month interval for recurrence intervals >2 years, based on Atlas 14.
(2) Time and duration represent the time period where USGS Fresh Pond RG data was unavailable/ no data was recorded.

Table 5-3. Summary of Storm Events at Somerville Rain Gauge for March 10, 2025, to May 6, 2025

Event	Date & Start Time	Duration (hr)	Volume (in)	Average Intensity (in/hr)	Peak 1hr Intensity (in/hr)	Peak 24hr Intensity (in/hr)	Peak 48hr Intensity (in/hr)	Atlas-14 Recurrence Interval (1)		
								1-hr	24-hr	48-hr
1	3/17/25 1:00	15.25	1.43	0.09	0.55	0.06	0.03	6m	3m-6m	N/A
2	3/21/25 0:30	7.50	0.34	0.05	0.10	0.01	0.01	<3m	<3m	N/A
3	3/24/25 9:15	9.00	0.74	0.08	0.22	0.03	0.02	<3m	<3m	N/A
4	3/29/25 3:15	0.50	0.02	0.04	0.02	0.00	0.00	<3m	<3m	N/A
5	3/30/25 0:00	2.50	0.03	0.01	0.02	0.00	0.00	<3m	<3m	N/A
6	3/31/25 22:45	3.75	0.70	0.19	0.43	0.03	0.01	3m	<3m	N/A
7	4/2/25 21:30	13.00	0.31	0.02	0.12	0.01	0.01	<3m	<3m	N/A
8	4/5/25 13:00	22.25	0.64	0.03	0.11	0.03	0.01	<3m	<3m	N/A
9	4/7/25 4:45	11.25	0.07	0.01	0.02	0.00	0.00	<3m	<3m	N/A
10	4/8/25 7:45	4.75	0.06	0.01	0.03	0.00	0.00	<3m	<3m	N/A
11	4/11/25 1:30	3.75	0.12	0.03	0.04	0.01	0.00	<3m	<3m	N/A
12	4/11/25 21:00	12.25	0.3	0.02	0.06	0.01	0.01	<3m	<3m	N/A
13	4/13/25 2:15	0.25	0.01	0.04	0.01	0.00	0.00	<3m	<3m	N/A
14	4/13/25 16:15	4.50	0.05	0.01	0.02	0.00	0.00	<3m	<3m	N/A
15	4/15/25 7:45	10.50	0.14	0.01	0.08	0.01	0.00	<3m	<3m	N/A
16	4/22/25 1:30	3.00	0.47	0.16	0.36	0.02	0.01	3m	<3m	N/A
17	4/25/25 7:00	3.00	0.03	0.01	0.02	0.00	0.00	<3m	<3m	N/A
18	4/26/25 5:45	11.00	0.60	0.05	0.27	0.03	0.01	<3m	<3m	N/A
19	5/2/25 3:45	1.25	0.18	0.14	0.17	0.01	0.00	<3m	<3m	N/A
20	5/3/25 17:00	41.00	0.90	0.02	0.24	0.03	0.02	<3m	<3m	3m

(1) Recurrence intervals given in ranges of less than 3 months (<3m), 3-months, (3m), 3-6 months (3-6m), 6 months (6m), 6 months-1 year (6m-1y), 1 year (1y), 1 to 2 years (1y-2y) or the nearest 6-month interval for recurrence intervals >2 years, based on Atlas 14.

During the field investigation period, the number of rainfall events recorded at the three gauges listed above ranged between 16 and 22. One CSO occurred during the sampling period at SOM007A/MWR205A during the March 17, 2025 storm. For this event, the Somerville rain gauge recorded a total rainfall depth of 1.43-inches and a peak hourly rainfall intensity of 0.55 in/hr, which was in the range of the average rainfall conditions that would be associated with CSO activations at SOM007A/MWR205A presented in Table 4-2. However, this CSO occurred outside of working hours at 4:35 AM with a duration of only 10 minutes and as a result, odor sampling was not conducted. No other storms during this period had a rainfall depth or intensity above the historical average depths and intensities associated with CSO events at the variance outfalls.

5.2 Alewife Brook and Mystic River Sampling Events

5.2.1 Dry Weather

Dry weather odor sampling was conducted on March 19, 2025 at 14 different locations along Alewife Brook/ Alewife Brook Parkway and the Mystic River. Of the 49 H_2S samples taken, all measurements were 0.000 ppm. Odor intensities of 2 (on a scale of 0 to 8, reference Table 4 of the POP for the Observation Scale) were reported at two of the 14 locations. Table 5-4 below summarizes the H_2S measurements and observed odors.

Table 5-4. Summary of March 19, 2025 Dry Weather Odor Sampling Results; Alewife Brook/ Mystic River

Sample Location	Number of H_2S Samples	H_2S (ppm)	Observed Odor (0 – 8 Scale)	Date of Last Rainfall Event	Date of Last MWRA CSO Event	Observation
Alewife Brook Pump Station (South)	3	0.000	0	3/17/2025 (USGS Fresh Pond Rain Gauge)	1/10/2024 (MWR003)	
Alewife Brook Pump Station (North)	3	0.000	0			
ABC and ABBS Interceptor Connection #3 (Sta. 83+55)	4	0.000	0			
ABC and ABBS Interceptor Connection #2 (Sta. 70+71)	4	0.000	0			
ABC and ABBS Interceptor Connection #1 (Sta. 63+63)	4	0.000	0			
ABC Siphon Near Mass Ave. (Sta. 55+72)	4	0.000	2			A piece of trash was observed in the Alewife Brook near CAM401B; A "light" sewage odor was noted at the siphon vent pipe. See data sheet appendices and Figures 5-1 and 5-2 for more details.
ABC Siphon Near Mass Ave. (Sta. 53+00)	4	0.000	0			
Downstream End of MWR003-REG Siphon (Sta. 34+26)	4	0.000	0			
MWR003-REG and Upstream End of Siphon	3	0.000	0			
MWR003-OF	4	0.000	0			
ABC Siphon Near MBTA Garage (Sta. 2+92)	3	0.000	2			"Light" odor at siphon headhouse and on footbridge. See data sheet appendices and Figure 5-3 for more details.
ABC Siphon Near MBTA Garage (Sta. 2+21)	3	0.000	0			
MWR205A-DIV	3	0.000	0	3/17/2025 (Somerville Rain Gauge)	3/17/2025 (SOM007A/ MWR205A)	
MWR205A-OF	3	0.000	0			

In addition to odor sampling, field crews noted any observed floatable material in the Alewife Brook. From the south side of the Massachusetts Avenue bridge, a white paper/packaging like piece of debris was observed downstream of CAM401B (Figure 5-1). Prior to the dry weather sampling, a CSO had not occurred at CAM401B since April 30, 2024 and thus, it is unlikely the piece of trash shown in Figure 5-1 was the result of a CSO. Other trash such as wrappers and packaging was noted along the banks of Alewife Brook upstream of this location as well as other locations along the Alewife Brook.

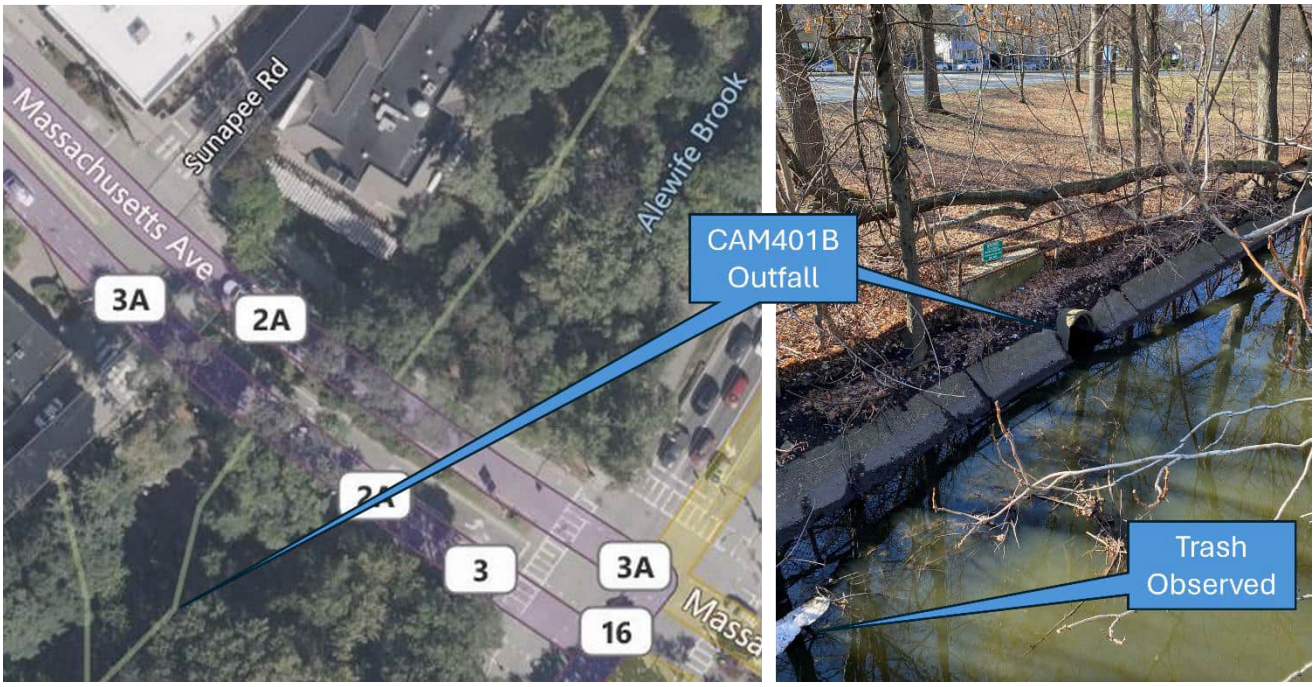

Figure 5-1. Mass Ave Bridge/ CAM401B Outfall where Trash was Observed in Alewife Brook on 03/19/25

The siphon vent shown in Figure 5-2 below is located along the Alewife Brook Parkway near the downstream end of the ABC siphon near Mass Ave (Sta. 55+72). Odor intensities of 2 ("light") were observed at sub-locations b, c, and d during dry weather field sampling. No odor was observed at sub-location a which was upwind, and H_2S measurements read 0.000 ppm at this site location.

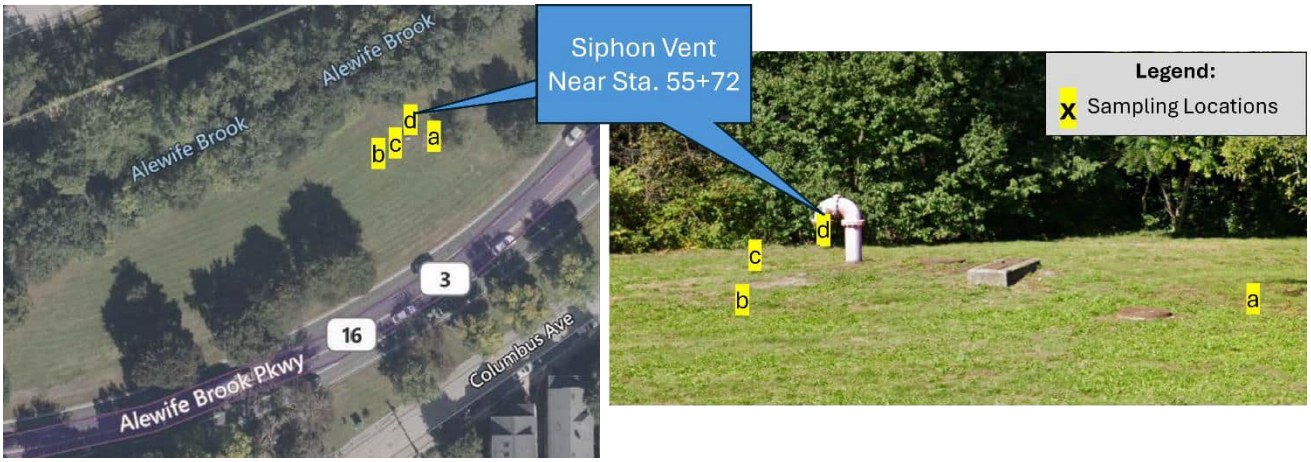

Figure 5-2. ABC Siphon Vent Near Mass Ave (Sta. 55+72)

The siphon headhouse shown in Figure 5-3 below is located adjacent to the MBTA Alewife garage near the MWR003 regulator along the ABC (Sta. 2+92). An odor intensity of 2 ("light") was observed at sub-location c along the edge of the metal cover and along the footbridge. No odor was observed at sub-location a or b, and H_2S measurements read 0.000 ppm.

Figure 5-3. Upstream End of ABC Siphon Near MBTA Garage (Sta. 2+92)

5.2.2 Wet Weather

As noted in Section 4.2, samples were intended to be collected during wet weather when CSOs were active. The weather was monitored during the study period to assess if forecasted rainfall was likely to cause CSO activations in the Alewife Brook/Upper Mystic River area using Table 4-2 as a reference. One event during this period (May 6, 2025) had predicted rainfall that had the potential to cause a CSO activation at outfalls MWR003 or SOM007A. Therefore, wet weather odor sampling was conducted on May 6, 2025, at each of the 14 locations described in Section 5.2.1. As shown in Table 5-2 and 5-3, rainfall began on May 3, 2025, with a duration of 41 hours, a total depth of 0.90 inches, and a peak intensity of 0.29 in/hr. While this storm did not result in a CSO at MWR003 or SOM007A/MWR205A, under these conditions the collection system was subject to higher flows due to stormwater inflow which would increase turbulence in the flow and potentially lead to the release of odorous gases. Of the 49 H_2S samples taken, 47 recorded 0.000 ppm. Observed odor intensities of 1 and 2 (on a scale of 0 to 8, reference Table 4 of the POP for the Observation Scale) were reported at five of the locations. Table 5-5 summarizes the observed odor and H_2S measurements.

Table 5-5. Summary of May 6, 2025 Wet Weather Odor Sampling Results; Alewife Brook/ Mystic River

Sample Location	Number of H_2S Samples	H_2S (ppm)	Observed Odor (0 – 8 Scale)	Date of Last Rainfall Event	Date of Last MWRA CSO Event	Observation
Alewife Brook Pump Station (South)	3	0.000	0	5/5/2025 (USGS Fresh Pond Rain Gauge)	1/10/2024 (MWR003)	
Alewife Brook Pump Station (North)	3	0.017 – 0.048	1			0.017 ppm approximately 1 ft above access grate. 0.048 ppm inside grate opening. Odor intensity of 1 (“very light”) in breathing zone in vicinity of grate. See data sheet appendices and Figure 5-4 for more details.
ABC and ABBS Interceptor Connection #3 (Sta. 83+55)	4	0.000	1			Odor intensity of 1 (“very light”) in breathing zone near manhole. See data sheet appendices and Figure 5-5 for more details.
ABC and ABBS Interceptor Connection #2 (Sta. 70+71)	4	0.000	0			
ABC and ABBS Interceptor Connection #1 (Sta. 63+63)	4	0.000	0			
ABC Siphon Near Mass Ave. (Sta. 55+72)	4	0.001	2			Odor intensity of 2 (“light”) in in vicinity of siphon vent. H_2S reading of 0.001 ppm at siphon vent. See data sheet appendices and Figure 5-6 for more details.
ABC Siphon Near Mass Ave. (Sta. 53+00)	4	0.000	0			
Downstream End of MWR003-REG Siphon (Sta. 34+26)	4	0.000	1			Odor intensity of 1 (“very light”), likely coming from vent pipe. See data sheet appendices and Figure 5-8 for more details.
MWR003-OF	4	0.000	0			
MWR003-REG and Upstream End of Siphon	3	0.000	0			
ABC Siphon Near MBTA Garage (Sta. 2+92)	3	0.000	1			Odor intensity of 1 (“very light”) observed at metal panel at siphon structure. See data sheet appendices and Figure 5-7 for more details.
ABC Siphon Near MBTA Garage (Sta. 2+21)	3	0.000	0			
MWR205A-DIV	3	0.000	0	5/3/2025 (Somerville Rain Gauge)	3/17/2025 (SOM007A/ MWR205A)	
MWR205A-OF	3	0.000	0			

H_2S was measured on the North side of the Alewife Brook Pump Station near the metal panel identified as sample location c in Figure 5-4. When the Jerome meter was held up to the seam in the panel, 0.048 ppm of H_2S was recorded. A reading of 0.017 ppm was recorded approximately one foot above the panel, indicating the H_2S

concentration dissipated by a factor of 2.8 just one foot away while sample location b recorded 0.000 ppm H_2S. Odor at sample location c, an odor level of 1 out of 8 (“very light”) was detected.

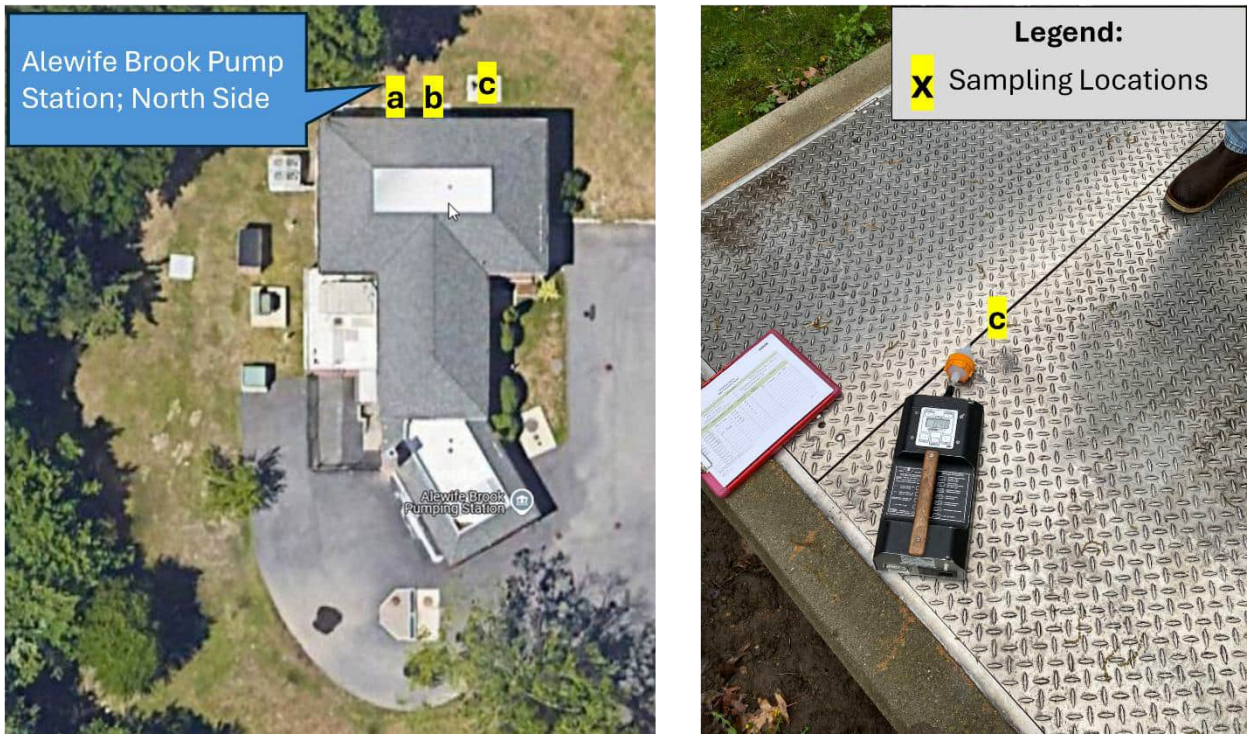

Figure 5-4. Alewife Brook Pump Station, North Side

Odor was observed at ABC and ABBS Interceptor Connection #3 (Sta. 83+55) which appeared to be emanating out of the manhole shown below in Figure 5-5. H_2S was not detected by the Jerome meter, and the observed odor at sample location d was ranked 1 out of 8 (“very light”).

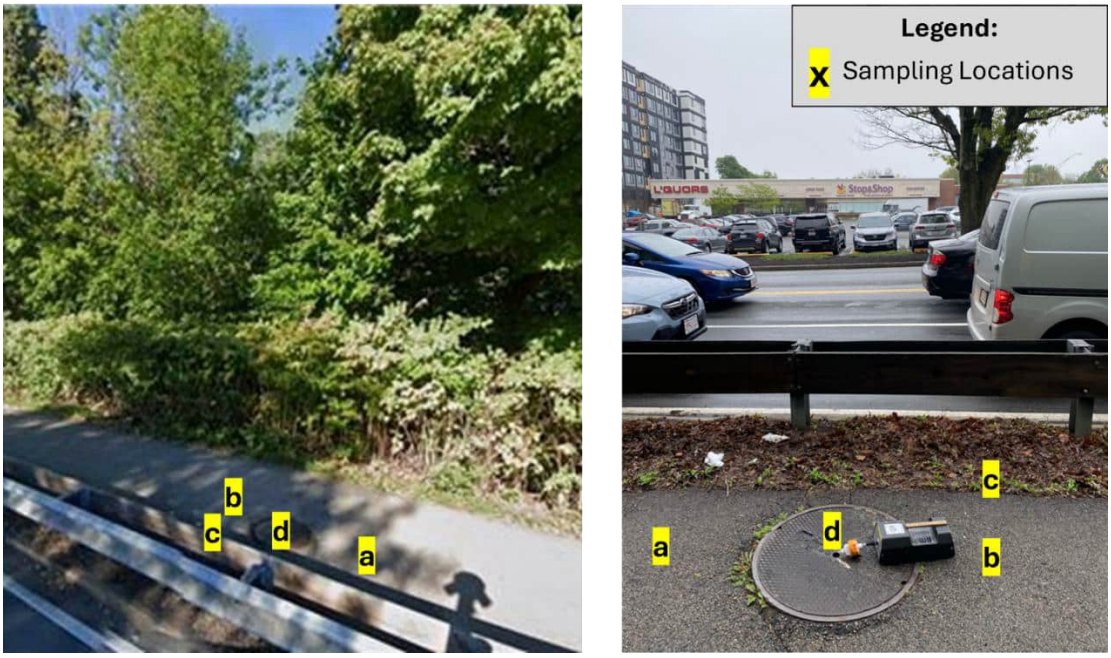

Figure 5-5. ABC and ABBS Interceptor Connection #3 (Sta. 83+55)

An odor level of 2 (“light”) was observed adjacent to the siphon vent at the downstream end of the ABC siphon near Mass Ave. (Sta. 55+72). An H_2S concentration of 0.001 ppm was also measured when the Jerome meter was placed against the exhaust of the siphon vent (sample location d, shown in Figure 5-6 below). As shown in Table 3 of the POP, that reading was below the accuracy threshold of the sensor (+/- 0.003 ppm).

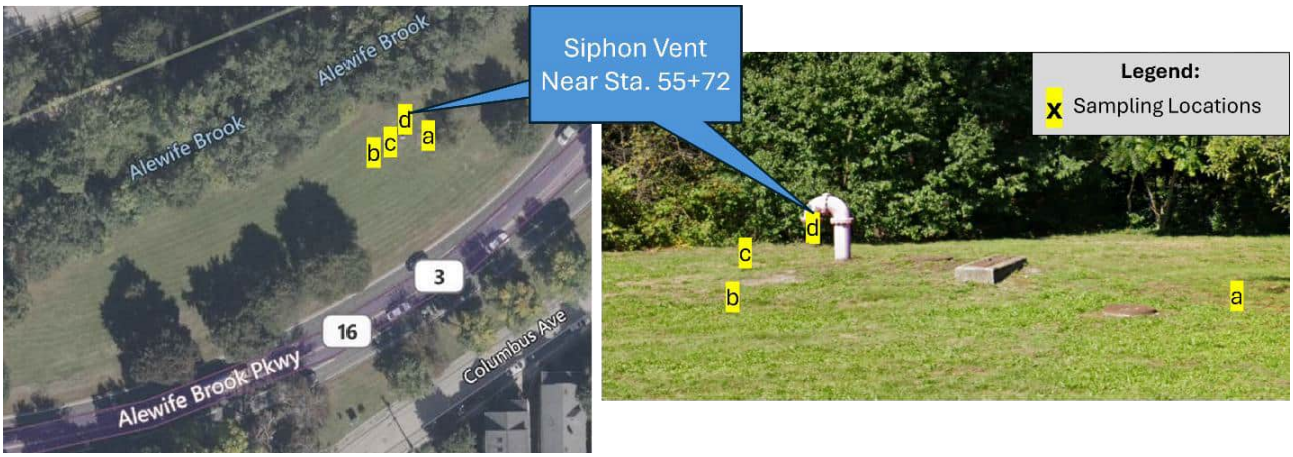

Figure 5-6. ABC Siphon Vent Near Mass Ave (Sta. 55+72)

Odor was observed at Sta. 34+26 at the downstream end of the MWR003 siphon under the Alewife Brook in Arlington. The odor appeared to be emanating out of the siphon vent in the wooded area adjacent to the bike path identified as sample location c in Figure 5-7 below. H_2S was not detected by the Jerome meter, and the observed odor at sample location c was ranked 1 out of 8 (“very light”). Odor was not observed on the bike path.

Figure 5-7. Siphon Under Alewife Brook near MWR003 (Sta. 34+26)

Odor was observed at the upstream end of the ABC siphon near the MBTA garage (Sta. 2+92). The odor appeared to be emanating out of the metal panel identified as sample location c in Figure 5-8 below. H_2S was not detected by the Jerome meter, and the observed odor at sample location c was ranked 1 out of 8 (“very light”). The odor was not observed on the footbridge, however commentary from residents while samples were being taken indicated that the odor can often be detected on the footbridge.

Figure 5-8. Upstream End of ABC Siphon Near MBTA Garage (Sta. 2+92)

5.3 Charles River Sampling Events

5.3.1. Dry Weather

Dry weather odor sampling was conducted on March 26, 2025, at 14 different locations along the Charles River. Of the 51 H_2S samples taken, 48 measurements were 0.000 ppm and three measurements ranged between 0.001 and 0.002 ppm (below the +/- 0.003 ppm accuracy threshold of the sensor). Table 5-6 below summarizes the H_2S measurements and observed odors.

Table 5-6. Summary of March 26, 2025 Dry Weather Odor Sampling Results; Charles River

Sample Location	Number of H_2S Samples	H_2S (ppm)	Observed Odor (0 – 8 Scale)	Date of Last Rainfall Event	Date of Last CSO Event	Observation
MWR201-DIV-North	4	0.001 & 0.002	0	3/25/25 Ward St Headworks (BO-DI-1)	12/11/2024 (MWR201)	Positive H_2S sample recorded at two of the four sample locations. An idling truck approximately 15 feet away may have impacted results. No odors observed. See data sheet appendices and Figure 8 for more details.
MWR201-DIV-South	4	0	0			
MWR201-OF	3	0	0			
MWR010-REG	5	0.001	0		Data was reviewed back to January 2016 and during that period, there were no recorded activations (MWR10)	Positive H_2S sample recorded at one of the five locations. No odors observed. See data sheet appendices and Figure 9 for more details.
MWR010-DROP	2	0	0			
MWR010-OF	3	0	0			
MWR023-FGH	2	0	0		6/26/2024 (MWR023)	
MWR023-OF	4	0	0			
MWR018-REG	4	0	0		6/26/2024 (MWR018)	
MWR018-OF	4	0	0			
MWR019-REG	4	0	0		6/26/2024 (MWR019)	
MWR019-OF	4	0	0			
MWR020REG	4	0	0		6/26/2024 (MWR020)	
MWR020-OF	4	0	0			

Figure 5-9 shows four locations where H_2S samples were taken at the Cottage Farm CSO Facility (MWR201) where the North Charles Relief Sewer (NCRS) diversion structure access manhole is located. While odors were not observed at this location, H_2S samples were registered at locations a (0.001 ppm) and c (0.002 ppm). As shown in Table 3 of the POP, these readings are below the accuracy threshold of the sensor (+/- 0.003 ppm).

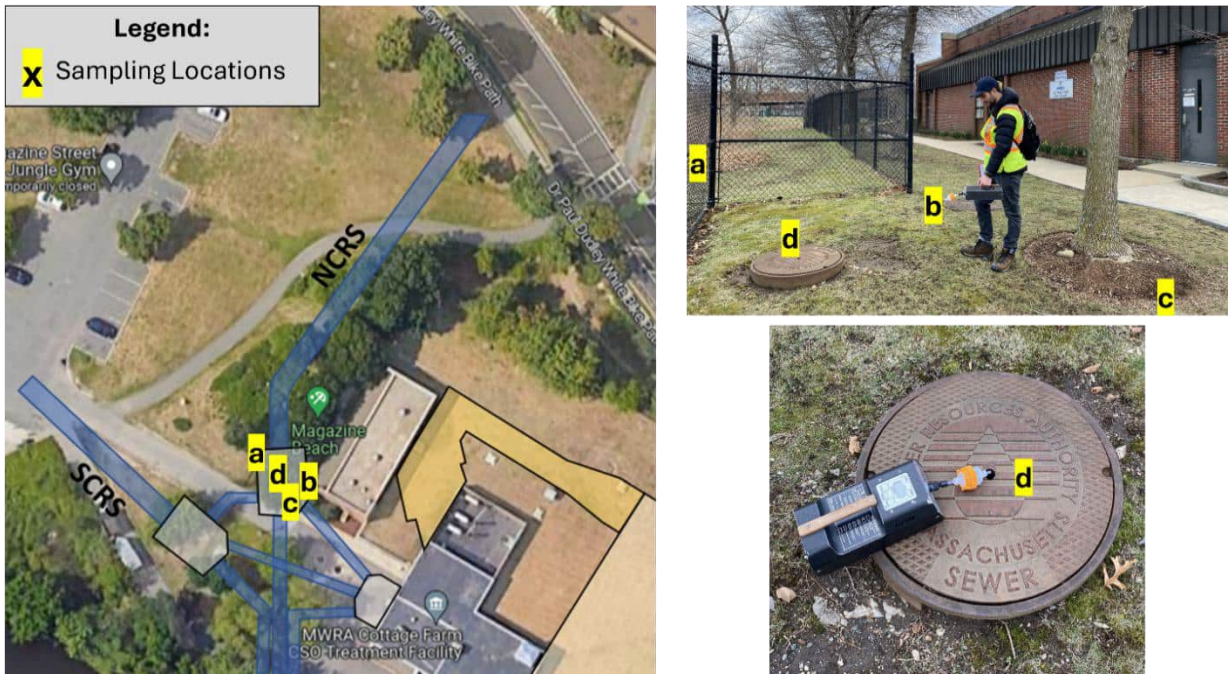

Figure 5-9. MWR201 Cottage Farm CSO Facility – North Charles Relief Sewer

Figure 5-10 shows five locations where H_2S samples were taken at the MWR010 regulator structures along Commonwealth Ave, across from the Boston University Marsh Chapel. While odors were not observed at this location, an H_2S sample was registered at location a (0.001 ppm). As shown in Table 3 of the POP, these readings are below the accuracy threshold of the sensor (+/- 0.003 ppm).

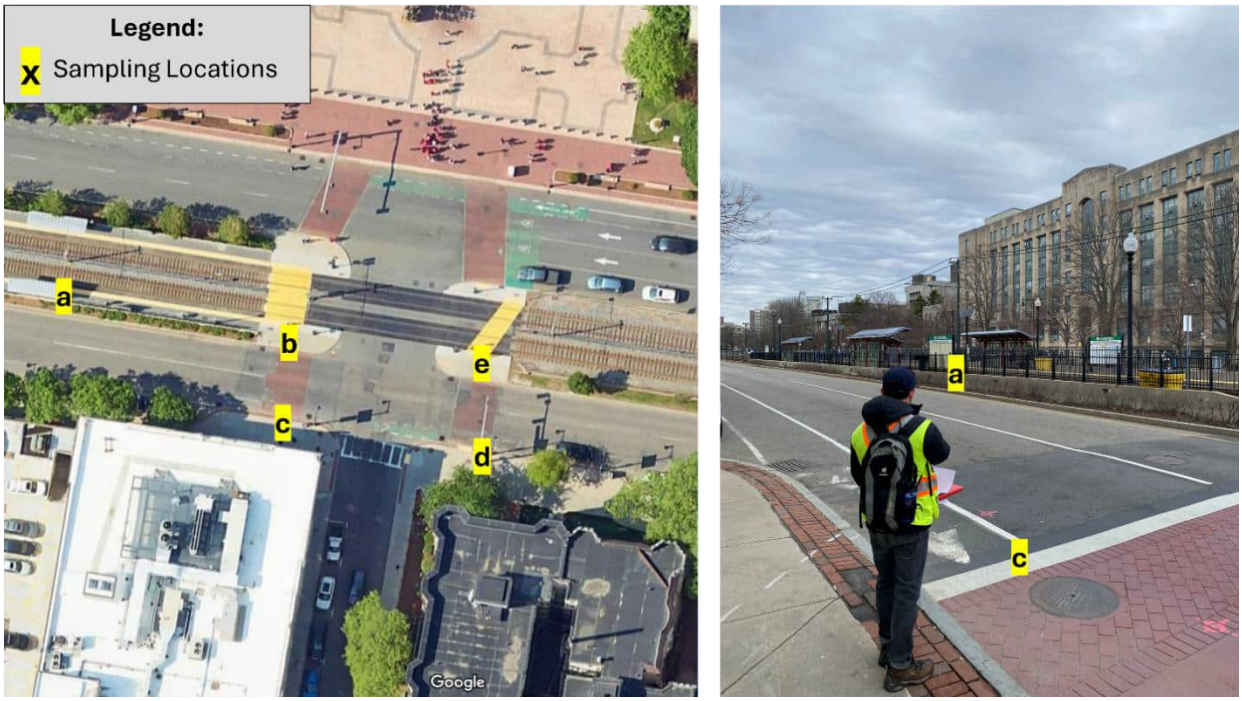

Figure 5-10. MWR010 Regulator Structures on Commonwealth Ave

5.3.2 Wet Weather

As noted in Section 4.2, samples were intended to be collected during wet weather when CSOs were active. The weather was monitored during the study period to assess if forecasted rainfall was likely to cause CSO activations in the Charles River area using Table 4-2 as a reference. Although the May 6, 2025 storm event was selected for sampling for the Alewife Brook/Mystic River, this event was not predicted to be of a magnitude expected to result in a CSO at the Charles River outfalls. During the study period, no forecasted rain events were of a magnitude expected to cause the Charles River CSO outfalls to activate, therefore, wet weather sampling was not conducted along the Charles River. As indicated in Table 5-5, none of the Charles River CSO outfalls were active during the study period.

6. Odor Control Technologies/ BMPs

This section summarizes management practices and technologies that have commonly been used to control sewage-related odors. Best Management Practices (BMPs) and maintenance activities can often be relatively simple and effective methods for addressing odors. In general, treatment technologies fall under two categories: liquid-phase (applied to the wastewater liquid) and vapor phase (applied to the gases coming off of the liquid phase). As discussed below, the applicability of some treatment technologies to address odors at localized points in the collection system may be limited based on the extent of mechanical equipment needed for the installations, and the associated siting needs. Thus, not all of the approaches presented below will necessarily be considered to mitigate odors at MWRA-owned structures in the vicinity of the Variance waters. This section is intended as a general overview of odor control approaches and technologies.

6.1 BMPs

6.1.1 Sealing Manhole Covers

Air can leak out of a manhole around the edge of the manhole cover where it sits on the manhole frame. This joint can be effectively sealed using a caulking-type sealant which can be readily broken if access to the manhole is required. MWRA recently sealed a manhole cover on a siphon structure along Alewife Brook using this approach (Figure 6-1).

Figure 6-1. Example of Sealant Applied Around Manhole Cover

6.1.2 Repairing Cracks in Structures

Air can also leak out of a manhole through cracks in the manhole structure. Sealing or repairing these cracks would reduce air leakage from the manhole. MWRA has a manhole inspection and rehabilitation program, where the Technical Inspections Unit (TIU) of the Wastewater Department conducts regular inspections of manholes. Based on the findings from these inspections, pipeline maintenance crews complete rehabilitation and repair activities. These activities can include coating the inside of the manhole using cementitious material and special coatings to resist corrosion from hydrogen sulfide (MWRA, 2025).

6.1.3 Removing Material that May be Contributing to Odors

Sediment and other debris that may accumulate in manholes or regulator structures could be a potential source of odors. Removal of the sediment and debris should help to control odors generated from that source. An assessment of the conditions that led to the accumulation of the sediment and debris could then lead to potential modifications to the structures to minimize the chances for sediment to reaccumulate in the future.

6.1.4 Continuous Odor Monitoring

Continuous odor monitoring systems allow for the detection and tracking of odor-causing gases over extended time periods, while minimizing the need for field staff resources. The monitoring data can provide information on the types of collection systems and/or meteorological conditions that tend to correlate with the presence of odors, which could then inform more targeted approaches to controlling the odors. Devices such as the Acrulog H_2S Parts Per Billion Monitor allow for continual use with battery backup and wireless download of data (Figure 6-2).

Figure 6-2. Example of Continuous Odor Monitoring Device (Acrulog)

6.2 Liquid-Phase Technologies

6.2.1 Chemical Addition

Chemicals can be added to the collection system for odor mitigation. The chemical addition options generally require a location to store the chemicals as well as the design of an injection system to deliver the correct dose. Due to the equipment needs for these chemical systems, permanent chemical dosing stations may not be feasible or cost-effective for isolated locations. Examples of chemicals that have been used for odor control include:

- Iron salts such as ferrous chloride and ferrous sulfate. These compounds can oxidize and precipitate dissolved sulfides to form insoluble ferrous sulfides (Metcalf & Eddy, 2003). Although iron salts are relatively inexpensive, they are highly corrosive, typically requiring secondary containment for storage and special handling precautions (WEA, 2025).

- Oxidants such as sodium hypochlorite, hydrogen peroxide, and ozone. These chemicals work by oxidizing the sulfide to sulfate and sulfur. Ozone is often considered a more viable option for pump stations rather than treatment in the collection system (Finger, 2009).
- Various proprietary products. Examples would include the following:
    - Bioxide is a patented solution that uses nitrate, which along with the bacteria, can react with H_2S to form non-odorous compounds such as sulfate, water, nitrogen, and hydrogen (King County DNRP).
    - BioSafe Systems offers a product that uses peroxyacetic acid (PAA) to oxidize H_2S and other compounds without producing byproducts such as trihalomethanes (THMs) or haloacetic acids (HAAs) (BioSafe Systems, 2025).

6.2.2 Bioaugmentation

Bioaugmentation can reduce odors by inhibiting hydrogen sulfide formation from sulfate reducing bacteria (SRB). Bioaugmentation involves adding specific types of microorganisms to the collection system that will compete with the SRB for available food sources (typically volatile fatty acids), and will also consume sulfate, reducing the availability of these two key components required for SRB to flourish. The bioaugmentation products are typically dosed during low flow periods upstream of the locations being targeted (Cray, et al., 2022).

6.3 Vapor-Phase Technologies

6.3.1 Activated carbon scrubbers

Activated carbon systems adsorb chemical contaminants from a polluted air stream onto high surface area carbon granules. Carbon scrubbers are a common and highly effective odor control technology. MWRA currently has activated carbon scrubbers at a number of its wastewater facilities. These systems typically use a blower fan to push the air through activated carbon canisters (Figure 6-3). Due to the extent of equipment required for these systems, they are more appropriate for wastewater facilities and would not be practical to address odors at manholes, regulators, or outfalls in the collection system. This limitation would also apply to other high-volume scrubber technologies such as packed towers or bio-trickling scrubbers.

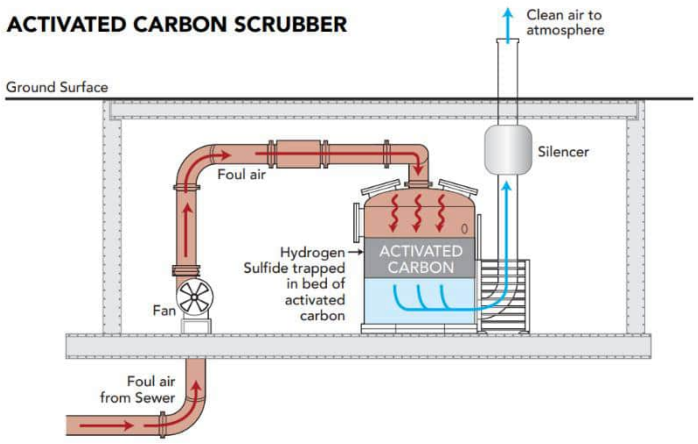

Figure 6-3. Example of an Activated Carbon Scrubber Layout (King County DNRP)

Activated carbon manhole inserts are designed to fit right below the manhole cover, such that any air leaving the manhole is first filtered through the activated carbon (Figure 6-4). These devices would be much more suitable for installations at manholes and regulator structures than the activated carbon scrubber units described above.

Figure 6-4. Activated Carbon Manhole Insert (Inventive Resources Inc., 2016)

6.3.3 Biofilters

Biofilters rely on microorganisms attached to a filter media such as wood chips to consume odorous compounds in the air that passes through the filter. Biofilters are more effective when a constant stream of odorous air passes through the filters. At locations with only intermittent odors, there may not be enough "food" to support the microbial population during the periods when odorous compounds are not present in the air stream, leading to reduced performance when the odorous compounds do appear. MWRA currently has a biofilter on a three-barrel siphon on the North Metropolitan Sewer in Medford adjacent to Mystic Valley Parkway.

7. Summary and Recommendations

This feasibility study included a review of the potential sources of odors in the MWRA's sewer collection system and at CSO locations, a review of odor complaints, the development and implementation of a sampling program, and a review of odor control technologies and best management practices. Dry weather sampling was conducted on March 19, 2025 at locations along the Alewife Brook and Mystic River and on March 26, 2025 at locations along the Charles River. Wet weather sampling was conducted along the Alewife Brook and Mystic River on May 6, 2025. Wet weather samples were not conducted along the Charles River during this program due to insufficient rainfall to cause a CSO activation during this period.

During the sampling events, odors were observed and/or H_2S concentrations >0.001 ppm were measured at 7 locations. The table below lists the locations where the odors were observed, the associated observations and a suggested course of action.

Table 7-1. Summary of Odor Observations and Recommended Next Steps

Sample Location	Dry Weather Sample Date and Observation	Wet Weather data and Observation	Recommended Next steps
Alewife Brook Pump Station-North side of facility ABPS-North	NA	- May 6, 2025 - Odor intensity of 1 (“very light”) from metal panel. - 0.048 ppm H_2S measured in the panel seam.	Investigate if a gasketed metal cover to reduce odors leaving the structure would be appropriate at this location.
ABC and ABBS Interceptor Connection #3 Sta. 83+55	NA	- May 6, 2025 - Odor intensity of 1 (“very light”) from manhole. - 0.000 ppm H_2S measured.	Consider caulking/sealing the manhole to reduce odors.
ABC Siphon Structure near Mass Ave. Sta. 53+00 (upstream, Arlington side) and Sta. 55+72 (downstream, Cambridge side)	- March 19, 2025 - “Light” sewage odor from siphon vent pipe. Had to get very close to smell an odor at this location. - 0.000 ppm H_2S measured	- May 6, 2025 - “Very light” sewage odor from siphon vent. - 0.001 ppm H_2S measured at the siphon vent outlet.	Sample up to 6 times over the next 6 months.
ABC Siphon near MBTA Garage Sta. 2+92	- March 19, 2025 - “Light” odor observed coming from around the metal siphon headhouse cover. Odor was also observable from the bike path. - 0.000 ppm H_2S measured.	- May 6, 2025 - “Very light” odor observed coming from around the metal siphon headhouse cover - 0.000 ppm H_2S measured	Investigate if a gasketed metal cover to reduce odors leaving the structure would be appropriate at this location.
Siphon Under Alewife Brook Sta. 34+26	NA	- May 6, 2025 - “Very light” sewage odor from siphon vent. - 0.000 ppm H_2S measured.	Sample up to 6 times over the next 6 months.
Cottage Farm CSO Facility (MWR201) at the North Charles Relief Sewer (NCRS) diversion chamber MWR201-DIV-North	- March 26, 2025 - Two positive H_2S samples recorded. - Truck was idling at the site. Exhaust from vehicles may have H_2S which may have contributed to this measurement. - No odors observed.	NA	Consider resampling at this location to check for presence of H_2S and investigate the source. Based on the results consider sampling up to 6 times over the next 6 months.
Regulator structures tributary to outfall MWR010 (RE036-9 and RE037) MWR010-REG	- 03/26/25. - One positive H_2S sample recorded. - No odors observed. - Exhaust from truck present at the site may have contributed to this measurement.	NA	Sample up to 6 times over the next 6 months.

8. References

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Appendix A: Dry Weather Field Data Sheets

AECOM
250 Apollo Drive
Chelmsford, MA 01824

AECOM

Field Data Sheet
Odor Feasibility Study

Site Information			
Project:	MWRA CSO Monitoring	**Technician:**	M. Arvanites; T. Brinson
Date:	3/26/2025	**General Weather Conditions:**	Overcast, cool
Instrument:	Jerome® 631-X H_2S Analyzer	**Instrument Serial Number:**	1792

Time	Location[1]	Weather Conditions	H_2S ppm	Odor Intensity[2] (0 – 8)	Visual of Floatables	Comments
0828	MWR201-DIV-N-a	NNW 2.2 mph, 39°F	0.001	0	--	Truck idling approximately 15 feet away
0830	MWR201-DIV-N-b	NNW 2.2 mph, 39°F	0.000	0	--	Truck idling approximately 15 feet away
0831	MWR201-DIV-N-c	NNW 2.2 mph, 39°F	0.002	0	--	Truck idling approximately 15 feet away
0832	MWR201-DIV-N-d	NNW 2.2 mph, 39°F	0.000	0	--	
0834	MWR201-DIV-S-a	NNW 2.2 mph, 39°F	0.000	0	--	
08335	MWR201-DIV-S-b	NNW 2.2 mph, 39°F	0.000	0	--	
0836	MWR201-DIV-S-c	NNW 2.2 mph, 39°F	0.000	0	--	
0837	MWR201-DIV-S-d	NNW 2.2 mph, 39°F	0.000	0	--	
0839	MWR201-a	Calm, 39°F	0.000	0	No	
0840	MWR201-b	Calm, 39°F	0.000	0	No	
0841	MWR201-c	Calm, 39°F	0.000	0	No	

[1]*See Site Maps or GPS positions for locations*
[2]*See odor intensity descriptions from Project Operating Procedure*

Reviewed By: TB
Date: 3/28/2025

AECOM
250 Apollo Drive
Chelmsford, MA 01824

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Field Data Sheet
Odor Feasibility Study

Site Information			
Project:	MWRA CSO Monitoring	**Technician:**	M. Arvanites; T. Brinson
Date:	3/26/2025	**General Weather Conditions:**	Overcast, cool
Instrument:	Jerome® 631-X H_2S Analyzer	**Instrument Serial Number:**	1792

Time	Location[1]	Weather Conditions	H_2S ppm	Odor Intensity[2] (0 – 8)	Visual of Floatables	Comments
0907	MWR010-REG-a	Calm, 43°F	0.001	0	--	
0912	MWR010-REG-b	NW 4.0 mph, 43°F	0.000	0		
0913	MWR010-REG-c	NW 4.0 mph, 43°F	0.000	0	--	
0914	MWR010-REG-d	NW 4.0 mph, 43°F	0.000	0	--	
0916	MWR010-REG-e	NW 4.0 mph, 43°F	0.000	0	--	
0919	MWR010-DROP-a	NW 3.5 mph, 43°F	0.000	0	--	
0921	MWR010-DROP-b	NW 3.5 mph, 43°F	0.000	0	--	
0925	MWR010-a	NW 3.5 mph, 43°F	0.000	0	--	
0927	MWR010-b	NW 3.5 mph, 43°F	0.000	0	--	
0928	MWR010-c	NW 3.5 mph, 43°F	0.000	0	--	
0951	MWR023-FG-a	Calm, 45°F	0.000	0	--	
0952	MWR023-FG-b	Calm, 45°F	0.000	0	--	

[1]*See Site Maps or GPS positions for locations*
[2]*See odor intensity descriptions from Project Operating Procedure*

Reviewed By: TB
Date: 3/28/2025

AECOM
250 Apollo Drive
Chelmsford, MA 01824

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Field Data Sheet
Odor Feasibility Study

Site Information			
Project:	MWRA CSO Monitoring	**Technician:**	M. Arvanites; T. Brinson
Date:	3/26/2025	**General Weather Conditions:**	Overcast, cool
Instrument:	Jerome® 631-X H_2S Analyzer	**Instrument Serial Number:**	1792

Time	Location[1]	Weather Conditions	H_2S ppm	Odor Intensity[2] (0 – 8)	Visual of Floatables	Comments
1005	MWR023-a	NW 2.0 mph, 45°F	0.000	0	No	
1007	MWR023-b	NW 2.0 mph, 45°F	0.000	0	No	
1008	MWR023-c	NW 2.0 mph, 45°F	0.000	0	No	
1009	MWR023-d	NW 2.0 mph, 45°F	0.000	0	--	Measurement taken on bike path
1017	MWR018-a	Calm, 45°F	0.000	0	No	
1018	MWR018-b	Calm, 45°F	0.000	0	No	
1019	MWR018-c	Calm, 45°F	0.000	0	No	
1021	MWR018-REG-a	W 2.1 mph, 45°F	0.000	0	--	
1023	MWR018-REG-b	W 2.1 mph, 45°F	0.000	0	--	
1024	MWR018-REG-c	W 2.1 mph, 45°F	0.000	0	--	
1025	MWR018-REG-d	W 2.1 mph, 45°F	0.000	0	--	

[1]*See Site Maps or GPS positions for locations*
[2]*See odor intensity descriptions from Project Operating Procedure*

Reviewed By: TB
Date: 3/28/2025

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250 Apollo Drive
Chelmsford, MA 01824

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Field Data Sheet
Odor Feasibility Study

Site Information			
Project:	MWRA CSO Monitoring	**Technician:**	M. Arvanites; T. Brinson
Date:	3/26/2025	**General Weather Conditions:**	Overcast, cool
Instrument:	Jerome® 631-X H_2S Analyzer	**Instrument Serial Number:**	1792

Time	Location[1]	Weather Conditions	H_2S ppm	Odor Intensity[2] (0 – 8)	Visual of Floatables	Comments
1035	MWR019-REG-a	W 3.8 mph, 45°F	0.000	0	--	
1036	MWR019-REG-b	W 3.8 mph, 45°F	0.000	0	--	
1037	MWR019-REG-c	W 3.8 mph, 45°F	0.000	0	--	
1038	MWR019-REG-d	W 3.8 mph, 45°F	0.000	0	--	Measurement taken on bike path
1043	MWR019-a	W 2.6 mph, 45°F	0.000	0	No	
1044	MWR019-b	W 2.6 mph, 45°F	0.000	0	No	
1045	MWR019-c	W 2.6 mph, 45°F	0.000	0	No	
1046	MWR019-d	W 2.6 mph, 45°F	0.000	0	--	Measurement taken on bike path
1054	MWR020-a	W 4.2 mph, 45°F	0.000	0	No	
1055	MWR020-b	W 4.2 mph, 45°F	0.000	0	No	
1056	MWR020-c	W 4.2 mph, 45°F	0.000	0	No	
1057	MWR020-d	W 4.2 mph, 45°F	0.000	0	--	Measurement taken on bike path

[1]*See Site Maps or GPS positions for locations*
[2]*See odor intensity descriptions from Project Operating Procedure*

Reviewed By: TB
Date: 03/28/2025

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250 Apollo Drive
Chelmsford, MA 01824

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Field Data Sheet
Odor Feasibility Study

Site Information			
Project:	MWRA CSO Monitoring	**Technician:**	M. Arvanites; T. Brinson
Date:	3/26/2025	**General Weather Conditions:**	Overcast, cool
Instrument:	Jerome® 631-X H_2S Analyzer	**Instrument Serial Number:**	1792

Time	Location[1]	Weather Conditions	H_2S ppm	Odor Intensity[2] (0 – 8)	Visual of Floatables	Comments
1102	MWR020-REG-a	W 2.0 mph, 45°F	0.000	0	--	
1103	MWR020-REG-b	W 2.0 mph, 45°F	0.000	0	--	
1104	MWR020-REG-c	W 2.0 mph, 45°F	0.000	0	--	
1106	MWR020-REG-d	W 2.0 mph, 45°F	0.000	0	--	Measurement taken on bike path

[1]*See Site Maps or GPS positions for locations*
[2]*See odor intensity descriptions from Project Operating Procedure*

Reviewed By: TB
Date: 3/28/2025

AECOM
250 Apollo Drive
Chelmsford, MA 01824

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Field Data Sheet
Odor Feasibility Study

Site Information			
Project:	MWRA CSO Monitoring	**Technician:**	M. Arvanites; T. Brinson
Date:	3/19/2025	**General Weather Conditions:**	Clear Skies
Instrument:	Jerome® 631-X H_2S Analyzer	**Instrument Serial Number:**	1792

Time	Location[1]	Weather Conditions	H_2S ppm	Odor Intensity[2] (0 – 8)	Visual of Floatables	Comments
0849	ABPS-North-a	NNE 2.6 mph, 36°F	0.000	0	--	
0850	ABPS-North-b	NNE 2.6 mph, 36°F	0.000	0	--	
0851	ABPS-North-c	NNE 2.6 mph, 36°F	0.000	0	--	
0845	ABPS-South-a	NNE 2.2 mph, 36°F	0.000	0	--	
0846	ABPS-South-b	NNE 2.2 mph, 36°F	0.000	0	--	
0846	ABPS-South-c	NNE 2.2 mph, 36°F	0.000	0	--	
0802	STA83+55-a	N 1.1 mph, 36°F	0.000	0	--	
0803	STA83+55-b	N 1.1 mph, 36°F	0.000	0	--	
0804	STA83+55-c	N 1.1 mph, 36°F	0.000	0	--	
0805	STA83+55-d	N 1.1 mph, 36°F	0.000	0	--	
0916	STA70+71-a	Calm 42°F	0.000	0	--	
0917	STA70+71-b	Calm 42°F	0.000	0	--	

[1] *See Site Maps or GPS positions for locations*

Reviewed By: TB
Date: 3/21/2025

AECOM
250 Apollo Drive
Chelmsford, MA 01824

[2]*See odor intensity descriptions from Project Operating Procedure*

Field Data Sheet
Odor Feasibility Study

Site Information			
Project:	MWRA CSO Monitoring	**Technician:**	M. Arvanites; T. Brinson
Date:	3/19/2025	**General Weather Conditions:**	Clear Skies
Instrument:	Jerome® 631-X H_2S Analyzer	**Instrument Serial Number:**	1792

Time	Location[1]	Weather Conditions	H_2S ppm	Odor Intensity[2] (0 – 8)	Visual of Floatables	Comments
0918	STA70+71-c	Calm 42°F	0.000	0	--	
0919	STA70+71-d	Calm 42°F	0.000	0	--	
0924	STA63+63-a	NNE 5.0 mph, 43°F	0.000	0	--	
0926	STA63+63-b	NNE 5.0 mph, 43°F	0.000	0	--	
0927	STA63+63-c	NNE 5.0 mph, 43°F	0.000	0	--	
0928	STA63+63-d	NNE 5.0 mph, 43°F	0.000	0	--	
0938	STA53+00-a	NNE 4.7mph, 43°F	0.000	0	--	
0939	STA53+00-b	NNE 4.7mph, 43°F	0.000	0	--	
0940	STA53+00-c	NNE 4.7mph, 43°F	0.000	0	--	
0941	STA53+00-d	NNE 4.7mph, 43°F	0.000	0	--	

[1]*See Site Maps or GPS positions for locations*
[2]*See odor intensity descriptions from Project Operating Procedure*

Reviewed By: TB
Date: 3/21/2025

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250 Apollo Drive
Chelmsford, MA 01824

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Field Data Sheet
Odor Feasibility Study

Site Information			
Project:	MWRA CSO Monitoring	**Technician:**	M. Arvanites; T. Brinson
Date:	3/19/2025	**General Weather Conditions:**	Clear Skies
Instrument:	Jerome® 631-X H_2S Analyzer	**Instrument Serial Number:**	1792

Time	Location[1]	Weather Conditions	H_2S ppm	Odor Intensity[2] (0 – 8)	Visual of Floatables	Comments
0957	STA55+72-a	NNE 3.7mph, 45°F	0.000	0	Yes	White coloured trash seen in brook by CAM401B outfall. Appears to be foam packing material or similar. White fabric/paper material seen hanging from tree branch about equal to bridge elevation.
0958	STA55+72-b	NNE 3.7mph, 45°F	0.000	2	--	Sewage odor from vent pipe.
0959	STA55+72-c	NNE 3.7mph, 45°F	0.000	2	--	Sewage odor from vent pipe.
1000	STA55+72-d	NNE 3.7mph, 45°F	0.000	2	--	Sewage odor from vent pipe.
1022	STA2+92-a	E 1.3mph, 45°F	0.000	0	--	
1024	STA2+92-b	E 1.3mph, 45°F	0.000	0	--	
1025	STA2+92-c	E 1.3mph, 45°F	0.000	2	--	Odor at siphon headhouse and on footbridge.
1030	STA2+21-a	E 1.1 mph, 45°F	0.000	0	--	
1031	STA2+21-b	E 1.1 mph, 45°F	0.000	0	--	
1032	STA2+21-c	E 1.1 mph, 45°F	0.000	0	--	

[1]*See Site Maps or GPS positions for locations*
[2]*See odor intensity descriptions from Project Operating Procedure*

Reviewed By: TB
Date: 3/21/2025

AECOM
250 Apollo Drive
Chelmsford, MA 01824

AECOM

Field Data Sheet
Odor Feasibility Study

Site Information			
Project:	MWRA CSO Monitoring	**Technician:**	M. Arvanites; T. Brinson
Date:	3/19/2025	**General Weather Conditions:**	Clear Skies
Instrument:	Jerome® 631-X H_2S Analyzer	**Instrument Serial Number:**	1792

Time	Location[1]	Weather Conditions	H_2S ppm	Odor Intensity[2] (0 – 8)	Visual of Floatables	Comments
1039	MWR003-REG-a	E 3.3 mph, 45°F	0.000	0	--	
1040	MWR003-REG-b	E 3.3 mph, 45°F	0.000	0	--	
1041	MWR003-REG-c	E 3.3 mph, 45°F	0.000	0	--	
1044	MWR003-a	E 1.3 mph, 45°F	0.000	0	--	
1046	MWR003-b	E 1.3 mph, 45°F	0.000	0	--	
1047	MWR003-c	E 1.3 mph, 45°F	0.000	0	--	
1048	MWR003-d	E 1.3 mph, 45°F	0.000	0	--	
1058	STA34+26-a	E 4.0 mph, 45°F	0.000	0	--	
1058	STA34+26-b	E 4.0 mph, 45°F	0.000	0	--	
1059	STA34+26-c	E 4.0 mph, 45°F	0.000	0	--	
1101	STA34+26-d	E 4.0 mph, 45°F	0.000	0	--	

[1]*See Site Maps or GPS positions for locations*
[2]*See odor intensity descriptions from Project Operating Procedure*

Reviewed By: TB
Date: 3/21/2025

AECOM
250 Apollo Drive
Chelmsford, MA 01824

AECOM

Field Data Sheet
Odor Feasibility Study

Site Information			
Project:	MWRA CSO Monitoring	**Technician:**	M. Arvanites; T. Brinson
Date:	3/19/2025	**General Weather Conditions:**	Clear Skies
Instrument:	Jerome® 631-X H_2S Analyzer	**Instrument Serial Number:**	1792

Time	Location[1]	Weather Conditions	H_2S ppm	Odor Intensity[2] (0 – 8)	Visual of Floatables	Comments
1137	MWR205A- a	E 5.0 mph, 50°F	0.000	0	--	
1138	MWR205A- b	E 5.0 mph, 50°F	0.000	0	--	
1139	MWR205A- c	E 5.0 mph, 50°F	0.000	0	--	
1146	MWR205A-DIV-a	NE 4.0 mph, 50°F	0.000	0	--	
1148	MWR205A-DIV-b	NE 4.0 mph, 50°F	0.000	0	--	
1149	MWR205A-DIV-c	NE 4.0 mph, 50°F	0.000	0	--	

[1]*See Site Maps or GPS positions for locations*
[2]*See odor intensity descriptions from Project Operating Procedure*

Reviewed By: TB
Date: 3/21/2025

Appendix B: Wet Weather Field Data Sheets

AECOM
250 Apollo Drive
Chelmsford, MA 01824

AECOM

Field Data Sheet
Odor Feasibility Study

Site Information			
Project:	MWRA CSO Monitoring	**Technician:**	M. Arvanites; T. Brinson
Date:	5/6/2025	**General Weather Conditions:**	Overcast
Instrument:	Jerome® 631-X H_2S Analyzer	**Instrument Serial Number:**	1792

Time	Location[1]	Weather Conditions	H_2S ppm	Odor Intensity[2] (0 – 8)	Visual of Floatables	Comments
0814	ABPS-South-a	NE 1.1 mph	0.000	0	--	
0815	ABPS-South-b		0.000	0	--	
0816	ABPS-South-c		0.000	0	--	
0820	ABPS-North-a	NE 3.3 mph	0.000	0	--	
0820	ABPS-North-b		0.000	0	--	
0821	ABPS-North-c		0.017 - 0.048	1	--	0.017ppm approximately 1 ft above access grate. 0.048 ppm inside grate opening. Odor in breathing zone in vicinity of grate.
0835	STA83+55-a	Calm	0.000	1	--	Odor in breathing zone near manhole.
0836	STA83+55-b		0.000	1	--	Odor in breathing zone near manhole.
0837	STA83+55-c		0.000	1	--	Odor in breathing zone near manhole.
0838	STA83+55-d	NE 2.4 mph	0.000	0	--	
0846	STA70+71-a	Calm	0.000	0	--	
0847	STA70+71-b		0.000	0	--	

Reviewed By: TB
Date: 5/9/2025

AECOM
250 Apollo Drive
Chelmsford, MA 01824

[1]*See Site Maps or GPS positions for locations*
[2]*See odor intensity descriptions from Project Operating Procedure*

Field Data Sheet
Odor Feasibility Study

Site Information			
Project:	MWRA CSO Monitoring	**Technician:**	M. Arvanites; T. Brinson
Date:	5/6/2025	**General Weather Conditions:**	Overcast
Instrument:	Jerome® 631-X H_2S Analyzer	**Instrument Serial Number:**	1792

Time	Location[1]	Weather Conditions	H_2S ppm	Odor Intensity[2] (0 – 8)	Visual of Floatables	Comments
0848	STA70+71-c		0.000	0	--	
0849	STA70+71-d		0.000	0	--	
0853	STA63+63-a	NE 3.1 mph	0.000	0	--	
54	STA63+63-b		0.000	0	--	
0855	STA63+63-c		0.000	0	--	
0855	STA63+63-d		0.000	0	--	
0905	STA53+00-a	NE 3.5 mph	0.000	0	--	
0906	STA53+00-b		0.000	0	--	
0907	STA53+00-c		0.000	0	--	
0907	STA53+00-d		0.000	0	--	

[1]*See Site Maps or GPS positions for locations*
[2]*See odor intensity descriptions from Project Operating Procedure*

Reviewed By: TB
Date: 5/9/2025

AECOM
250 Apollo Drive
Chelmsford, MA 01824

AECOM

Field Data Sheet
Odor Feasibility Study

Site Information			
Project:	MWRA CSO Monitoring	**Technician:**	M. Arvanites; T. Brinson
Date:	5/6/2025	**General Weather Conditions:**	Overcast
Instrument:	Jerome® 631-X H_2S Analyzer	**Instrument Serial Number:**	1792

Time	Location[1]	Weather Conditions	H_2S ppm	Odor Intensity[2] (0 – 8)	Visual of Floatables	Comments
0914	STA55+72-a	Calm	0.000	0	--	
0915	STA55+72-b		0.000	0	--	
0916	STA55+72-c		0.000	2	--	
0917	STA55+72-d		0.001	2	--	
0945	STA2+92-a	Calm	0.000	0	--	
0947	STA2+92-b		0.000	0	--	
0948	STA2+92-c	SE 1.5 mph	0.000	1	--	
0952	STA2+21-a	Calm	0.000	0	--	
0954	STA2+21-b		0.000	0	--	
0955	STA2+21-c		0.000	0	--	

[1]*See Site Maps or GPS positions for locations*
[2]*See odor intensity descriptions from Project Operating Procedure*

Reviewed By: TB
Date: 5/9/2025

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250 Apollo Drive
Chelmsford, MA 01824

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Field Data Sheet
Odor Feasibility Study

Site Information			
Project:	MWRA CSO Monitoring	**Technician:**	M. Arvanites; T. Brinson
Date:	5/6/2025	**General Weather Conditions:**	Overcast
Instrument:	Jerome® 631-X H_2S Analyzer	**Instrument Serial Number:**	1792

Time	Location[1]	Weather Conditions	H_2S ppm	Odor Intensity[2] (0 – 8)	Visual of Floatables	Comments
1000	MWR003-REG-a	Calm	0.000	0	--	
1001	MWR003-REG-b		0.000	0	--	
1002	MWR003-REG-c		0.000	0	--	
1005	MWR003-a	Calm	0.000	0	--	
1006	MWR003-b		0.000	0	--	
1007	MWR003-c		0.000	0	--	
1008	MWR003-d		0.000	0	--	
1012	STA34+26-a	Calm	0.000	0	--	
1013	STA34+26-b		0.000	1	--	Slight odor, likely coming from vent pipe.
1014	STA34+26-c		0.000	0	--	
1016	STA34+26-d		0.000	0	--	

[1]*See Site Maps or GPS positions for locations*
[2]*See odor intensity descriptions from Project Operating Procedure*

Reviewed By: TB
Date: 5/9/2025

AECOM
250 Apollo Drive
Chelmsford, MA 01824

Field Data Sheet
Odor Feasibility Study

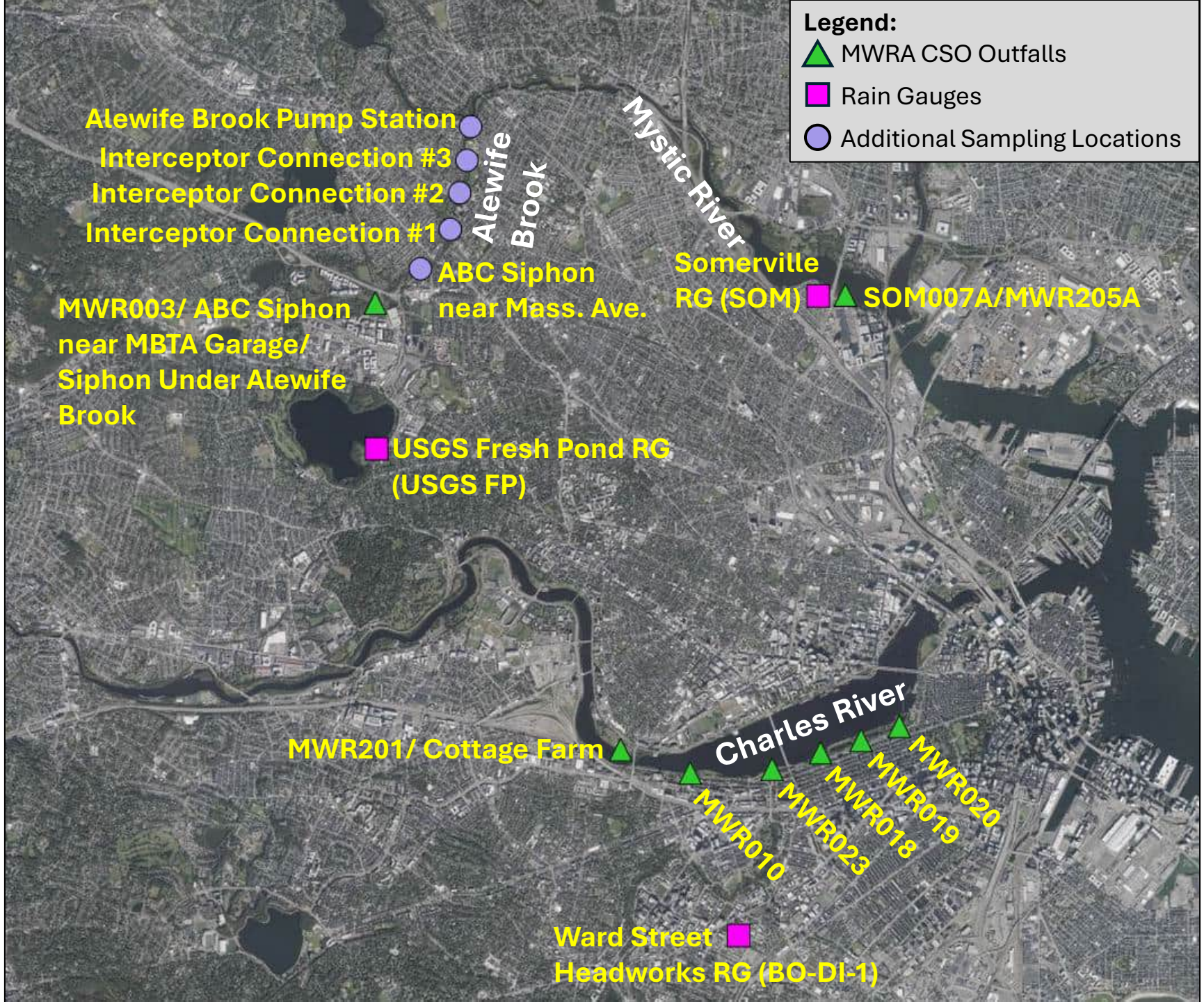
Site Information			
Project:	MWRA CSO Monitoring	**Technician:**	M. Arvanites; T. Brinson
Date:	5/6/2025	**General Weather Conditions:**	Overcast
Instrument:	Jerome® 631-X H_2S Analyzer	**Instrument Serial Number:**	1792

Time	Location[1]	Weather Conditions	H_2S ppm	Odor Intensity[2] (0 – 8)	Visual of Floatables	Comments
1204	MWR205A- a	NE 5.6 mph	0.000	0	--	
1206	MWR205A- b		0.000	0	--	
1207	MWR205A- c		0.000	0	--	
1200	MWR205A-DIV-a	NW 4.0 mph	0.000	0	--	
1201	MWR205A-DIV-b		0.000	0	--	
1202	MWR205A-DIV-c		0.000	0	--	

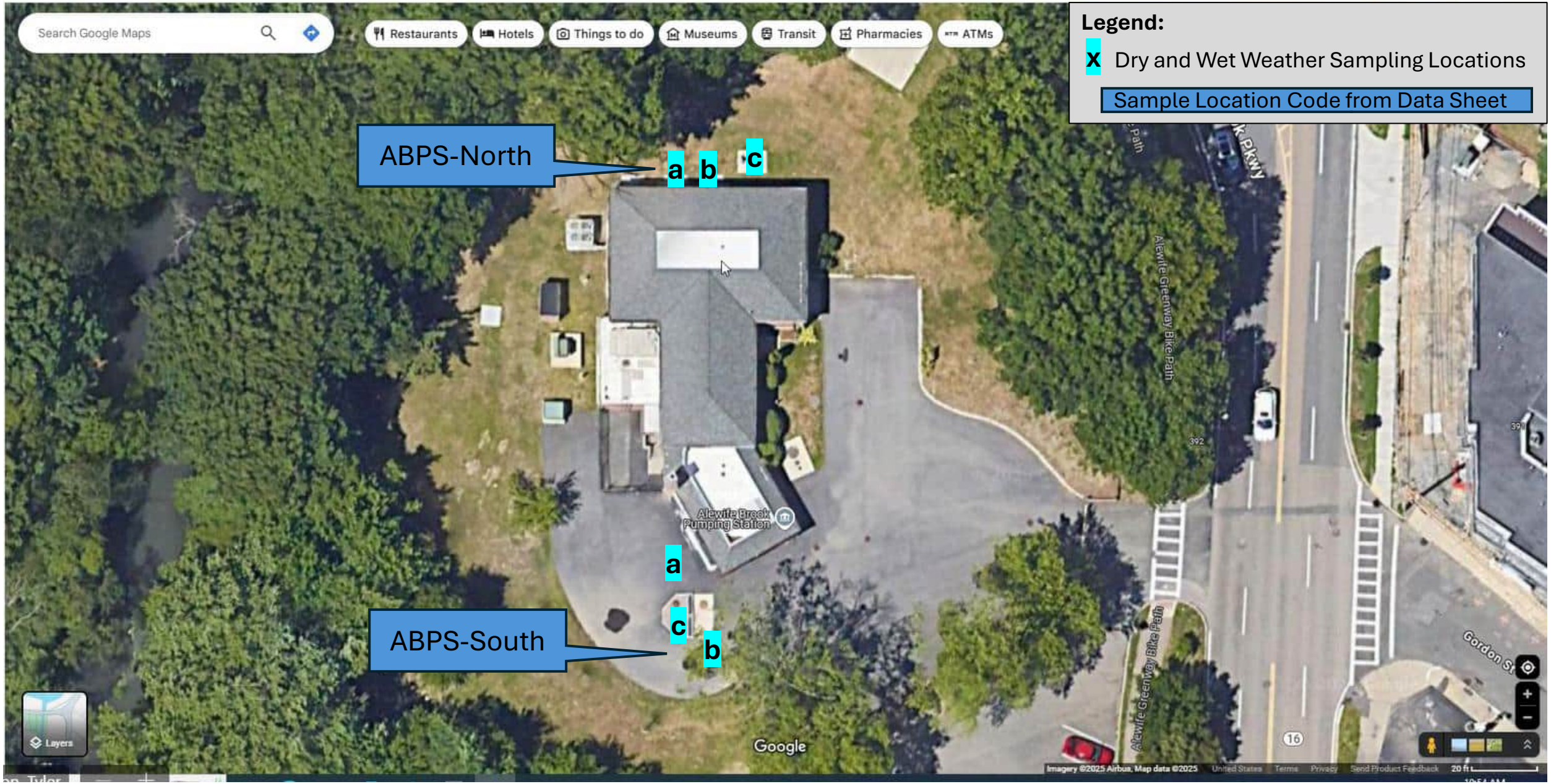
[1]*See Site Maps or GPS positions for locations*
[2]*See odor intensity descriptions from Project Operating Procedure*

Reviewed By: TB
Date: 5/9/2025

Appendix C: Sample Locations

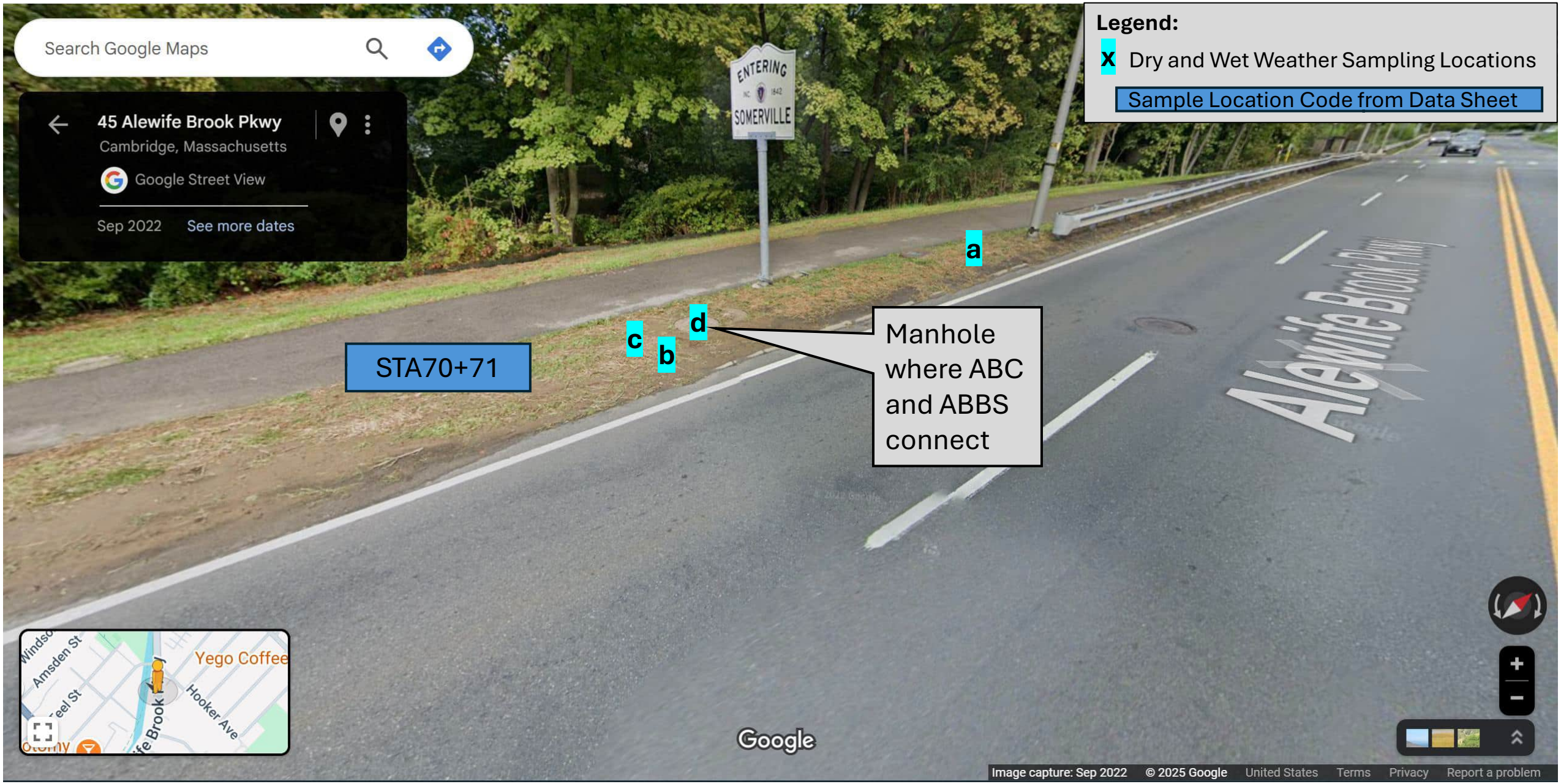

Legend:
MWRA CSO Outfalls
Rain Gauges
Additional Sampling Locations
Alewife Brook Pump Station
Interceptor Connection #3
Interceptor Connection #2
Interceptor Connection #1
Alewife Brook
Mystic River
ABC Siphon near Mass. Ave.
MWR003/ ABC Siphon near MBTA Garage/ Siphon Under Alewife Brook
Somerville RG (SOM)
SOM007A/MWR205A
USGS Fresh Pond RG (USGS FP)
Charles River
MWR201/ Cottage Farm
MWR020
MWR019
MWR018
MWR023
MWR010
Ward Street Headworks RG (BO-DI-1)

Alewife Brook Pump Station – Alewife Brook

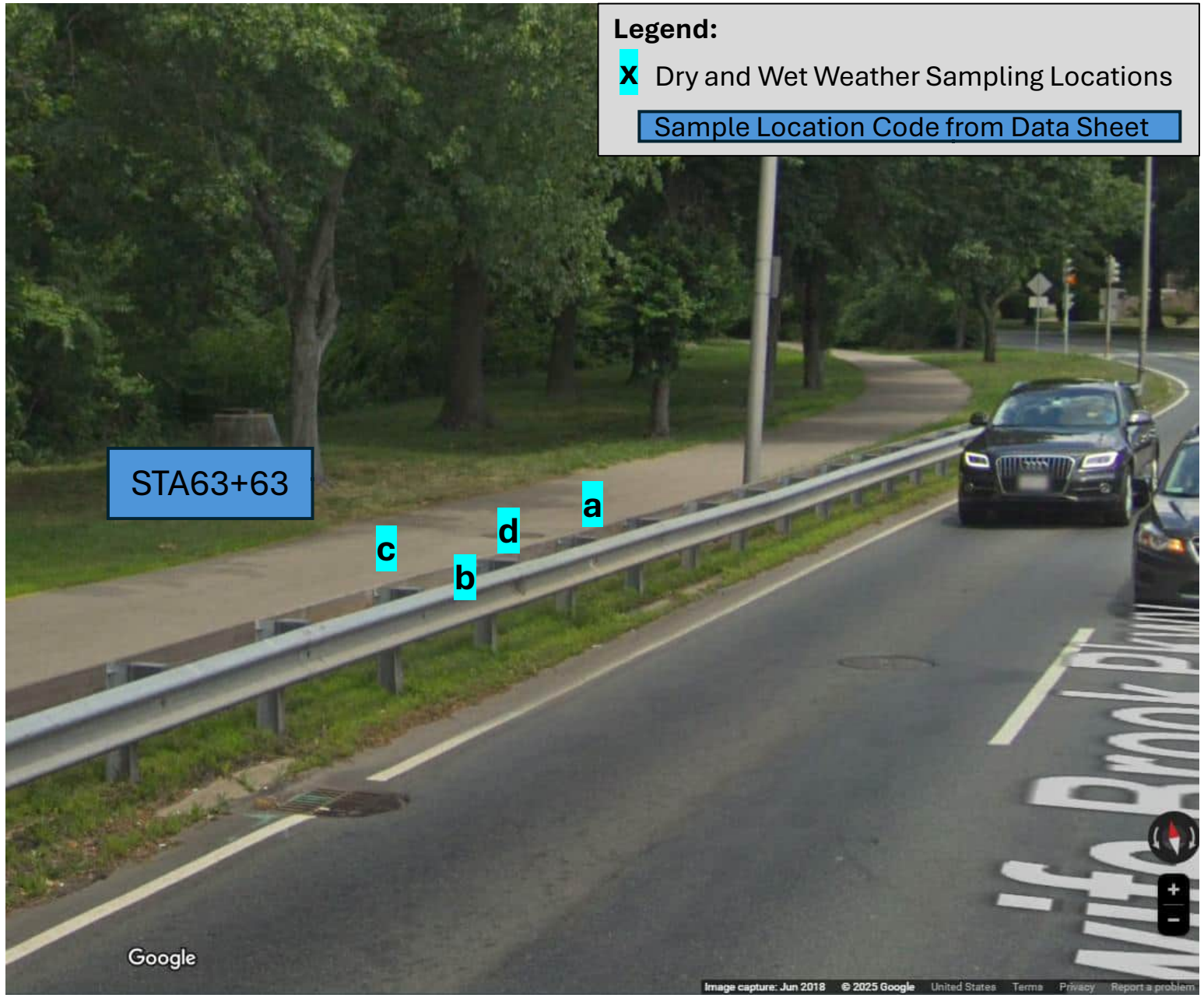


ABBS & ABC Interceptor Connection #3 STA83+55 – Alewife Brook

ABBS & ABC Interceptor Connection #2 STA70+71 – Alewife Brook



ABBS & ABC Interceptor Connection #1 STA63+63 – Alewife Brook



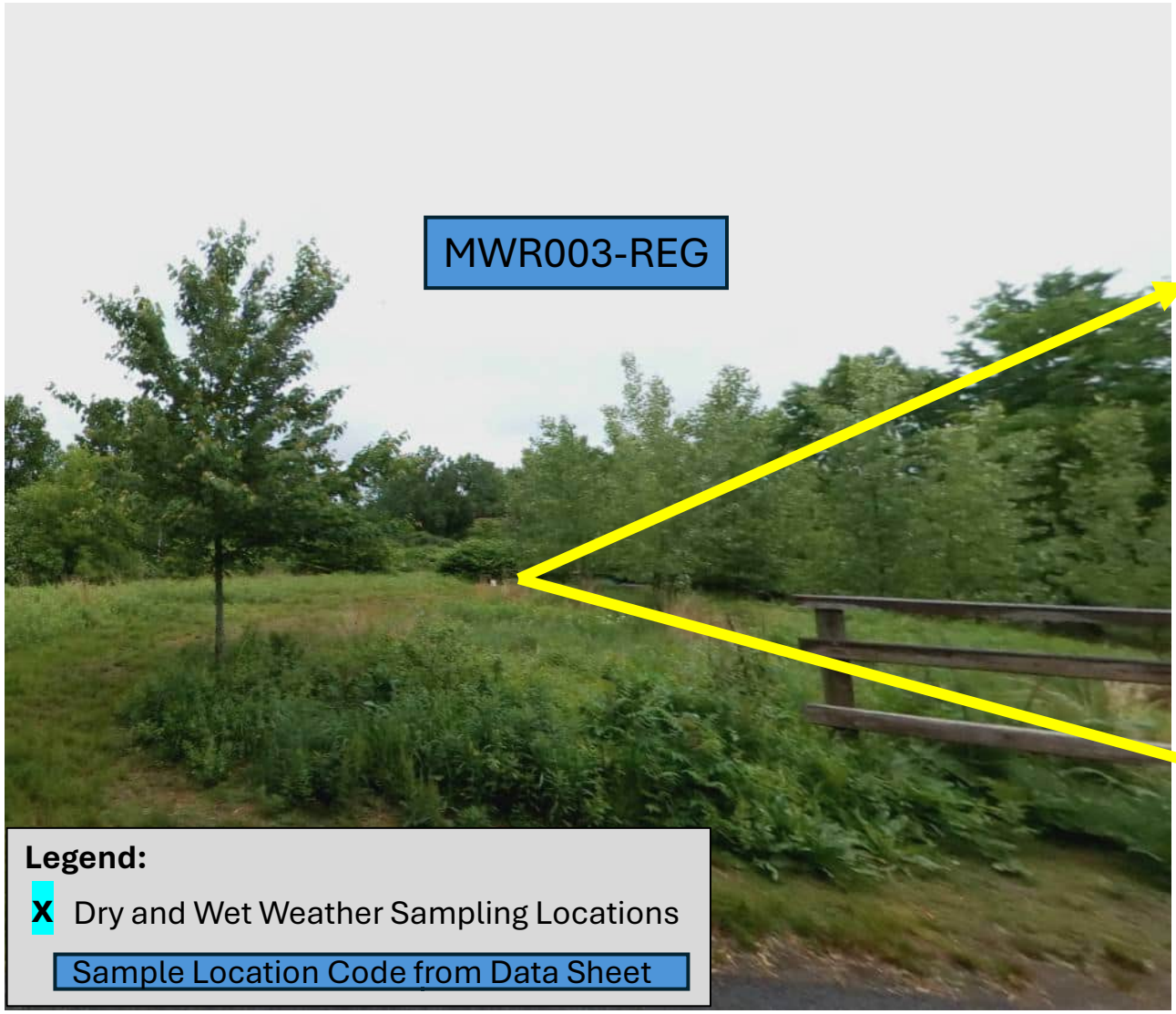
Siphon – Section 177 B STA53+00 (STA52+97 in GIS) – Alewife Brook

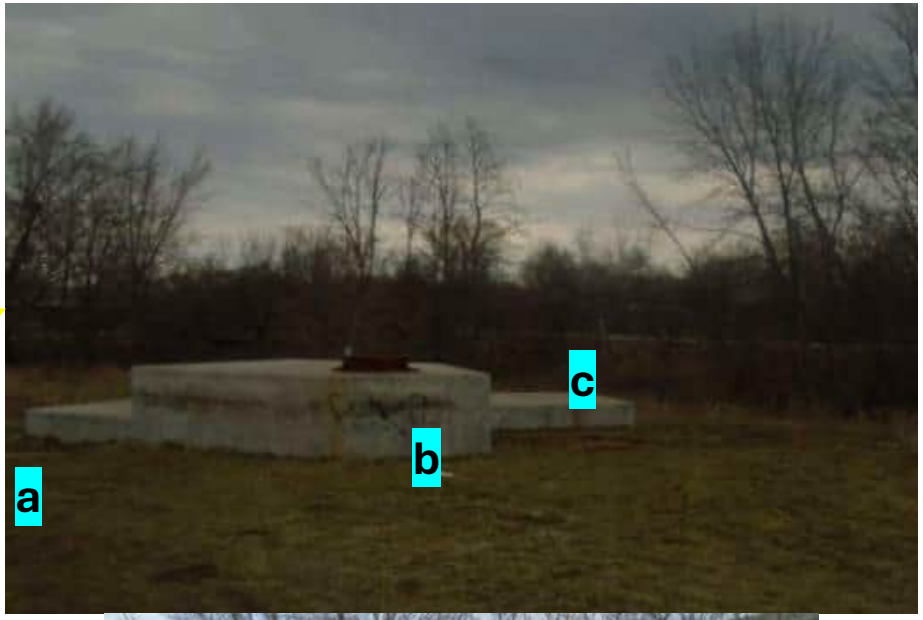
Siphon – Section 177B near STA55+72 (55+65 in GIS) – Alewife Brook

Upstream End of ABBS-Rindge Ave Siphon STA2+92 (MWR003) – Alewife Brook

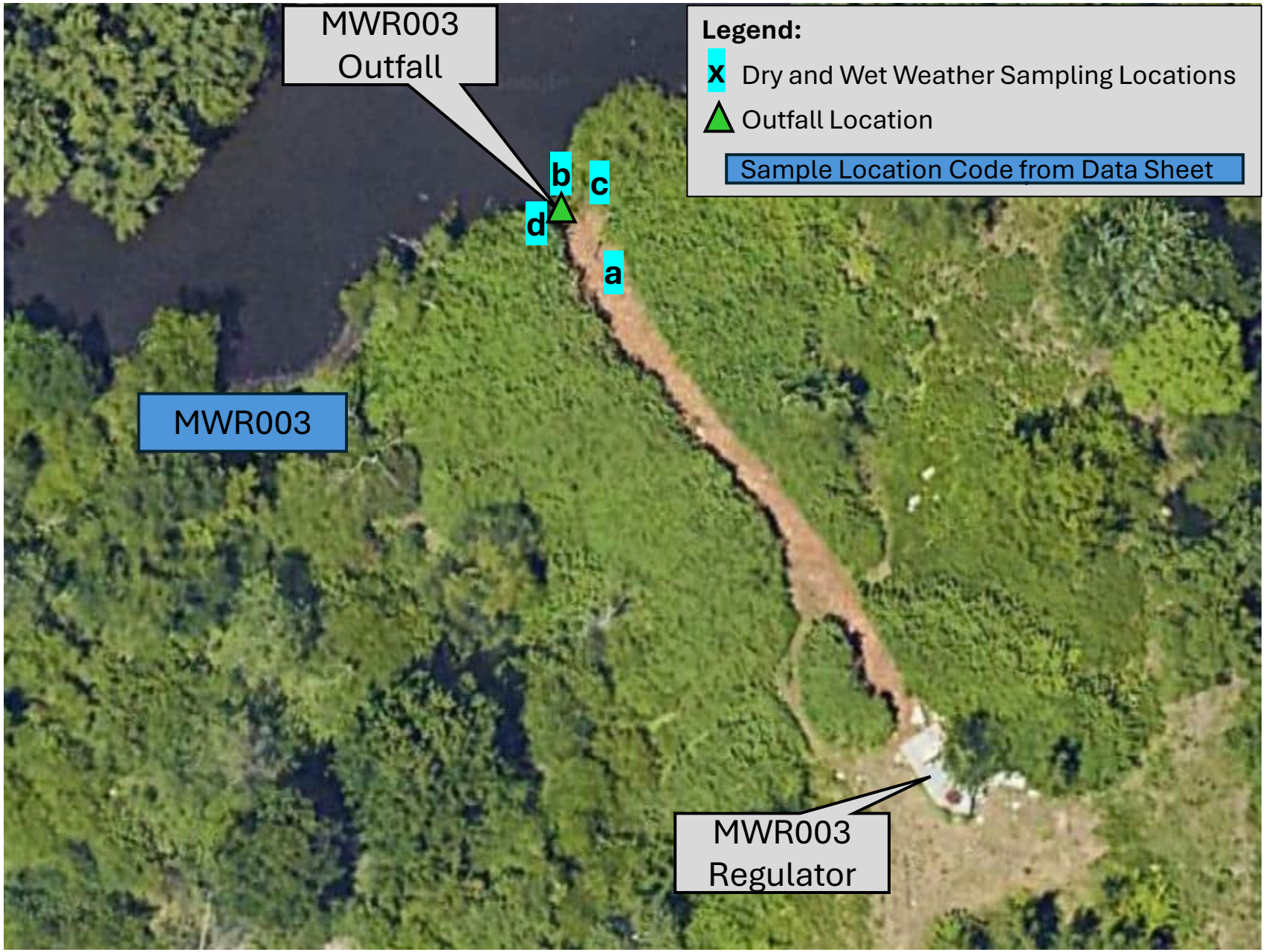
Downstream End of ABBS-Rindge Ave Siphon STA2+21 (MWR003) – Alewife Brook

MWR003 – Regulator – Alewife Brook

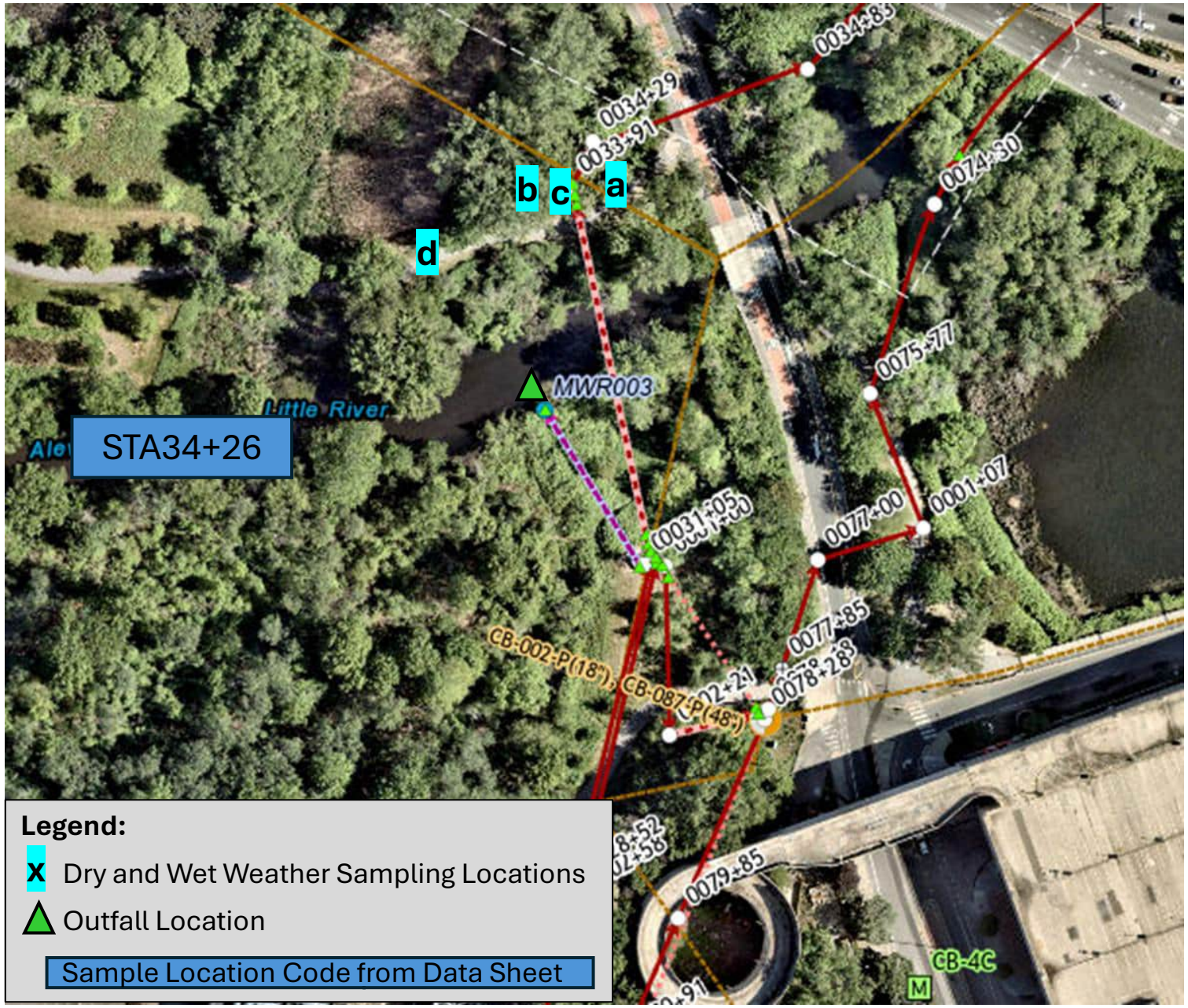




MWR003 Outfall – Alewife Brook

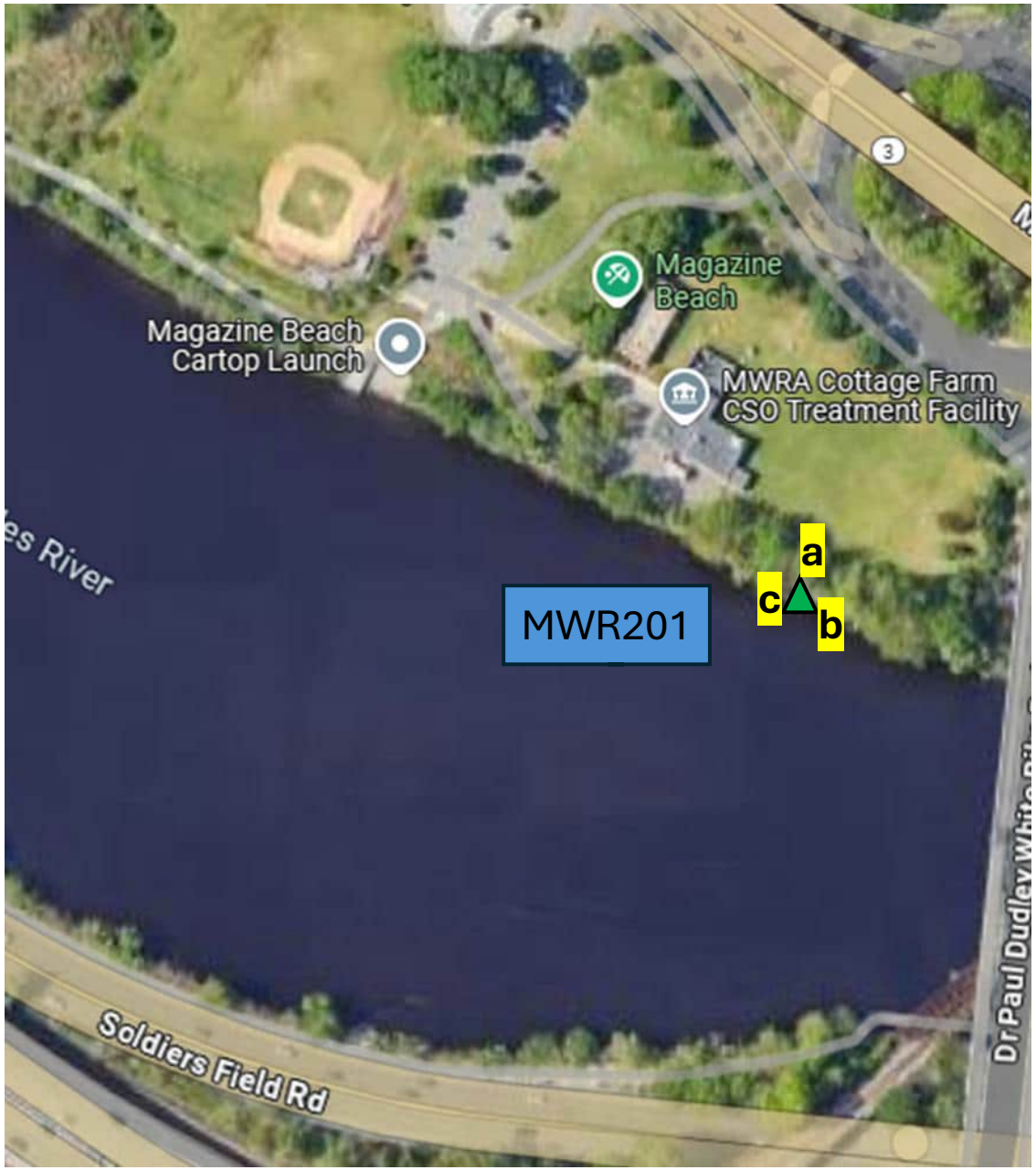


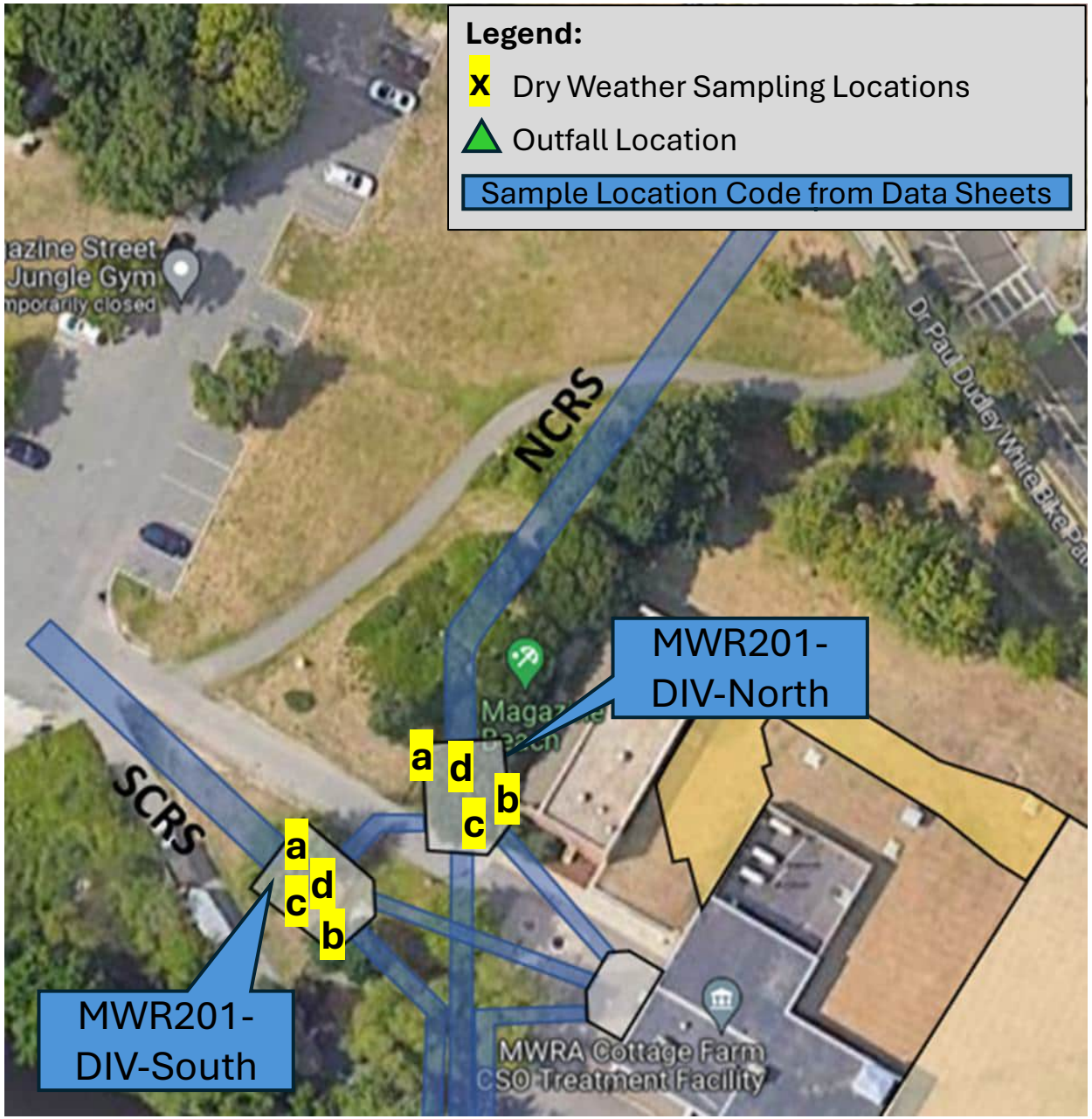
Siphon Under Alewife Brook STA34+26 – Alewife Brook



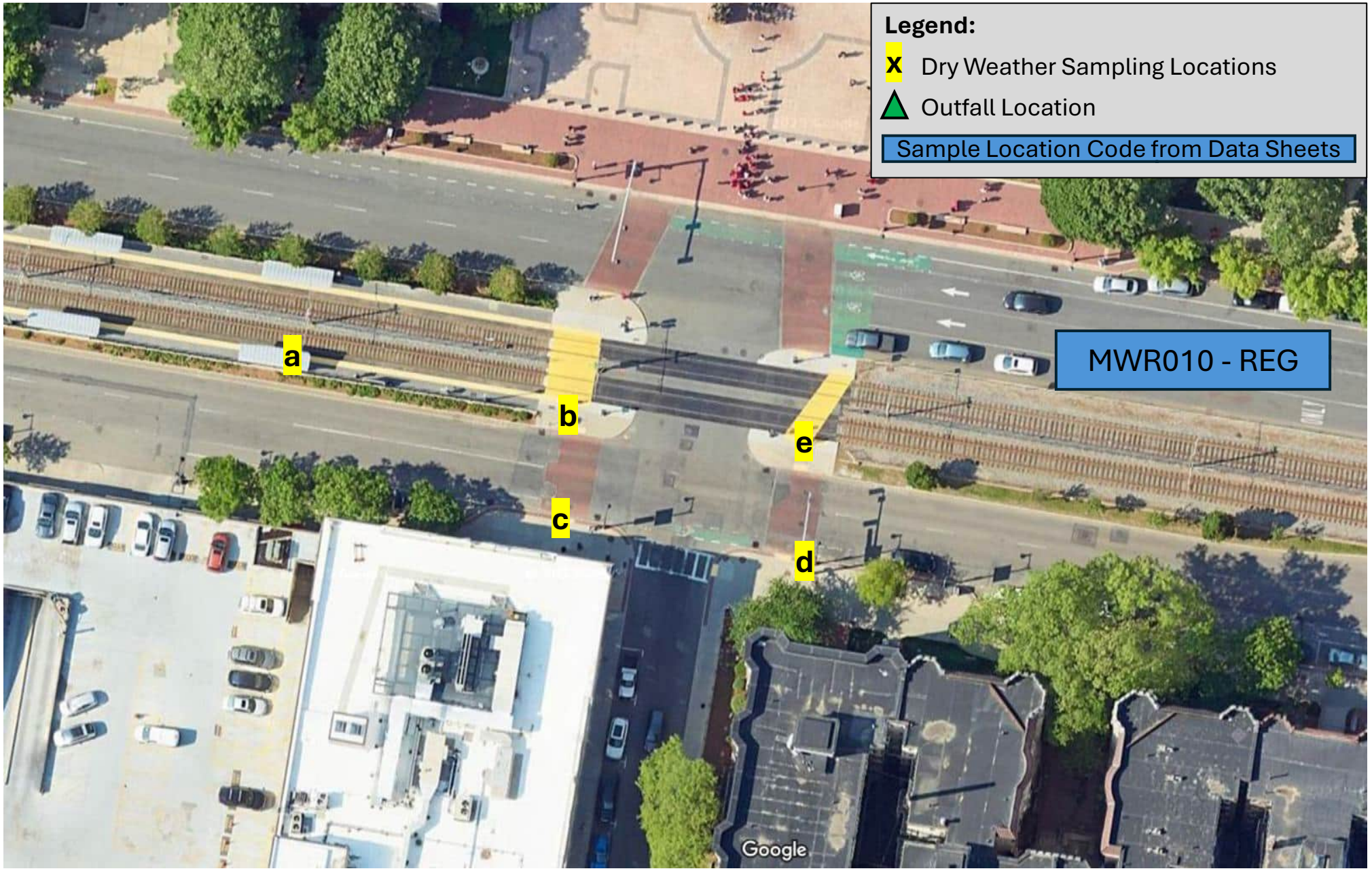
Somerville Marginal CSO Facility/Outfall SOM007A/MWR205A – Upper Mystic River

Outfall MWR201- Charles River

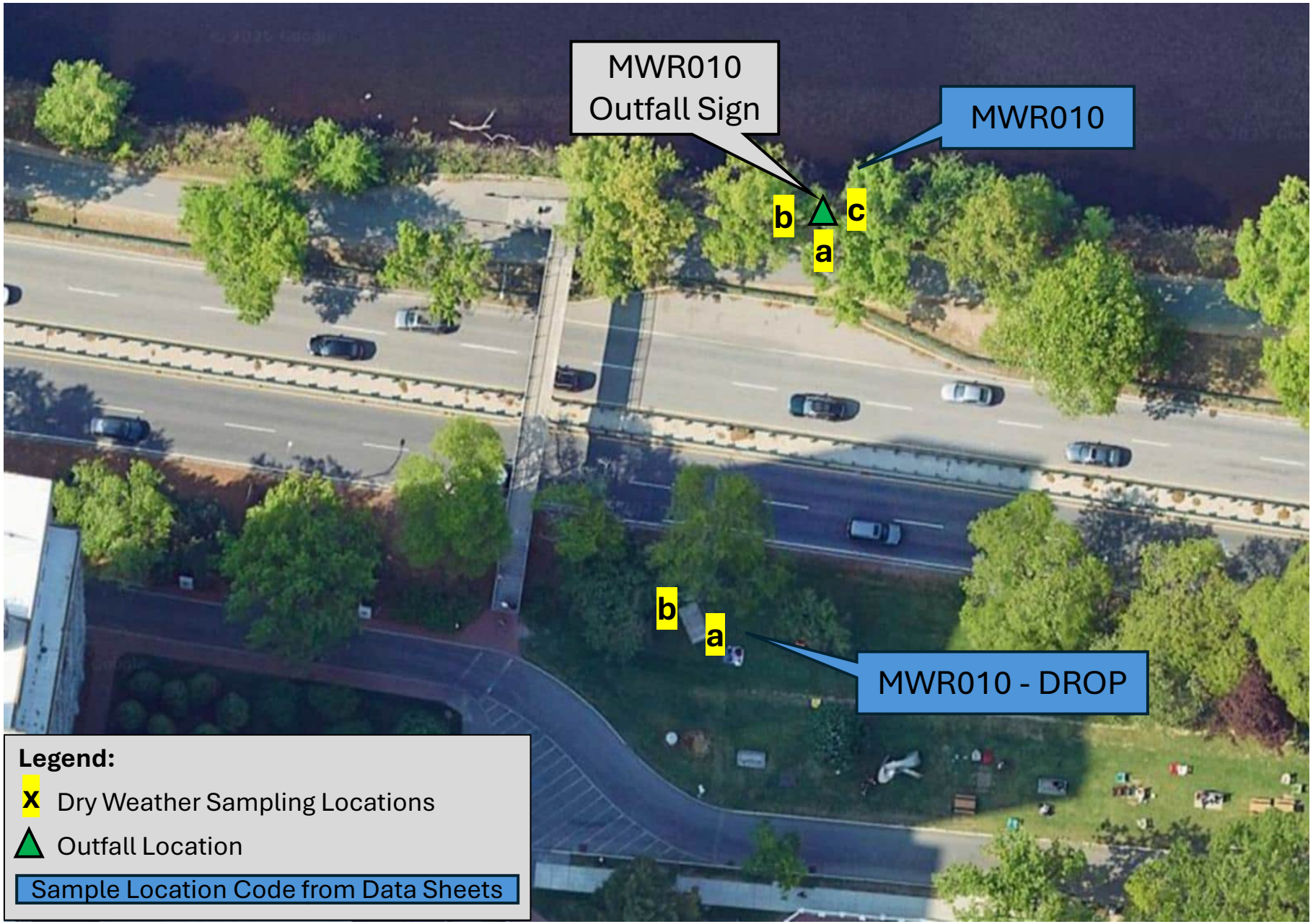




Regulator MWR010 - Charles River



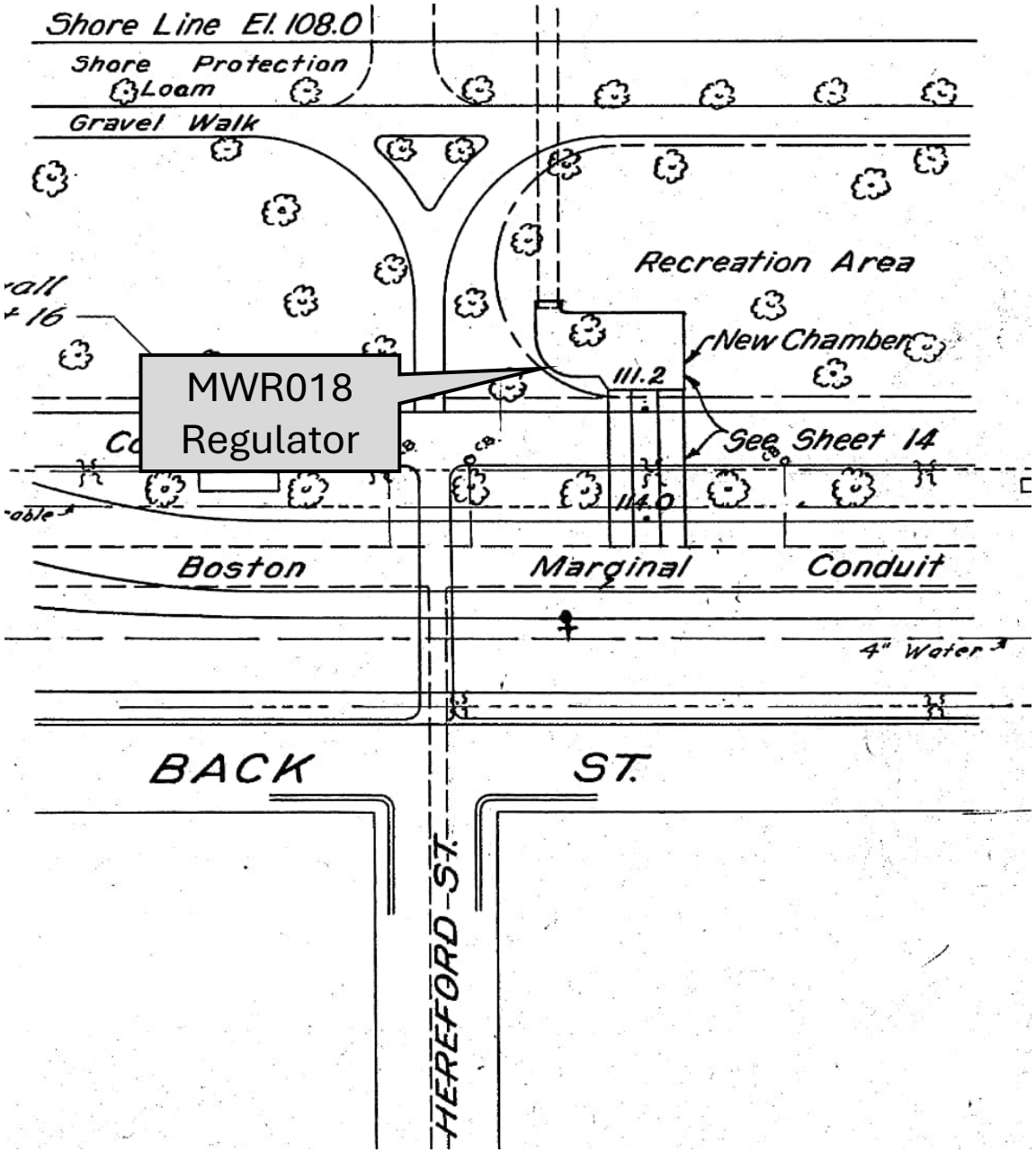
Outfall MWR010 – Charles River

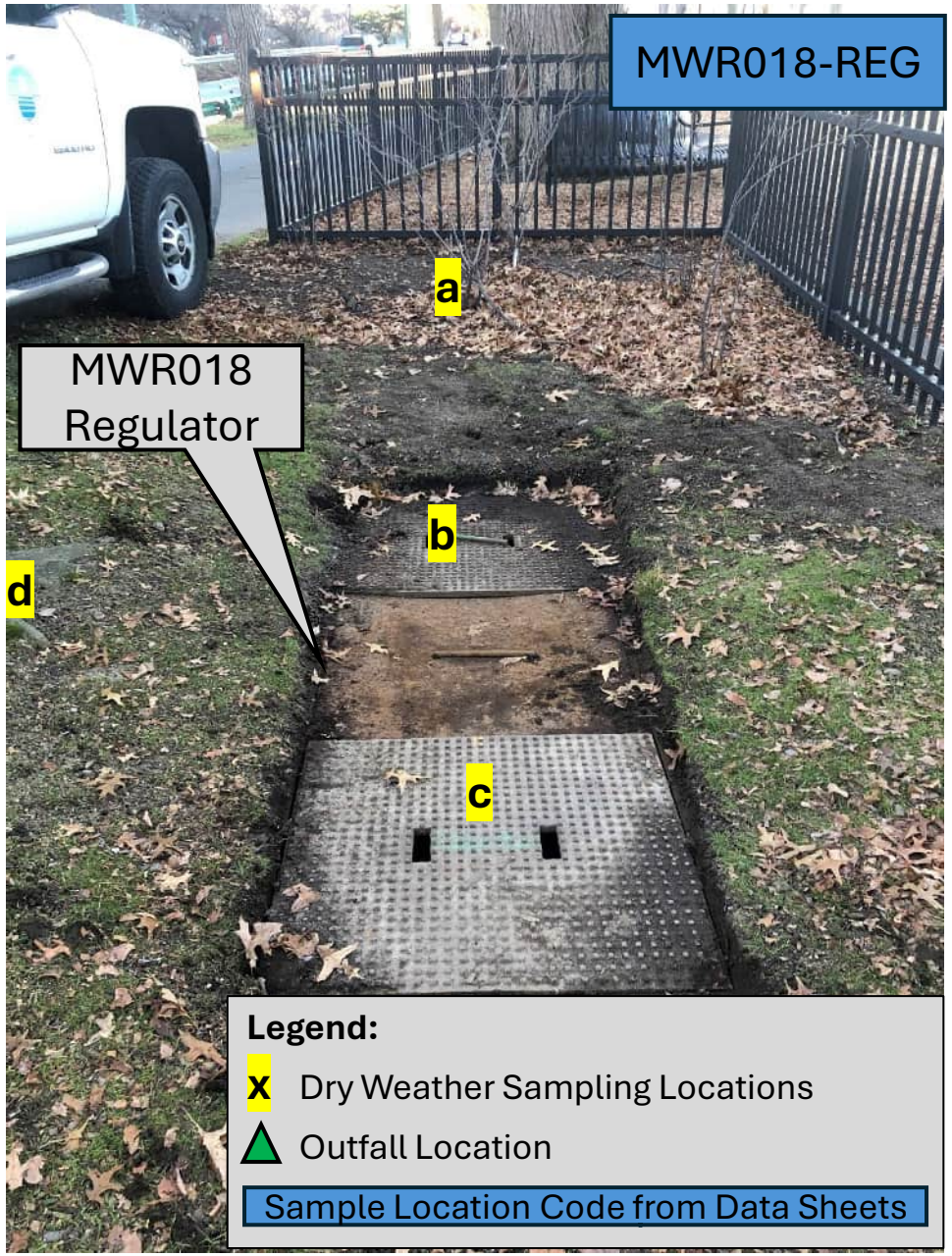


Outfall MWR023 – Charles River

Outfall MWR018 – Charles River

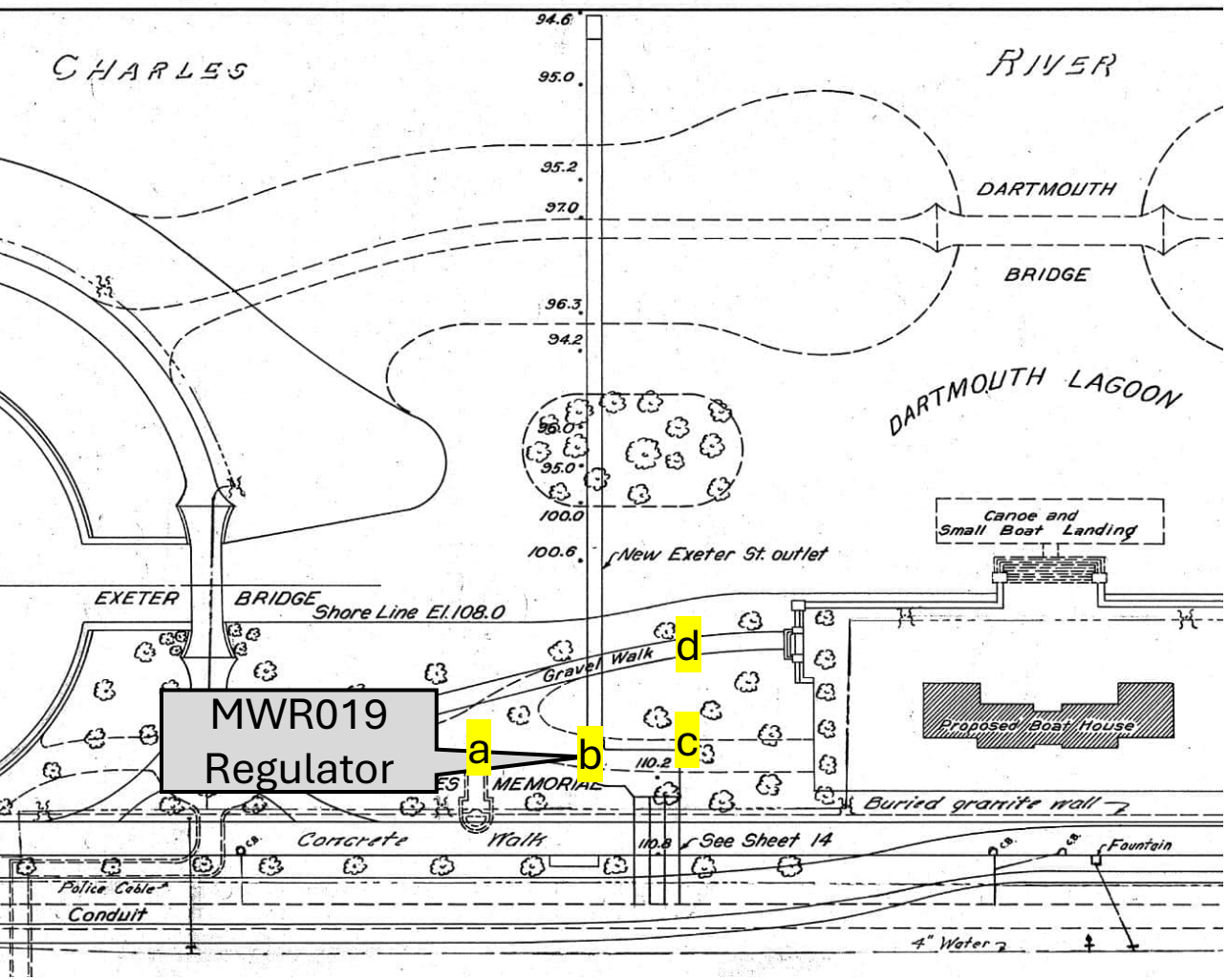
Regulator MWR018 – Charles River

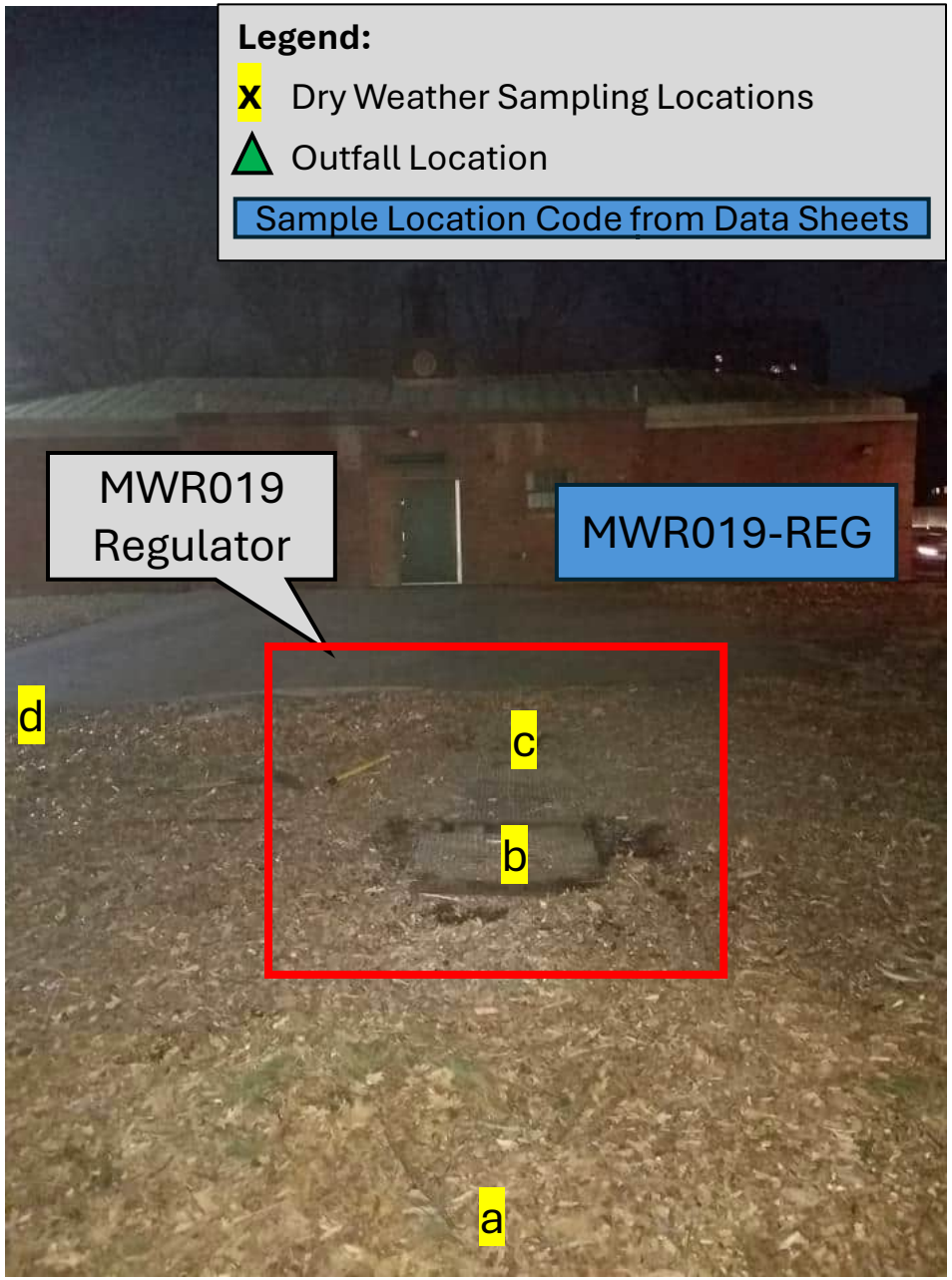




Outfall MWR019 – Charles River

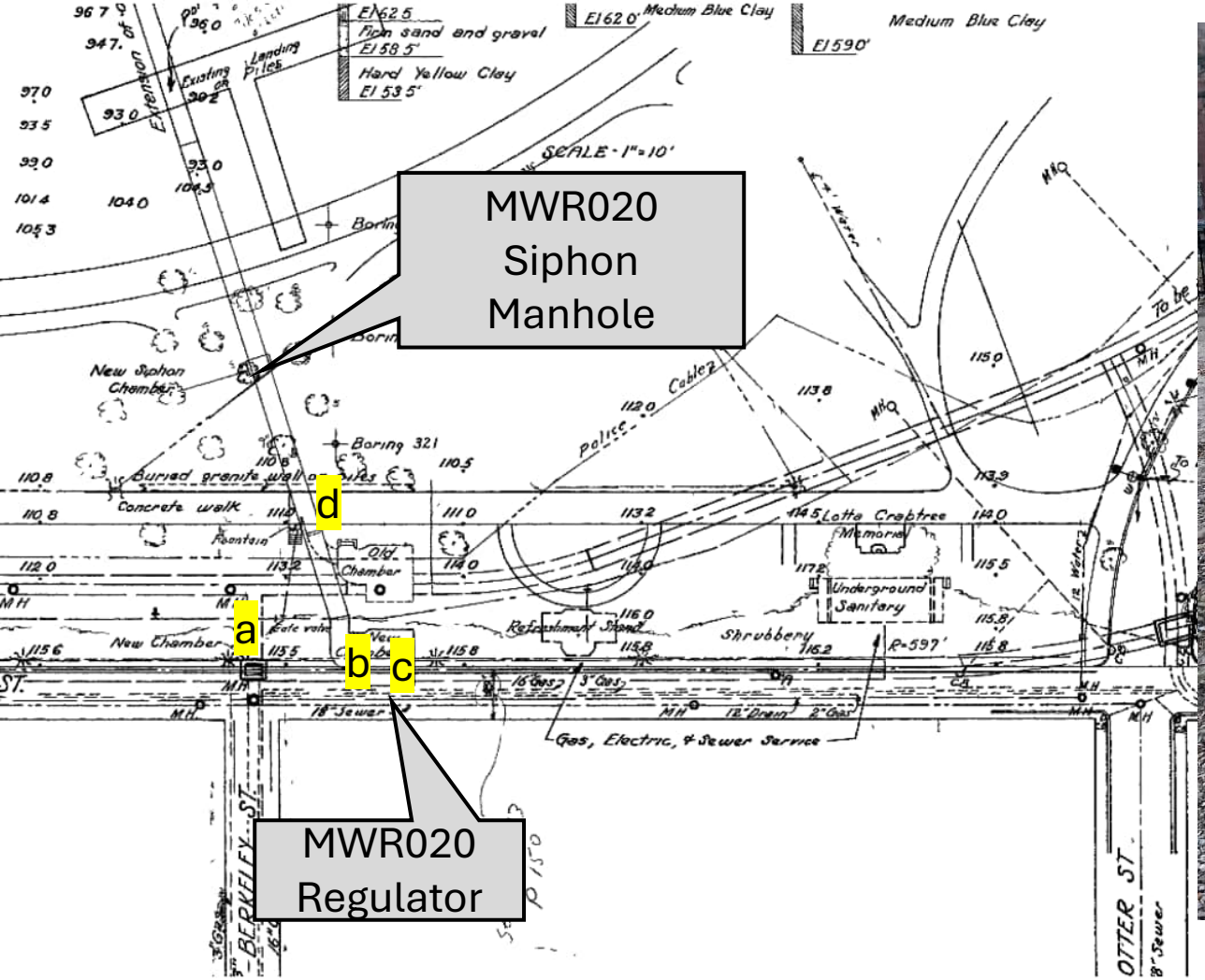
Regulator MWR019 – Charles River

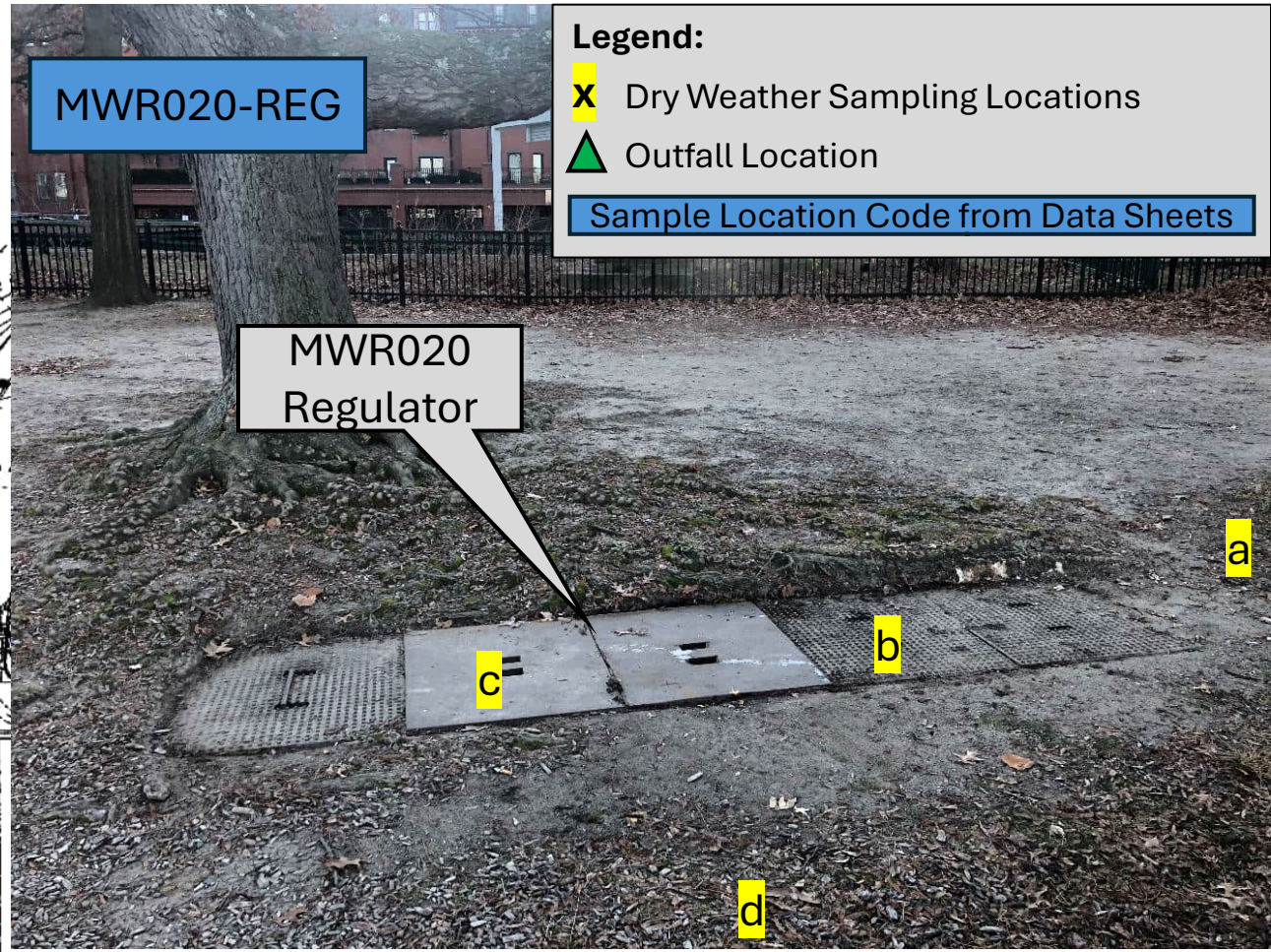




Outfall MWR020 – Charles River

Regulator MWR020 – Charles River





Appendix D: Project Operating Procedure

AECOM

Environment

Project Operating Procedure

Hydrogen Sulfide Monitoring, Massachusetts Water Resource Authority, City of Boston, Cambridge, and Somerville, Massachusetts

1. Scope and Applicability

This Project Operating Procedure (POP) outlines the approach related to monitoring, data evaluation, and assessment for hydrogen sulfide (H_2S) gas and odor intensity as part of the Massachusetts Water Resource Authority (MWRA) Odor Control Feasibility Study. Hand-held H_2S monitoring and observational monitoring for odor intensity and visible floatables will be performed in the area of the combined sewer outfalls (CSOs) to research complaints submitted by residents of the City of Boston, Cambridge, and Somerville. This POP also takes into consideration site-specific challenges and environmental factors to support accurate monitoring.

This POP is to be utilized for the work identified in the title of this POP. In the event the Project Manager or Project Team determines that protocols or procedures listed in this POP are not applicable to the project or in need of revision, this POP will be revised and reissued to the project team.

2. Health and Safety Considerations

The health and safety considerations for the work associated with this POP, including both potential physical and chemical hazards, will be addressed in the site-specific Health and Safety Plan (HASP). In the absence of a site-specific HASP, work will be conducted according to the AECOM Health and Safety Policy and Procedures Manual and/or direction from the Regional Health and Safety Manager.

3. Potential Interference

The operation of inadequately maintained equipment and hardware may lead to inaccurate measurements during the H_2S monitoring program. Potential interferences to the Jerome® 631-X H_2S Analyzer are unusual and can be avoided through proper instrument maintenance. There are a few things to be aware of when operating the Jerome® 631-X H_2S Analyzer:

- The gold film sensor used in the Jerome H_2S Analyzer does not respond to hydrocarbons, carbon monoxide (CO), carbon dioxide (CO_2), sulfur dioxide (SO_2) and water vapor. Exposure to water vapor condensation on the gold film can cause damage to the sensor and should be avoided.
- The gold film sensor used in the Jerome H_2S Analyzer may respond to chlorine, ammonia, nitrogen dioxide (NO_2) and most mercaptans (organic sulfur compounds). Filters designed to remove chlorine and ammonia gas are available through the instrument manufacturer and routine filter replacement is recommended.

4. Equipment

- Jerome® 631-X H_2S Analyzer
- Low Level H_2S Functional Test Module (FTM) (Z2600-0930)
- Permeation tube (H_2S 30 ppb target concentration)
- Tygon® tubing
- Rotating Vane Anemometer
- AC power converter for vehicle

5. Instrument Calibration Procedures

5.1 Low Level H_2S FTM

The Low Level H_2S FTM is designed to generate a known concentration of H_2S gas to be used for the "fit for use" calibration checks of the Jerome® 631-X H_2S Analyzer. The FTM will be factory calibrated annually by the manufacturer. The permeation tube shall be removed from the FTM and is subject to the certification from the manufacturer.

5.2 Jerome® 631-X H_2S Analyzer

5.2.1 Calibration Procedures

The Jerome® 631-X H_2S Analyzer has a gold film sensor that is inherently stable and does not require frequent calibrations. The interval between calibrations depends on the application and frequency of use and the recommended interval is 12 months. However, this interval can be extended based on fit for use checks of the instrument's functionality using the Low Level H_2S FTM. Therefore, calibration of the Jerome® 631-X H_2S Analyzer will be documented using the instrument's manufacturers calibration, or the fit for use test performed in the field using the Low Level H_2S FTM if beyond one year of the factory calibration. Results of the calibration procedures will be documented on the project-specific Field Calibration Form (included in **Attachment 1**).

5.2.2 Fit for Use Calibration Checks

Fit for use checks will be performed each time the instrument is deployed to the field. The Jerome® 631-X H_2S Analyzer will be zeroed and checked against a calibration standard generated by the Low Level H_2S FTM. During this calibration check, the technician will use a 30 ppb (0.030 ppm) gas standard to bump test the instrument and confirm that the reading is equal to the input gas concentration applied, +/- 20%. Each fit for use check will be documented on the appropriate field documentation forms. If the sensor does not pass the fit for use check, the technician will return the instrument for maintenance. The following are some considerations when performing calibration checks:

- Zero tests should be performed in fresh uncontaminated air.
- Bump tests should be performed in fresh, well-ventilated air.
- Ambient temperature should be between 50°F and 86°F.
- Bump test should be performed in an area free from other cross interference gases (e.g., exhaust fumes, cigarette smoke, solvents).

5.2.2.1 Bump Test

Bump tests will be performed prior to the start of each field sampling event. These checks may be performed up to 1 week before use in the field. Refer to Jerome® 631-X H_2S Analyzer and Low Level H_2S FTM operational manuals for detailed instructions. Bump tests will be conducted in accordance with the following procedures:

1. Perform sensor regeneration on the Jerome® 631-X H_2S Analyzer.

2. Set up the Low Level H_2S FTM for operation by attaching the tubing to the sample gas outlet and sealing the exposed end with the red vacuum cap and replace spent desiccant.
3. Turn the unit on and allow the Low Level H_2S FTM to warm-up and stabilize. Note it may take up to 12 hours for the Low Level H_2S FTM to fully warm-up and stabilize.
4. Remove the red vacuum cap from the tubing attached to the sample gas outlet and attach to the Jerome® 631-X H_2S Analyzer intake tube nut to ensure an airtight seal.
5. Verify the Jerome® 631-X H_2S Analyzer is either in Auto-range mode or an appropriate manually selected range for the gas level being produced by the Low Level H_2S FTM.
6. Take and record 10 analyzer bump test samples as follows:
    a. Press SAMPLE on the Jerome® 631-X H_2S Analyzer.
    b. When the concentration appears, record it, wait 30 seconds, then take another sample.
    c. Repeat this until a total of 10 samples have been taken and recorded.
    d. Disregard the first 5 samples and average the last 5.
    e. If the average is within the acceptable range (see **Table 1**), the Jerome® 631-X H_2S Analyzer is functioning properly and fit for use has been demonstrated.
    f. If the average is outside the acceptable range (see **Table 1**) the Jerome® 631-X H_2S Analyzer is not functioning properly. See **Section 5.3 Troubleshooting the Jerome® 631-X H_2S Analyzer**.
7. Remove Jerome® 631-X H_2S Analyzer from FTM and remove the tube from the instrument's intake and cap the output tube adaptor (or the sample gas outlet if the tube is removed) using the vacuum cap.
8. Turn the Low Level H_2S FTM off.

5.2.2.2 Zero Checks

Zero checks will be performed prior to the start of each field sampling event. These checks should be performed in the field immediately before use. Refer to Jerome® 631-X H_2S Analyzer operational manual for detailed instructions. Zero checks will be performed in accordance with the following procedures:

1. Place Zero Air Filter on Jerome® 631-X H_2S Analyzer and press SAMPLE on the Jerome® 631-X H_2S Analyzer and sample continuously until the readings stabilize.
2. Perform sensor regeneration.
3. Re-zero the Jerome® 631-X H_2S Analyzer.
    a. If FTM was used immediately before zero check, wait 30 minutes before re-zeroing the Jerome® 631-X H_2S Analyzer.
    b. If performing zero check only, the instrument is ready for re-zero immediately.
4. Remove the zero-air filter from Jerome® 631-X H_2S Analyzer. The instrument is ready for use.

Table 1 Low Level H_2S FTM Acceptable Average Range Values

Fit for Use Checks	Frequency	Target H_2S Concentration	Acceptable Average H_2S Concentrations
Zero Check	Daily Before Instrument Use	0 ppb	0 – 6 ppb
Bump Check	Within One Week of Instrument Use	30 ppb	24 to 36 ppb

5.2.3 Troubleshooting the Jerome® 631-X H_2S Analyzer

If the instrument is determined to not be operating within an acceptable range, consider the following troubleshooting questions and make necessary corrections:

1. Were the fit for use procedures followed exactly?
2. Is either the source or exhaust port plugged?
3. Did the Low Level H_2S FTM warm-up and stabilize for the recommended time period?
4. Are connections tight and proper?
5. Does your permeation tube need replacement? How long has it been in use and for how many hours?
6. Can you check the Low Level H_2S FTM output with another instrument? Is it within range?
7. Do you suspect your Jerome® 631-X H_2S Analyzer may be malfunctioning or is out of calibration?
8. Has the instrument been calibrated by the manufacturer in the last 12 months?

A table of the Jerome® 631-X H_2S Analyzer's operational codes and definitions can be found in Section 4 of the instrument manual.

5.3 Rotating Vane Anemometer

A portable rotating vane anemometer will be used to document onsite weather conditions. The make and model of this device may change based on availability. This device will be used to provide relative weather conditions and is not subject to a formal calibration procedure. The results of the rotating anemometer will be compared against locally available weather data during each field use to confirm reasonability of the data.

6. Monitoring Procedures

Hand-held H_2S monitoring and observational monitoring for odor intensity, visible floatables, and relevant weather conditions will be performed at each of the MWRA-owned CSO structures that discharge to variance waters. Additionally, locations along MWRA interceptors adjacent to the receiving waters where potentially turbulent flow could occur including the upstream and downstream ends of siphons will be sampled. Table 1 lists these locations. Monitoring will be performed during non-active (dry weather) and active (wet weather) timeframes.

Dry weather was defined as a period when no rainfall or only trace amounts occurred in the period of approximately 36 hours prior to the sampling event. Dry weather monitoring will be performed to understand baseline conditions at the locations listed in Table 2.

Wet weather was defined as having a period of rain prior to or during the sampling with the goal of collecting samples when higher flows were present in the collection system due to stormwater inflow and if possible, when CSOs were active. Wet weather monitoring locations are also based off of Table 2 but may change based on conditions during monitoring events and may include all or a subset of locations identified in the baseline (dry weather) monitoring.

Table 2. Sampling Locations

Name	Sampling Location Description	Address
Alewife Brook		
Alewife Brook Pump Station	1) North Side of pump station near grates 2) South side of pump station	392 Alewife Brook Parkway, Somerville, MA 02144
ABC and ABBS Interceptor Connection #3 Sta. 83+55	1) Manhole is located in the sidewalk across the street from Stop and Shop	105 Alewife Brook Parkway, Somerville, MA 02144
ABC and ABBS Interceptor Connection #2 Manhole at Sta. 70+71	1) Across the street from 45 Alewife Brook Parkway, Cambridge, MA 02140	Alewife Brook Parkway, Cambridge, MA
ABC and ABBS Interceptor Connection #1 Manhole at Sta. 63+63	1) Across the street from 25 Alewife Brook Parkway, Cambridge, MA 02140 between the bike path and Alewife Brook	25 Alewife Brook Parkway, Cambridge, MA
ABC Siphon Structure near Mass. Ave. Sta. 53+00 (upstream) Sta. 55+72 (downstream)	1) Siphon Head House Sta. 53+00 (Arlington) – Near Eversource Valve chamber. 2) Siphon Vent Sta. 55+72 (Cambridge)	Boulevard Road, near intersection of Mass. Ave. and Alewife Brook Parkway Arlington, MA.
MWR003 Outfall and Regulator	1) At the regulator structure 2) Where the outfall meets the shoreline	Alewife Station Access Road, Arlington, MA
ABC Siphon near MBTA garage	1) Siphon Head House Sta. 2+92 2) Downstream End of Siphon Sta. 2+21	Alewife Station Access Road, Arlington, MA
Siphon Under Alewife Brook Sta. 34+26	1) In the wooded area adjacent to the bike path on the Arlington side of the brook.	Alewife Station Access Road, Arlington, MA
Charles River		
Cottage Farm CSO Facility (MWR201)	1) North Charles Relief Sewer (NCRS) diversion chamber 2) South Charles Relief Sewer (SCRS) diversion chamber 3) Where the outfall meets the shoreline	Magazine Beach 668 Memorial Drive, Cambridge, MA
MWR010 Outfall and Regulators (RE037 and RE036-9)	1) At the grates where the overflow line drops below Storrow Drive 2) Two regulator structures (measurements taken from the curb) 3) Where outfall meets the shoreline.	Commonwealth Ave and St Mary's Street, Boston, MA
MWR023 Outfall and Fens Gatehouse	1) Outside of Fens Gatehouse	Storrow Drive Boston, MA
MWR018 Outfall and Regulator	1) At the regulator structure 2) Where the outfall meets the shoreline	Storrow Drive Boston, MA
MWR019 Outfall and Regulator	1) At the regulator structure 2) Where the outfall meets the shoreline	Storrow Drive Boston, MA
MWR020 Outfall and Regulator	1) At regulator structure 2) Where the outfall meets the shoreline	Storrow Drive Boston, MA
Mystic River		
MWR205A/SOM007A Outfall and Regulator	1) At the weir structure for MWR205A 2) Where the outfall meets the shoreline	Fellsway and Grand Union Boulevard Somerville, MA

6.1 General Considerations

The following considerations will be evaluated on an event or location basis during the monitoring program.

- Monitoring will be scheduled based on anticipated/forecasted CSO meter and weather conditions. AECOM will work with MWRA to schedule dry and wet weather monitoring events.
- Safety during monitoring should be considered during monitoring events. If the intended monitoring target is in a busy street, monitoring should be done in nearest location downwind of the location off of the street. Monitoring may be performed at more than one location for each MWRA CSO to understand downwind conditions.
- Bump tests should be performed in the laboratory within one week of the sampling event. The Low Level H_2S FTM can take up to 12 hours to warmup prior to use.
- Regeneration of the Jerome sensor requires the use of AC power. Therefore, regeneration in the field will require the use of a vehicle power converter or vehicle AC outlet, if available. The instrument should be re-zeroed after each regeneration which can take up to 30 minutes to stabilize.
- Instrumentation is appropriate for use during active precipitation events; however, an effort should be made to keep the Jerome 631-X H_2S Analyzer dry or from pulling in moisture. The analyzer can be shielded from precipitation with an umbrella or protective jacket and by pointing the sample inlet down to prevent rain from being pulled into instrument.

6.2 Dry and Wet Weather Monitoring

At the start of each monitoring event (dry and wet weather) the AECOM field technician will prepare the instrumentation in accordance with this POP and perform the required monitoring. Monitoring results will be documented on the Field Data Sheet included in **Attachment 2**. Monitoring will be performed in accordance with the following procedures:

1. Prepare the Jerome 631-X H_2S Analyzer by performing calibration procedures presented in **Section 5**.
    a. Perform bump test within one week of monitoring event.
    b. Plug the Jerome into AC Power and regenerate sensor. NOTE: regeneration requires AC power and there is a recommended 30-minute wait following regeneration. However, the instrument can be used immediately if necessary.
    c. Zero check instrument in field conditions. If the instrument needs zero correction, press ZERO and adjust the ZERO ADJUST pot until 0 appears on the display. If the display reads “H”, turn the ZERO ADJUST counterclockwise. If the display reads “L”, turn the ZERO ADJUST clockwise.
2. Evaluate the monitoring location for safety hazards and establish safe measurement locations. Potential monitoring locations are included in the MWRA Odor Control Feasibility Study Observation Locations Power Point included as **Attachment 3**.
    a. Document location of hand-held and observational monitoring using the following naming convention:
        i. MWRA Outfalls: MWR###-A,B,C: Where: ### represents the MWRA CSO number and A,B,C indicate the monitoring positions for each CSO.
        ii. Interceptor locations (siphons, interceptor connections): STA###-A,B,C: where ### represents the stationing number of the manhole
        iii. MWRA Facilities: ABPS-A,B,C; SM-A,B,C; CF-A,B,C: where ABPS is Alewife Brook Pump Station, SM is the Somerville Marginal CSO Facility, and CF is the Cottage Farm CSO Facility

iv. Monitoring Locations should be identified on a Site map or documented through GPS coordinates.

b. Hand-held and observational monitoring will be performed at a minimum of three locations near each identified sampling site (2 downwind and 1 upwind locations). No on-water observations are planned. Monitoring at additional locations can be performed as needed based on field observations and MWRA request.

3. Determine relevant weather conditions, including wind speed and wind direction using the anemometer and local available data sources. Document conditions on the Field Data Sheet.

4. Perform hand-held H_2S monitoring at a minimum of three locations near each identified sampling site (2 downwind and 1 upwind) using the Jerome 631-X H_2S Analyzer:

   a. Press power ON (Display will show 000)

   b. Allow 1-mnute warmup before beginning measurements

   c. Press SAMPLE button. During the sampling cycle the display will show the sensor saturation. The length of sample will depend on the concentration of H_2S. Instrument ranges, concentrations, response time and accuracy are included in **Table 3**.

   d. At the end of the sampling cycle, the display will show the H_2S concentration in ppm. The value will remain on the display until the next sampling cycle is initiated.

      When elevated readings are detected: Concentrations should be confirmed by taking an additional sample. Install zero air filter to confirm zero or near zero conditions. Remove the filter and sample the location again to verify the elevated concentration.

      If sensor is completely saturated, the display will show ".8.8.8" instead of a concentration. The instrument will require sensor regeneration and a repeat of **Step 1**. The sensor will become saturated at 100 samples at 0.5 ppm.

   e. Record H_2S concentrations on the Field Data Sheet. If H_2S concentration is greater than 6 ppb provide a comment. If H_2S concentration is less than 6 ppb continue to survey the area.

5. Perform observational odor monitoring at a minimum of 3 locations near each identified sampling site (2 downwind and 1 upwind) using the odor observation scale in **Table 4**.

   a. Record odor intensity on the Field Data Sheet. If the odor intensity observation is a 3 or greater provide a description of the odor on the Field Data Sheet. Descriptions of common odors associated with CSOs are included in **Table 5**.

6. Perform observational monitoring of outflow for floatables.

   a. Record visual observations of floatables on Field Data Sheet. If floatables are observed provide description of floatable including general size and quantity. If possible, take pictures of the observed floatables.

7. Once monitoring is complete on site, confirm relevant H_2S, odor and visual observations have been recorded on the Field Data Sheet. Perform monitoring at additional locations, as needed.

8. Repeat steps 1 through 7 for each monitoring location.

9. When monitoring is complete for the day. Perform sensor regeneration before shutting down instrument for the day. Do not allow H_2S to stay on the gold film sensor overnight; this may damage the sensor.

10. Instrument should be stored with the zero-air filter on the Jerome 631-X H_2S Analyzer intake to prevent exposure of gold film sensor to H_2S during non-operational periods.

Table 3 Jerome 631-X H_2S Analyzer Accuracy based on Ambient Concentrations

Range	Concentration	Response Time	Accuracy at Mid-Range
0	0.001 – 0.099 ppm	30 seconds	± 0.003 ppm at 0.050 ppm
1	0.10 – 0.99 ppm	25 seconds	± 0.03 ppm at 0.50 ppm
2	1.0 – 9.9 ppm	16 seconds	± 0.3 ppm at 5.0 ppm
3	10 – 50 ppm	13 seconds	± 2 ppm at 25 ppm

Table 4 Odor Observation Scale

Scale Description	Odor Intensity Description
0 – Not Detectable	Odor not detectable by the sense of smell.
1 – Very Light	An odor present in air which activates the sense of smell, but the characteristics may not be distinguishable.
2 – Light	An odor present in air, which activates the sense of smell and is distinguishable and definite. This may not necessarily be objectionable in short durations but may be objectionable in longer durations.
3 – Moderate	An odor present in air which easily activates the sense of smell, is very distinct and clearly distinguishable, and may tend to be objectionable and/or irritating.
4 – Strong	An odor present in air, which would be objectionable and cause a person to attempt to avoid it completely and may cause physiological effects during prolonged exposure.
5 to 8 – Very Strong	An odor present in the outdoor air, which is so strong, it is overpowering and intolerable for any length of time and causes physiological effects.

Table 5 Odor Descriptions related to Wastewater and Stormwater Outflows

Chemical of Interest	Odor Description
Hydrogen Sulfide (H_2S)	Foul pungent, like rotten eggs
Methane	Odorless
Ammonia	Strong pungent odor commonly associated with cleaning products, cat urine, and occasionally sweet.
Carbon Dioxide (CO_2)	At low concentrations it's odorless; at high concentrations it has a sharp acidic odor.

7. Preventative Maintenance

The following are general preventive maintenance tasks to be completed for the Jerome 631-X H_2S Analyzer sensor. Refer to the owner's manual for detailed instructions.

- Charge Batteries: Charge batteries at least once per month, after 1 month's storage, or when "LO BAT" appears on display.
- Change 0.25" Fritware: Change 0.25" Fritware weekly or as needed.
- Change Internal Filters and Tubing: Change internal filters and tubing after 6 months of use or as needed.
- Replace Zero Filter: Replace zero air filter annually.
- Factory Calibration: Return instrument annually to the manufacturer for factory calibration or as needed. Factory calibration can be extended beyond one year, with use of the Low Level H_2S FTM to perform bump tests before instrument use.
- Calibration Check: Perform calibration check with the Low Level H_2S FTM within one week of monitoring event.
- Replace Batteries: Replace batteries annually or as needed.
- Instrument Storage: Instrument should be stored with the zero-air filter installed. This will prevent the sensor from becoming saturated during non-use.

8. Data and Records Management

Information relevant to the sampling period will be documented on the appropriate Field Calibration Form (**Attachment 1**) and Field Data Sheet (**Attachment 2**) in accordance with the procedures identified herein. Additional information related to field notes and site maps will be used to document other relevant information. Weather conditions will be documented in the field but data from available local sources may also be downloaded and used to support the measurement program. Information to be recorded includes the following:

- Date, time, and location of monitoring data. Location will be documented on Site maps or by GPS coordinates
- Field technician names
- Serial numbers for instruments used
- Calibration records including factory calibrations, fit for use checks, and zero checks.
- Relevant weather data collected onsite
- Field log of relevant information not included on the Field Calibration Form or Field Data Sheets

9. Personnel Qualifications and Training

9.1 Qualifications and Training

The individual executing these procedures will have read, and be familiar with, the requirements of this POP and the operational manuals for the instruments.

9.2 Responsibilities

The responsibilities of project staff are summarized as follows:

- Project Manager: The project manager is responsible for providing the project team with the materials, resources, and guidance necessary to properly execute the procedures described in this POP. The project manager is also responsible for seeing that the H_2S monitoring program is performed in accordance with this procedure.
- Air Quality Specialist: The air quality specialist is responsible for reviewing the data against the quality assurance/quality control (QA/QC) documentation provided by the Field Technician and compiling routine data summaries for distribution to the project team. The air quality specialist will be responsible for the management of the database and confirming required QA/QC documentation is available.
- Field Technician: The field technician performing the work is responsible for implementing the procedures as described in this POP. The field technician is responsible for scheduling and carrying out the monitoring outlined in this procedure, filling out the appropriate field documentation, and instrument maintenance/calibration checks.
- MWRA (owner): MWRA will be responsible for providing AECOM with available data and documentation on the portion of the CSO system to be monitored, which may include but are not limited to GIS data, engineering records, maintenance reports and flow metering data. MWRA will also be responsible for providing safe access to the monitoring locations as part of the H_2S monitoring program.

10. Records

The air quality specialist record monitoring data on hard copy field forms. These forms will be scanned and saved electronically into our air quality database for storage and reporting. Data will be reviewed by an air quality specialist and compared to the QA/QC documentation collected from the field instruments during the site visits. AECOM will provide a summary of the H_2S monitoring results for the Dry Weather and Wet Weather Monitoring Events.

11. Change Log

List the change history pertaining to this document including if it was identified differently throughout its life cycle:

Rev #	Change Date	Description of Change	Location of Change

Attachment 1 – Field Calibration Form

AECOM
250 Apollo Drive
Chelmsford, MA 01824

Calibration Checklist
Jerome® 631-X H_2S Analyzer

Analyzer Information			
Instrument:	Jerome® 631-X H_2S Analyzer	**Serial Number:**	
Date of Factory Calibration:		**Attach Copy of Factory Calibration:**	Yes
Low Level H_2S Factory Test Module (FTM) Information			
H_2S FTM Serial Number:		**Permeation Tube Serial Number:**	
H_2S FTM Date of Factory Calibration:		**Permeation Tube Certification Date:**	
Attach Copy of FTM Factory Calibration:	Yes	**Attach Copy of Permeation Tube Certification:**	Yes
Bump Test (Performed within 1 Week of Sampling)			
Technician:		**Instrument Units:**	ppm
Date:		**Time:**	
Record Bump Check Results (ppm):	1 = 2 = 3 = 4 = 5 = 6 = 7 = 8 = 9 = 10 =	**Calculate Average of the last Five Concentrations (Acceptable results: 0.024 to 0.036 ppm)**	
		Did Instrument Pass Bump Check?	
Zero Check Results (Performed in the Field prior to Use)			
Technician:		**Instrument Units:**	ppm
Date:		**Time:**	
Zero Check Result (acceptable results 0.000 to 0.006 ppm):		**Did Instrument Pass Zero Check?**	
If zero has drifted. Perform zero function. Record "As Left" results:		**Did Instrument Pass Zero Check after zero function was performed?**	
General Comments			

: Reviewed By:_____Date:_____

Attachment 2 – Field Data Sheet

AECOM
250 Apollo Drive
Chelmsford, MA 01824

AECOM

Field Data Sheet
Odor Feasibility Study

Site Information			
Project:		**Technician:**	
Date:		**General Weather Conditions:**	
Instrument:	Jerome® 631-X H_2S Analyzer	**Instrument Serial Number:**	

Time	Location[1]	Weather Conditions	H_2S ppm	Odor Intensity[2] (0 – 8)	Visual of Floatables	Comments

[1]*See Site Maps or GPS positions for locations*
[2]*See odor intensity descriptions from Project Operating Procedure*

Reviewed By: _____
Date: _____

Attachment 3 – MWRA Odor Control Feasibility Study Observation Locations

Refer to Appendix C of this report for the final sampling locations.