



**CAMBRIDGE COMBINED SEWER
OVERFLOW (CSO) ODOR CONTROL
REPORT**

CAMBRIDGE, MA

**PROJECT NUMBER:
25003516.001A**

May 30, 2025

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TABLE OF CONTENTS

<u>Section</u>	<u>Page</u>
1 EXECUTIVE SUMMARY	1
2 PROJECT BACKGROUND	3
2.1 LEGAL REQUIREMENTS	3
2.2 REPORT CONTENTS	3
3 ODOR CONTROL TECHNOLOGIES	4
3.1 PHYSICAL MODIFICATIONS	5
3.2 MECHANICAL CLEANING	6
3.3 SYSTEM REPAIR	7
3.4 VENTING	7
3.5 HOODS	8
3.6 SEALED MANHOLES	9
3.7 BACKFLOW CONTROLS	10
3.8 FILTRATION SYSTEMS	12
3.9 CHEMICAL ADDITION	14
3.10 BIOAUGMENTATION	14
4 EXISTING CONDITIONS	16
4.1 EXISTING OUTFALLS	17
4.2 EXISTING ODOR CONTROL MEASURES	23
5 REGULATORY AND PERMITTING CONSIDERATIONS	26
5.1 EXISTING PERMITS	26
5.2 LAND OWNERSHIP	27
6 ODOR CONTROL EVALUATION AND RECOMMENDATIONS	29
6.1 ODOR CONTROL MEASURES ALREADY IN PLACE	29
6.2 ODOR CONTROL MEASURES RECOMMENDED	31
6.3 ODOR CONTROL MEASURES NOT CURRENTLY RECOMMENDED	32
7 BIBLIOGRAPHY	34

TABLES

- 1 Physiological Effects of Hydrogen Sulfide Exposure at Various Concentrations
- 2 Check Valve Costs (2025)
- 3 Cambridge CSO Overflows
- 4 Odor Control Measures not Currently Recommended

FIGURES

- 1 Sewer Vent
- 2 Manhole Hood
- 3 Sealed manhole Frame and Cover
- 4 Backflow Control Valves
- 5 Flap Valve
- 6 Passive Filtration Systems
- 7 Active Filtration System
- 8 City of Cambridge CSOs
- 9 Plan and Profile View of CAM-001
- 10 Plan and Profile View of CAM-002
- 11 Plan and Profile View of CAM-401A
- 12 Plan and Profile View of CAM-401B
- 13 Plan and Profile View of CAM-005
- 14 Plan and Profile View of CAM-007
- 15 Plan and Profile View of CAM-017

APPENDICES

- A. Final Determination to Adopt a Water Quality Standards Variance for Combined Sewer Overflow Discharges to Lower Charles River/Charles Basin
- B. Final Determination to Adopt a Water Quality Standards Variance for Combined Sewer Overflow Discharges to Alewife Brook/Upper Mystic River Basin
- C. SeeClickFix Odor Complaints

CAMBRIDGE COMBINED SEWER OVERFLOW (CSO) ODOR CONTROL REPORT

CAMBRIDGE, MA

1 EXECUTIVE SUMMARY

The City of Cambridge already has robust systems in place to identify and address odor issues in the sewer collection system. These systems include management of the SeeClickFix application for residents to submit odor complaints, regular inspection, cleaning, and flushing of the system, and installation of vents, hoods, and manhole inserts. Odor complaint data collected from the SeeClickFix application indicates that catch basins are the primary cause of odor complaints in the system.

In recent years, residents and watershed advocacy organizations have raised concerns about odor control at CSO outfalls operated by the City of Cambridge, the City of Somerville, and the Massachusetts Watershed Authority (MWRA). In response, MassDEP incorporated odor control measures into the August 2024 Water Quality Standards Variance for CSO Discharges to the Lower Charles River/Charles Basin and the Alewife Brook/Upper Mystic River Basin (Variance). The variance requires that the City of Cambridge assess odor control at CSO outfall locations, recommend the most appropriate solution through a report due June 1, 2025, and implement this solution.

The City is committed to mitigating odors throughout the system including at CSO regulators and outfalls. As such, the City has evaluated the following odor control measures for CSOs in the following report: physical system modifications, system repair, mechanical cleaning, venting, catch basin hoods, sealed manholes, backflow controls, air filtration systems, chemical addition, and bioaugmentation. Each technology is evaluated based on installation cost, operation and maintenance requirements, and likely effectiveness. Regulatory and permitting requirements were evaluated as well.

Through this evaluation, the City has identified three odor control measures to implement. The first is additional monitoring of odors at CSO structures. Odor issues are most prevalent during dry summer months. The report deadline of June 1st precluded odor monitoring throughout the summer, hindering identification of CSO regulators and outfalls where odors occur. Odor monitoring throughout the summer will allow for more targeted odor control measures in the future, if they are deemed necessary. The second recommendation is mechanical cleaning of outfall pipes at CAM-002 and CAM-401B. This will

reduce debris build up and odor generation at these outfalls. Cleaning is limited to these locations as they are the only outfalls at higher elevations than the water level of the receiving water body and therefore accessible to cleaning equipment. The third recommendation is the installation of inflow and infiltration inserts in manholes within the CAM-005 structure. While manhole inserts are often used to prevent water from entering the manhole, they are also effective at preventing gas from escaping the manhole. Inserts are proposed for CAM-005 as hydrogen sulfide readings at this structure are known to have exceeded 10 ppm and manhole inserts are not currently in place at this structure.

2 PROJECT BACKGROUND

2.1 LEGAL REQUIREMENTS

On August 30, 2024, MassDEP issued two updated Water Quality Variances (The Variance) [1] [2] to the City of Cambridge (City), which was later approved by the EPA. The Variance requires the City to take steps to reduce CSO events and mitigate their impact. MassDEP reached out to water advocacy groups for input on the Variance. Advocacy groups raised concerns about the odor associated with the CSO outfalls. As a result, the Variance requires that the City evaluate odors emanating from the CSO outfalls and regulators and identify best management practices (BMPs) to reduce odors. This report, which details those efforts, is due to MassDEP by June 1, 2025. The Variances also requires that the City implement the most feasible BMPs identified by the evaluation.

2.2 REPORT CONTENTS

Chapter 3: Odor Control – This chapter explains the process by which sewer systems generate odors. It details sewer characteristics that improve or worsen odor generation. It ends with a description of common odor control measures used in sewer systems.

Chapter 4: Existing Conditions – This chapter describes the existing conditions of Cambridge’s sewer system, with a focus on the design and condition of the CSO outfalls. It also documents the City’s existing operations and maintenance activities related to odor control.

Chapter 5: Regulations and Permits – This section details existing regulations and permits that apply to the Cambridge sewer system. It also describes the permits and permitting processes that may be required for the implementation of odor control measures.

Chapter 6: Evaluation of Options & Recommendations – This chapter presents the odor control recommendations for the City’s CSO outfalls and regulators. Odor control measures are evaluated based on their expected impact, implementation timelines, cost, regulatory and permitting requirements, and operations and maintenance needs.

3 ODOR CONTROL TECHNOLOGIES

Wastewater systems naturally generate sewer gas through the processes of decomposition. Sewer gas contains a mix of toxic and nontoxic gases including hydrogen sulfide (also known as H₂S), carbon dioxide, ammonia, and methane among others. Sewer gases often have a noxious, rotten egg-like odor due to the presence of hydrogen sulfide. As a result, sewer gases that escape from the wastewater system can lead to odor issues in the surrounding environment. **Table 1** shown below details various ranges of Hydrogen Sulfide concentrations and their potential physiological effects at the top of the range shown.

Table 1. Physiological Effects of Hydrogen Sulfide Exposure at Various Concentrations

Objective	Hydrogen Sulfide (ppm)	Exposure	Reference	Physiological Effect at Highest Value within Range ¹
Minimum Noticeable Concentration by Humans	0.1 to 1.5	Human Exposure	OSHA	Odor Threshold
Minimum Noticeable Concentration by Humans	0.1 to 3	Human Exposure	EPA ¹	Odor Threshold
Corrosion Control	2 to 5	Sewer Headspace	WERF ²	Offensive Odor
Corrosion Control	3 to 5	Sewer Headspace	EPA ³	Offensive Odor
Worker Safety	10	Human Exposure (10 minute)	NIOSH	Headache Nausea Throat and Eye Irritation
Worker Safety	10	Human Exposure (8-hour)	OSHA (construction work)	Headache Nausea Throat and Eye Irritation
Worker Safety	50	Human Exposure (10-minute)	OSHA	Headache Nausea Throat and Eye Irritation Eye Injury

Table References:

1. U.S. EPA, "Odor and Corrosion Control in Sanitary Sewerage Systems and Treatment Plants," U.S. EPA, Washington D.C., 1985.
2. Water Environment Research Foundation (04-CTS-1), Minimization of Odors and Corrosion in Collection Systems, Alexandria, VA: Water Environment Federation/IWA Publishing, 2007.
3. U.S. Environmental Protection Agency: Office of Enforcement and Compliance, "Detection, Control, and Correction of Hydrogen Sulfide Corrosion in Existing Wastewater Systems," U.S. Environmental Protection Agency, Washington D.C., 1992.

Odor issues are the result of three processes: hydrogen sulfide generation, release of hydrogen sulfide from the wastewater into the air, and air escaping from the wastewater system. Management of each of these three processes reduces odor issues. Hydrogen sulfide is the byproduct of anaerobic decomposition. Thus, the removal of organic matter and the mitigation of anaerobic environments reduces the likelihood of hydrogen sulfide generation. Both turbulence reduction and air filtration reduce the concentrations of hydrogen sulfide in the air space of the sewer. Air escapes from the sewer system through catch basins, holes within manhole covers, and sewer cleanouts. Sealing openings and keeping odors out of open structures reduces odorous air escaping from the system.

Outfalls themselves may not be the only source of odor at CSO locations. CSO outfalls are typically in wetland areas that naturally produce similar odors. Like sewer systems, wetlands contain decomposing organic matter which often give off unpleasant odors, especially in warmer weather. While sewer gas may contribute to the odor, it is likely not the sole source of the odor. CSO regulators are typically within roadways or directly adjacent to the public right of way (ROW). In urban environments, trash dumpsters from large residential and commercial buildings may be found in close proximity to the ROW, whereas public trash cans/receptacles are typically found where there is heavy or frequent pedestrian traffic. Both points of human trash collection can contribute to odors in the environments where CSO regulators exist. To address odors impacting the public, the following series of BMPs and/or sewer system improvements may be employed.

3.1 PHYSICAL MODIFICATIONS

Physical modifications are odor control options that physically alter the combined sewer system infrastructure to reduce hydrogen sulfide generation and/or limit the ability of hydrogen sulfide to be released into the surrounding environment. Examples of physical modifications include altering pipe slopes to maintain scouring velocity, removing hydraulic jumps, and installing structures to prevent odor release from the system. Maintaining scouring velocity prevents hydrogen sulfide generation by limiting the build-up of organic material. Sediment build-up most often occurs at low elevation points in the system or in flat stretches of pipe. Designing or modifying pipe slopes to eliminate such sections may reduce hydrogen sulfide generation within the system.

Physical modifications that mitigate turbulence in the system reduce hydrogen sulfide release from wastewater into the air. In locations of high turbulence, hydrogen sulfide can be stripped from the sewer flow into the air. Thus, reducing areas of turbulence by avoiding sharp bends, drop manholes, and hydraulic jumps prevents hydrogen sulfide from entering the vapor phase.

Less expensive physical modifications may be installed to prevent hydrogen sulfide and other odorous gases from escaping the system. Barriers to the air flow may be implemented by partitioning structures or installing curtain barriers. When water levels rise to the bottom of the partition wall or curtain, a water-lock seal is created. This stops odorous air from migrating through the system. Similarly, curtain barriers can be installed over openings to mitigate the odorous air flow.

The costs of physical modifications to address odor control issues range greatly. Modifications such as altering pipe slopes or redesigning siphons typically require road excavation. They are often highly disruptive and expensive as stand-alone projects. Cost varies greatly based on several factors including pipe diameter, pipe material, project location, and number of sewer laterals. As such, it is preferable to incorporate them into the design phase of projects as opposed to completing them as stand along projects. Alternatively, solutions such as curtain barriers can cost as little as \$100.

3.2 MECHANICAL CLEANING

Mechanical cleaning removes deposited organic matter which contributes to the production of hydrogen sulfide. Cleaning utilizes a high-velocity water jetting system, commonly referred to as a “jetter.” Jettors are mounted on a truck. They utilize a hose reel, a nozzle, and water (from a source such as a hydrant) to deliver high-pressure water into the system. Cleaning operations are typically categorized into three levels: light, medium, and heavy cleaning. The level of cleaning is determined by the number of times the hose reel must pass in and out of a pipe to remove sewer material and debris deposits. Light cleaning typically requires one or two passes, while heavy cleaning may require as many as eight or more passes. The number of passes associated with each cleaning level varies by sewer cleaning contractor and the cleaning equipment used.

Cleaning the system at more frequent intervals could mitigate the formation of deposits that generate hydrogen sulfide gas. In addition, regular cleaning of the system can prevent debris buildup and blockages and maintain the hydraulic capacity of the system. Cleaning regimens may be designed to clean an entire system at a set frequency or may focus on locations where sediment is known to accumulate.

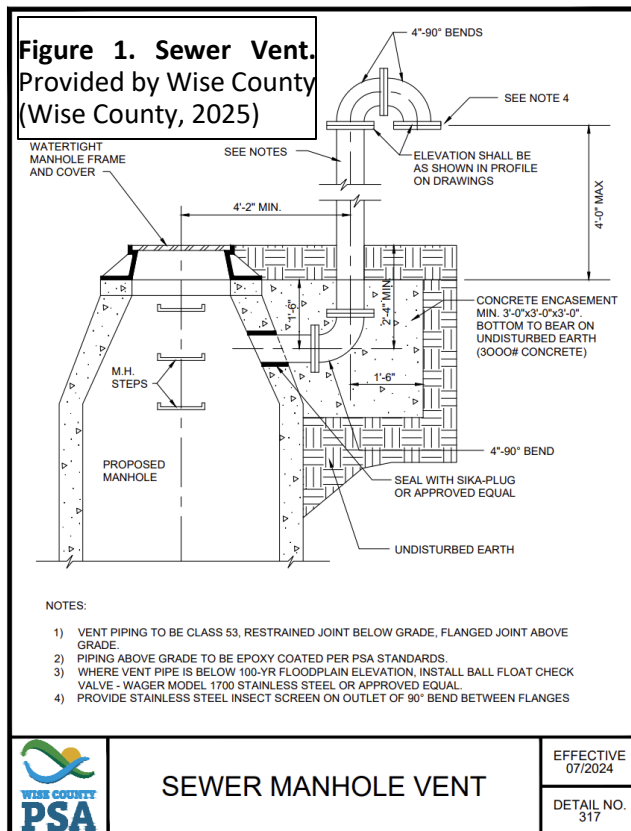
Costs for light cleaning of small diameter pipes (6”-18” diameter) ranges from \$0.30-\$2.00 per linear foot, while heavy cleaning ranges from \$2.00-\$10.00 per linear foot. Costs for light cleaning of large diameter pipes (greater than 18” diameter) ranges from \$1.00-\$5.00 per linear foot, while heavy cleaning ranges from \$10.00-\$20.00 per linear foot.

3.3 SYSTEM REPAIR

The repair of cracks and leaks within the sewer structures or pipes that are at or above grade can reduce odorous air and sewage from escaping the system. Frequent inspection and repair of any identified cracks are important maintenance practices to reduce odors in the system. The cost of repairs is low relative to the cost of physical modifications. The cost of cured-in-place pipelining (CIPP) a pipe may range from \$50 - \$350 per linear foot depending on pipe diameter and quantity of pipe being lined. For 8-in to 12-in pipe diameters, the costs are typically around \$50 - \$100.

3.4 VENTING

Vents release built up sewer gases from locations where they are likely to accumulate. Vents can either release sewer gases directly into the atmosphere, or they can include carbon filters that remove odorous gases. Venting relies on passive air flow resulting from pressure differentials to move air out of a structure. A schematic of a vent pipe installed within a sewer manhole is shown in **Figure 1**. This figure is solely shown for representative purposes.



Vents may be installed at CSO regulators themselves to vent sewer gas within the structure. Also, venting at upstream locations may be implemented to prevent sewer gas from reaching the regulator. Vents for odor control purposes are commonly installed at low elevation points because hydrogen sulfide is heavier than air and settles at low points within the system. Vents may also be installed at locations where turbulence is because turbulence increases the stripping of sewer gases into the air. In areas trafficked by pedestrians, vent outlets are typically raised above head height to reduce pedestrians' exposure to hydrogen sulfide gas.

Vents installed at CSO regulators are typically drilled into the structure near the ceiling and daylight above the surrounding grade. This

approach may require grouting of voids or cracks created in the structure during installation. Another vent

installation approach consists of excavating a segment of existing sewer pipe, installing a wye, and adding a vent off this branch to the main sewer line. This approach typically requires more extensive excavation.

Carbon filters are often installed within or at the end of vent pipes to prevent odors from exiting the vent into the surrounding area. Carbon filters increase maintenance requirements as the carbon within these filters requires replacement at regular intervals. Replacement intervals range from every few months to years. The cost of installing vent depends on the location and method of installation and could range from \$5,000 to \$20,000.

3.5 HOODS

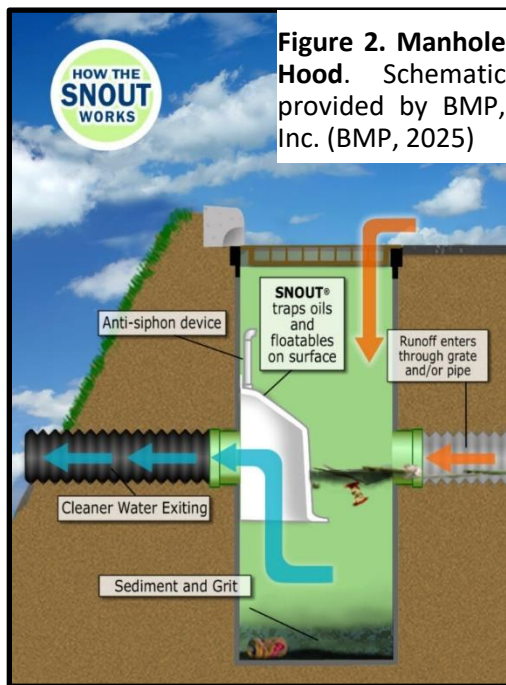


Figure 2. Manhole Hood. Schematic provided by BMP, Inc. (BMP, 2025)

Hoods are primarily used to control floatables. However, they have a secondary benefit of preventing odor migration by forming a water-lock seal when the system is surcharged. The placement of hoods on upstream manhole outlets may reduce hydrogen sulfide migration to downstream areas of odor concern. Hoods can be installed within nearby catch basins to further mitigate odors. An example of a manhole hood schematic is shown in **Figure 2**.

Hoods are installed within existing manholes and catch basins, so disruption to the surrounding community would be minimal. Installing a hood in an existing manhole or catch basin is estimated to cost approximately \$1,000 - \$3,000.

3.6 SEALED MANHOLES

Typical manhole covers have pick holes within them to allow for access to the sewer for routine maintenance, odorous air may emit from these holes. Typical manhole frame and covers are not airtight; therefore, there may be a slight gap between the frame and the cover. There are different options to



Figure 3. Airtight Manhole Frame and Cover. Provided by Pamtight (Pamtight, 2025)

mitigate the escaping of air from these locations, these include a full replacement of the frame and cover with an airtight frame and cover, the installation of an insert underneath the existing cover to prevent air from escaping, or the application of a temporary sealant to the cover.

Airtight manhole frames and covers prevent the sewer gases escaping into the atmosphere. The installation of airtight manhole frames and covers adjacent to a CSO may mitigate odor observed by

pedestrians nearby the outfall. However, the implementation of sealed manhole frame and covers will not help if odor is emitting from the outfall itself. Airtight manhole frames and covers typically have closed pick holes, gaskets, and are bolted. An example of an airtight manhole frame and cover is shown in **Figure 3.**

This solution reduces odor impacts from particular manholes but does not reduce the generation of odorous gases nor eliminate them from the system. If this solution is implemented, consideration should be given to how gases may be re-routed through the system and if the likely flow of gases will disrupt residence in other locations. In addition, hydraulics and pressurization scenarios should be evaluated in further analyses prior to implementing this alternative.

When selecting frames and covers, note that not all watertight manhole frame and covers are also airtight. The replacement of the existing manhole frame and covers with airtight manhole covers will require excavation (approximately 4-ft by 4-ft) around the existing manhole frame and cover. The cost of the replacement of the existing frame and cover with an airtight manhole frame and cover is approximately \$4,000 - \$5,000 each.

Manhole inserts have several different names such as “Inflow Protectors” or “Infiltration/Inflow (I/I) Inserts.” These are installed underneath the existing cover within a manhole and held in place between the frame and the cover. These plastic inserts prevent rainwater from entering the sewer system through

any gaps in the manhole. The cost for a typical manhole insert is approximately \$100 - \$200. In addition, the inserts could include a passive filtration system as detailed further in **Section 3.8.1**.

An alternative to purchasing airtight frames and covers or the installation of a manhole insert, is applying sealant to the cover of existing manholes. The sealant could be applied to any existing defects in the manhole frame and cover, over the pick holes for the manhole pick, and to the gap between the frame and cover itself. With this approach, the sealant must be chipped off and re-applied each time the manhole is opened. This approach would require no excavation. The approximate cost of applying a sealant to existing manhole frame and covers is approximately \$1,000 each.

3.7 BACKFLOW CONTROLS

3.7.1 Duck-bill Check Valves



Backflow prevention devices, such as duck-bill check valves, may be installed at outfalls to stop odors from escaping at CSO locations. Check valves only open to the level of fluid flow, preventing air from flowing through the pipe, as shown in **Figure 4**. This prevents sewer gases escaping during dry weather. Even during overflow events, when check valves open, they allow minimal air to release. This mitigates odor control issues during wet weather conditions.

Check valves can be fitted into most pipes and are relatively easy to install. Check valves are available in a wide range of pipe sizes from 3" to 72". They are typically installed in circular pipes but can be manufactured to have elliptical or arched shapes. Check valves are well suited for CSOs on land owned by others, as they require no work to be performed outside of the pipe, reducing permitting issues. Installation typically consists of sliding the check valve into a pipe, securing the clamp on either the upstream or downstream end, and bolting either the upstream or downstream end in place.

If check valves larger than 24" are to be installed through an access manhole, the manhole cone and chimney may need to be deconstructed to install the valve.

Headloss requirements and sewage composition must be evaluated prior to check valve installation. Check valves introduce additional headlosses into the system. Prior to installation, headloss curves must be compared to the sewer system’s hydraulics to ensure installation will not cause up stream back-ups and overflows. Check valves are less well suited for locations with high quantities of floatables, as this can lead to clogging of the valve.

The cost of check valve installation depends on outfall geometry and diameter. **Table 2** shows the cost of circular check valves for a range of pipe diameters. Outfalls with alternative geometries can expect higher costs.

Table 2. Check Valve Costs (2025)

Diameter	Cost
6-inch	\$610
18-inch	\$3,715
36-inch	\$12,920
48-inch	\$29,185

3.7.2 Flap Check Valves

Flap valves consist of a plate structure that pivots open on a hinge at the top to allow flow to pass through. Flap valves function similarly to the aforementioned duck-bill check valves to prevent the release of odorous gases during dry periods. However, they generally open with less pressure in comparison to in-line check valves and therefore introduce less head loss to the system.

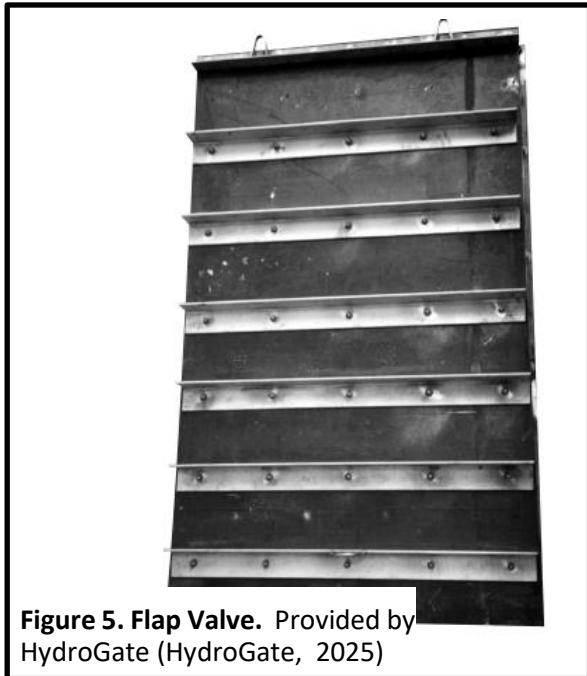


Figure 5. Flap Valve. Provided by HydroGate (HydroGate, 2025)

One major disadvantage of flap check valves is their propensity to trap floatables within the system, which may cause more upstream clogging and other maintenance issues. This can be mitigated through more routine cleaning of the upstream system. Another disadvantage is the potential for water hammer forming if the valve closes suddenly. This could damage upstream pipes and structures.

The cost of flap check valves range based on the diameter and material, a 36" cast iron flap valve is approximately \$14,000. The flap check valves can also be made of rubber, as shown in an example from HydroGate in **Figure 5**. The rubber flap valves have less

head loss in comparison to the cast iron and other metal valves. The cost of a 36" rubber check valve is approximately \$7,000.

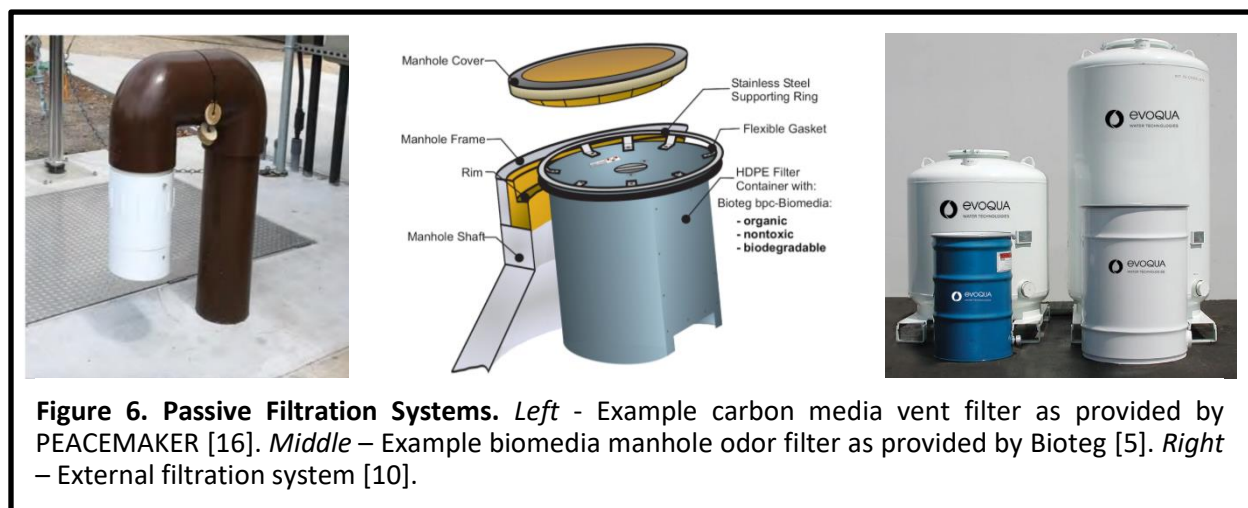
3.8 FILTRATION SYSTEMS

The release of sewer gas from the sewer system can be controlled using air filtration. Air treatment may consist of chemical scrubbers, biofilters, or dry media filters. Air treatment processes may be passive, relying on natural air flow, or active, requiring air blowers.

3.8.1 Passive Filtration

Passive filters are systems where air is pushed out of the system and through a filter media to remove odorous chemicals, relying on the passive airflow and existing pressure in the system to do so. These systems do not require a power source. Passive filters can be installed in any location where air flows out of the system. They may be installed within the sewer system in vent pipes or as manhole inserts. They may also be installed as external tanks and connected to the sewer system with a pipe. Examples of these types of passive filtration systems are shown in **Figure 6**. The airflow path through the filter media must be the path of least resistance for passive filtration to be effective.

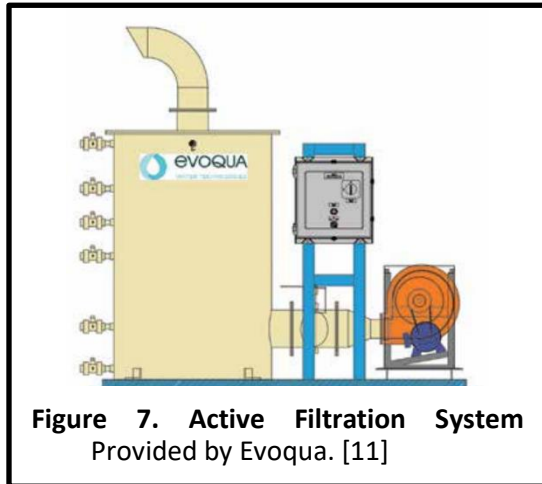
Numerous filter media are available for air filtration of hydrogen sulfide and other sewer gases. Common media types include carbon media and biological media. Carbon media removes odorous chemicals through adsorption. Biological media removes odorous chemicals through biological processes which consume hydrogen sulfide and converts it into odorless compounds including carbon dioxide and water.



The chemical make-up of sewer gas and the sewer gas flow rate must be considered when choosing an appropriate filter media and size of the filter. Some types of biological media require constant hydrogen sulfide concentrations to perform at their full capacity. Media service life ranges from months to years. The exact service life will depend on the media type, air flow rate, hydrogen sulfide concentration, and filter size.

The cost of air filtration varies based on the application chosen. Manhole inserts typically range from \$300 - \$1,500 depending on the media type. Filters within vent pipes can cost as little as \$75. External air filtration systems can cost between \$5,000 to \$7,500. Filter maintenance includes periodic replacement of filter media. Carbon filter media is not typically considered hazardous and can be easily disposed of after media change outs. Some biological media can be composted.

3.8.2 Active Filtration



Active media filters are similar to passive filters but contain air blowers that force air through the filtration media. Active filtration is used when air is stagnant or does not flow strongly enough to pass through a filter. Active filtration systems have higher installation and maintenance costs compared to passive filtration.

Active filtration systems are typically installed at the surface near sewer structures, such as manholes or pump stations. They contain air blowers that pull air from the sewer structure through filter vessels. Active air filtration

requires an electrical connection. An example active filtration system is shown in **Figure 7**.

Operation and maintenance of active air filtration systems are similar to passive systems as they also require media replacement. However, active systems will also require maintenance of air blowers and motors.

3.9 CHEMICAL ADDITION

Chemicals may be added to the system to reduce odors. The addition of a chemical addition system requires construction of a location to store chemicals as well as an injection system for introducing the chemicals into the sewer system. The quantity and type of chemical used requires an analysis of the existing system and hydrogen sulfide concentrations within the system. Chemical addition systems are not typically cost effective for isolated locations.

3.10 BIOAUGMENTATION

By introducing microorganisms at select locations in the collection system odors can be mitigated by the reduction of sulfate-reducing-bacteria (SRB) in the system. The SRB cause the hydrogen sulfide as a byproduct by their metabolism in anaerobic environments. Therefore, the reduction of the SRB in the system will cause the reduction of hydrogen sulfide. By adding a specific type of microorganism that will enhance the degradation of the SRB, the overall production of hydrogen sulfide will be mitigated as well. This can be done through the addition of non-SRB microbes to out-compete SRB for food sources.

Some factors to consider with the implementation of bioaugmentation include the flow velocity in the pipe, the current levels of SRB in the system, and the distance from the elevated hydrogen sulfide levels (Cray et al., 2022). The non-SRB microorganisms need to be introduced in the system at a location with low flows, to ensure the bacteria are not washed out. The dosage for microorganisms should be measured based on the current levels of SRB in the system to ensure an effective response. The dosing may need to occur at a regular frequency. There are several considerations surrounding the complexity of bioaugmentation within collection systems.

4 EXISTING CONDITIONS

The City of Cambridge manages nine CSOs. Seven outfalls are active and two are temporarily closed (CAM-009 and CAM-011). CSO outfalls are shown in Figure 8. Four outfalls discharge into the Alewife Brook and three active CSOs discharge into the Charles River. Both temporarily closed CSOs discharge into the Charles River. CSO frequency and volume varies by year, primarily as a result of variation in rainfall events. In the last 4 years CSO volumes have ranged from 0.63 MGD to 43.73 MGD, as shown in Table 3. A description of each of Cambridge’s CSOs is included below.

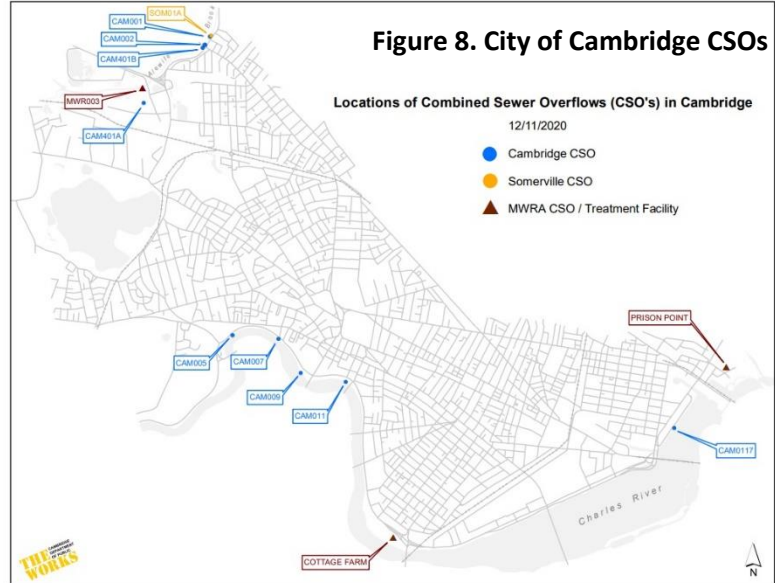


Figure 8. City of Cambridge CSOs

Locations of Combined Sewer Overflows (CSO's) in Cambridge

12/11/2020

- Cambridge CSO
- Somerville CSO
- ▲ MWRA CSO / Treatment Facility

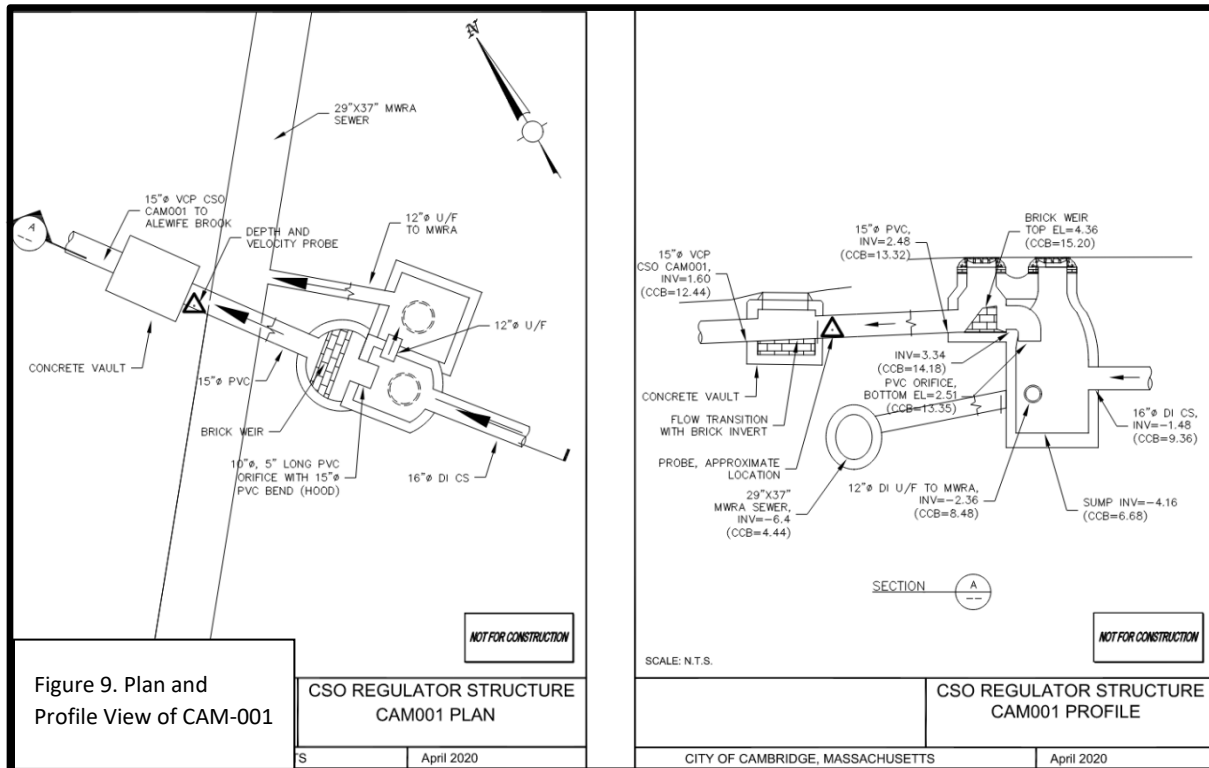
Table 3: Cambridge CSO Overflows

	2020	2021	2022	2023
ANNUAL RAINFALL (IN)	16.28	54.46	28.67	49.47
CAM-001	0.11	0.20	0.00	0.00
CAM-002	0.01	0.00	0.00	0.00
CAM-401A	2.50	21.69	0.47	20.52
CAM-401B	0.51	1.59	0.00	1.00
CAM-005	1.22	3.34	0.16	0.87
CAM-007	0.23	3.91	0.00	1.25
CAM-017	0.30	13.00	0.00	5.36
CAM-009*	0.00	0.00	0.00	0.00
CAM-011*	0.00	0.00	0.00	0.00
TOTAL	4.58	43.73	0.63	29.00
*CAM-009 and CAM-011 are temporarily closed, pending hydraulic analysis				

4.1 EXISTING OUTFALLS

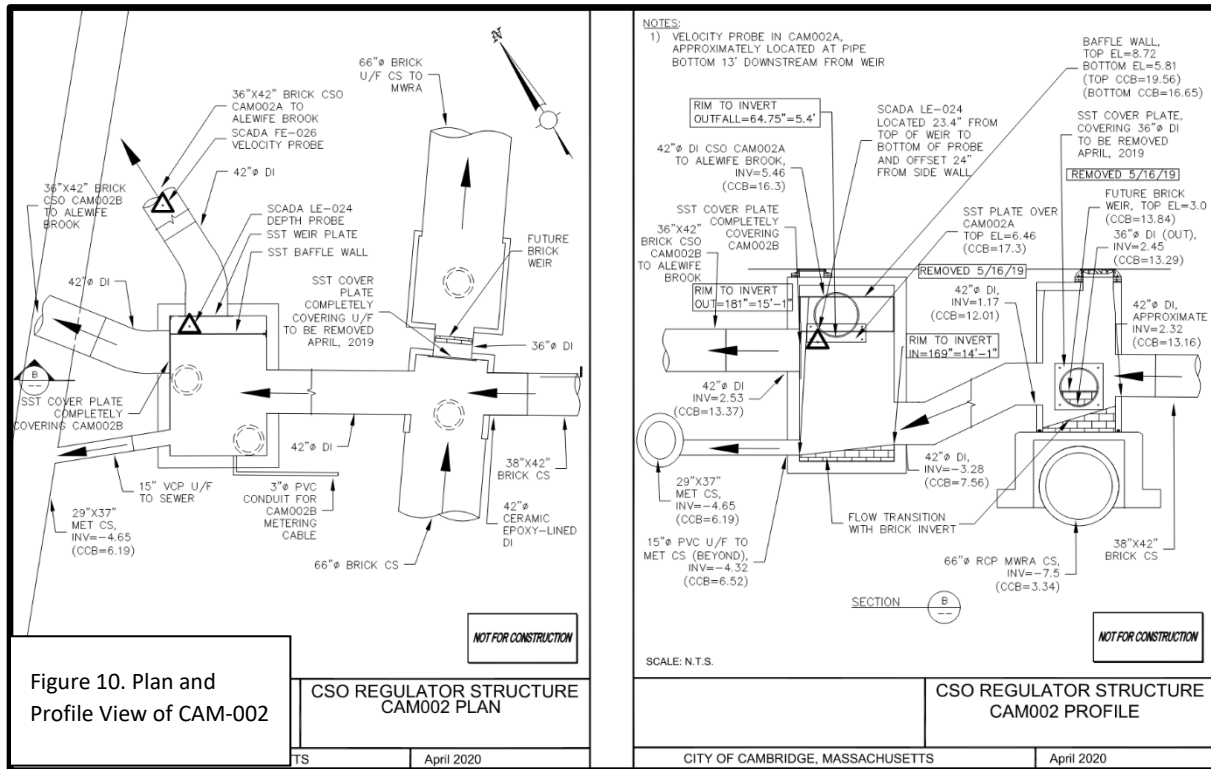
4.1.1 CAM-001

CAM-001 regulator is located next to Alewife Brook Parkway across from 29 Foch St. The regulator consists of three parts: two adjacent manhole chambers and a weir structure, as shown in Figure 9. Water from the Cambridge sewer system enters the first manhole chamber from the southeast. During typical dry weather conditions, water exits east through a 12" connection within the first chamber into the second adjacent manhole structure. Flow travels through the structure to an MWRA interceptor through a 12" pipe. During wet weather events, water elevation in the first structure exceeds the weir elevation and water travels northwest into the outfall pipe. The outfall discharges through a 15-inch VCP pipe to Alewife Brook. Annual discharges from 2020-2023 ranged from 0 - 0.2 MG. The CAM-001 regulator is located within the right of way of the Alewife Brook Parkway, which is owned by the department of Conservation and Recreation (DCR). The outfall is located along the Alewife Brook, which is also owned by DCR. No odor complaints were submitted through the SeeClickFix app to the Cambridge DPW for the regulator between January 2017 and September 2023.



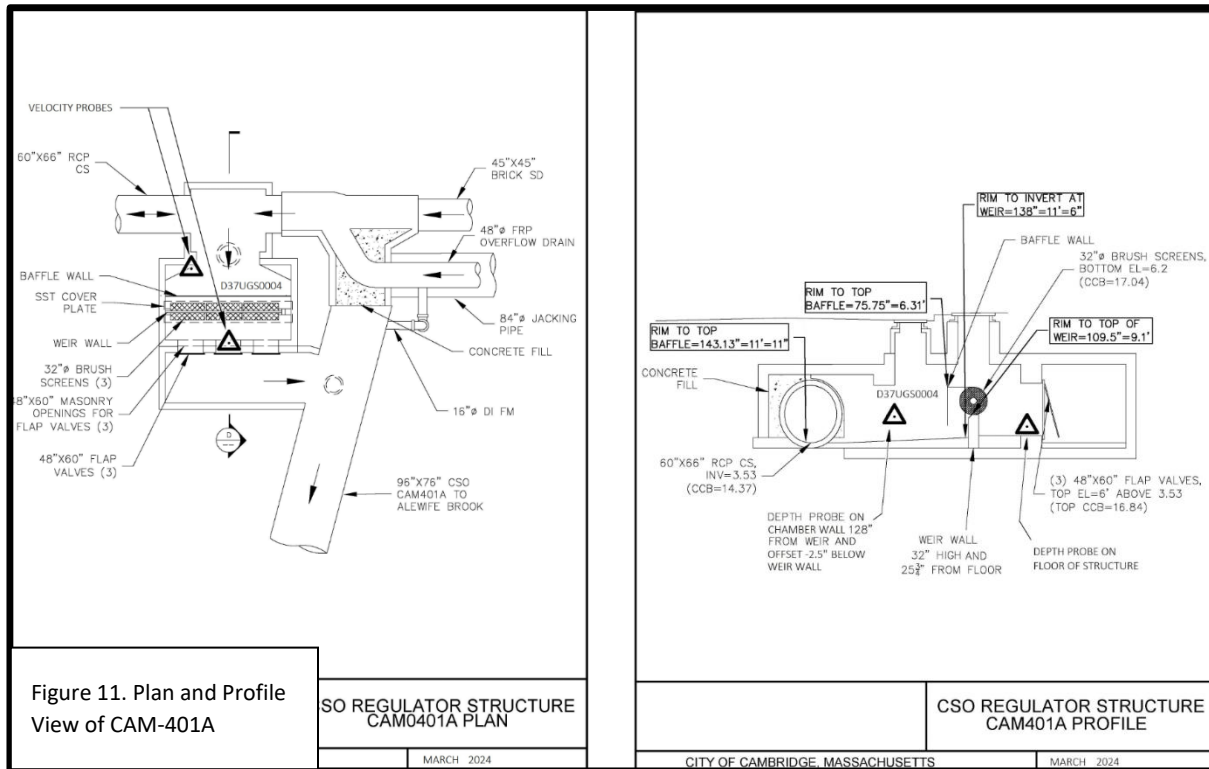
4.1.2 CAM-002

CAM-002 is located adjacent to Alewife Brook at the intersection of Alewife Brook Parkway and Massachusetts Avenue, directly north of Massachusetts Avenue. The regulator is shown below in Figure 10. Water from the Cambridge sewer system enters a manhole chamber from the southeast. During typical dry weather conditions, water travels west into another chamber and through a 15" pipe that discharges into a 29"x37" pipe. During wet weather events, water elevation in the exceeds a weir (invert = 2.45) located in the first manhole chamber and the water travels northeast into a 36" pipe that discharges into a 66" MWRA interceptor. During severe wet weather events, a second weir at a higher elevation (invert = 5.46) regulates flow into a 42-in pipe that discharges to the Alewife Brook. A baffle is installed for the CSO discharge pipe. This baffle does not contribute to odor control as it does not extend to the top of the structure. Annual discharges from 2020-2023 ranged from 0 - 0.01 MG. CAM-002 is located in a right of way owned by the City of Cambridge. No odor complaints were submitted through the SeeClickFix app to the Cambridge DPW for the regulator between January 2017 and September 2023.



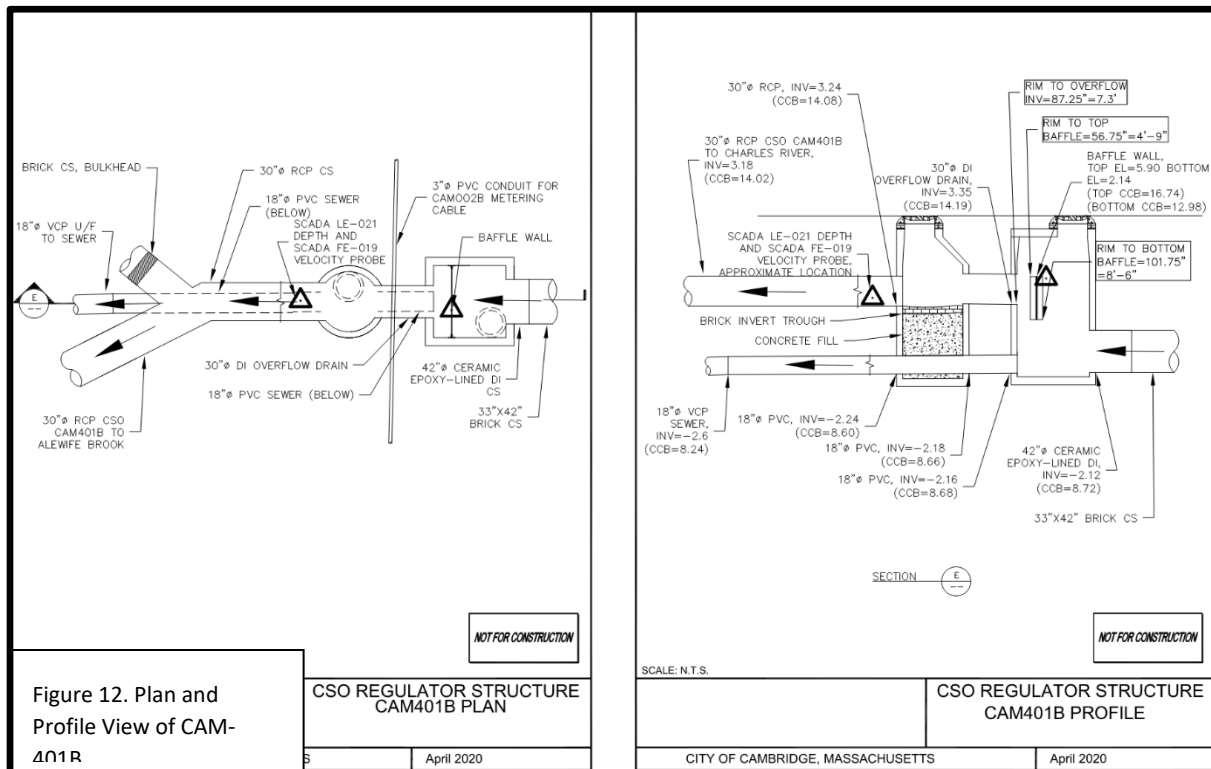
4.1.3 CAM-401A

CAM-401A is located in front of 40 Sherman Street. The regulator is shown below in Figure 11. Water enters the structure from the Cambridge sewer system through one 45"x55" pipe and one 48" pipe. During typical dry weather conditions, water travels north through the structure into a 60"x66" pipe. During wet weather events, water travels west under a baffle, over brush screens above a weir wall, and through flap valves within the structure and enters a 96"x76" pipe that discharges to the Alewife Brook. Annual discharges from 2020-2023 ranged from 0.47 - 21.69 MG. The CAM-401A regulator is located within the Sherman Street Right of way which is owned by the City of Cambridge. The outfall location is located on property owned by the Massachusetts Bay Transit Authority. No odor complaints were submitted through the SeeClickFix app to the Cambridge DPW for the regulator between January 2017 and September 2023.



4.1.4 CAM-401B

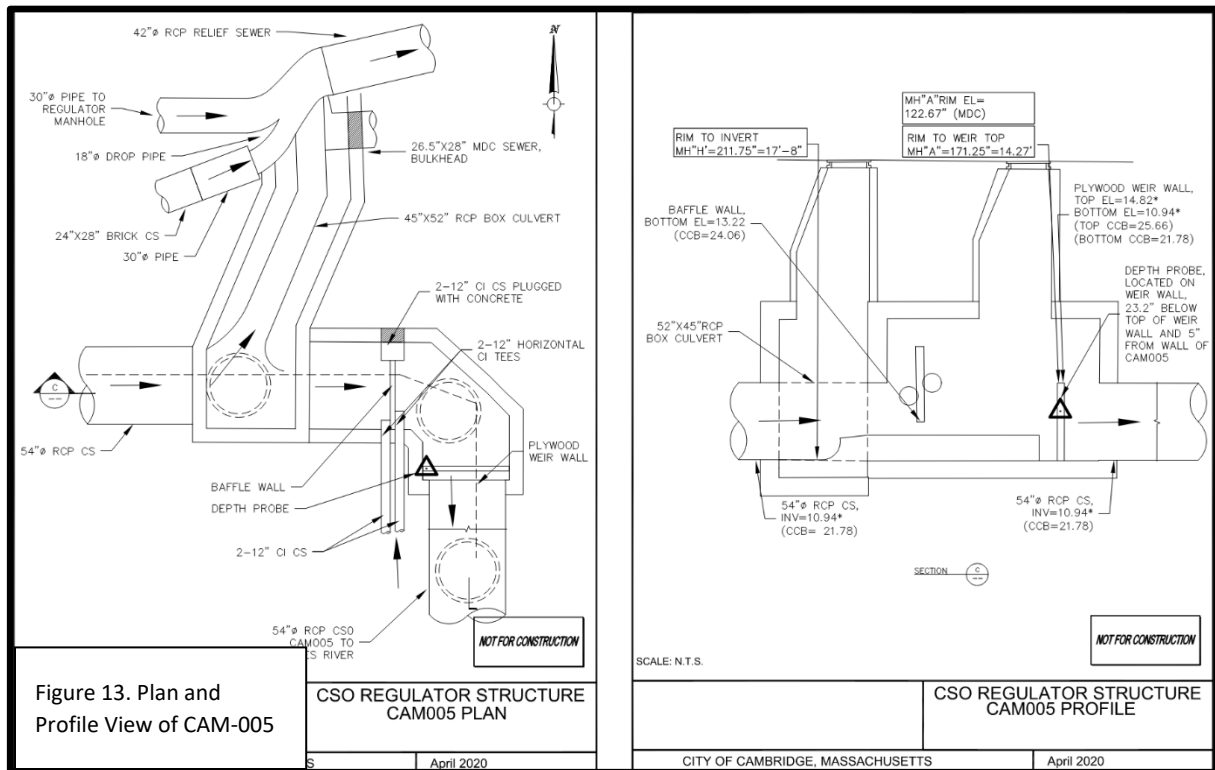
CAM-401B is located adjacent to Alewife Brook at the intersection of Alewife Brook Parkway and Massachusetts Avenue, directly south of Massachusetts Avenue. The regulator is shown below in Figure 12. Water from the Cambridge sewer system enters a manhole chamber from the southeast. During typical dry weather conditions, water travels northeast through an 18" pipe that discharges into a 66" MWRA Pipe. During wet weather events, water travels over a baffle within the structure and enters a 30" CSO pipe (invert = 3.35) that discharges to the Alewife Brook. Annual discharges from 2020-2023 ranged from 0 – 1.59 MG. The CAM-401B regulator is located in the Massachusetts Avenue right of way which is owned by the City of Cambridge. The outfall is located on land owned by DCR. No odor complaints were submitted through the SeeClickFix app to the Cambridge DPW for the regulator between January 2017 and September 2023.



4.1.5 CAM-005

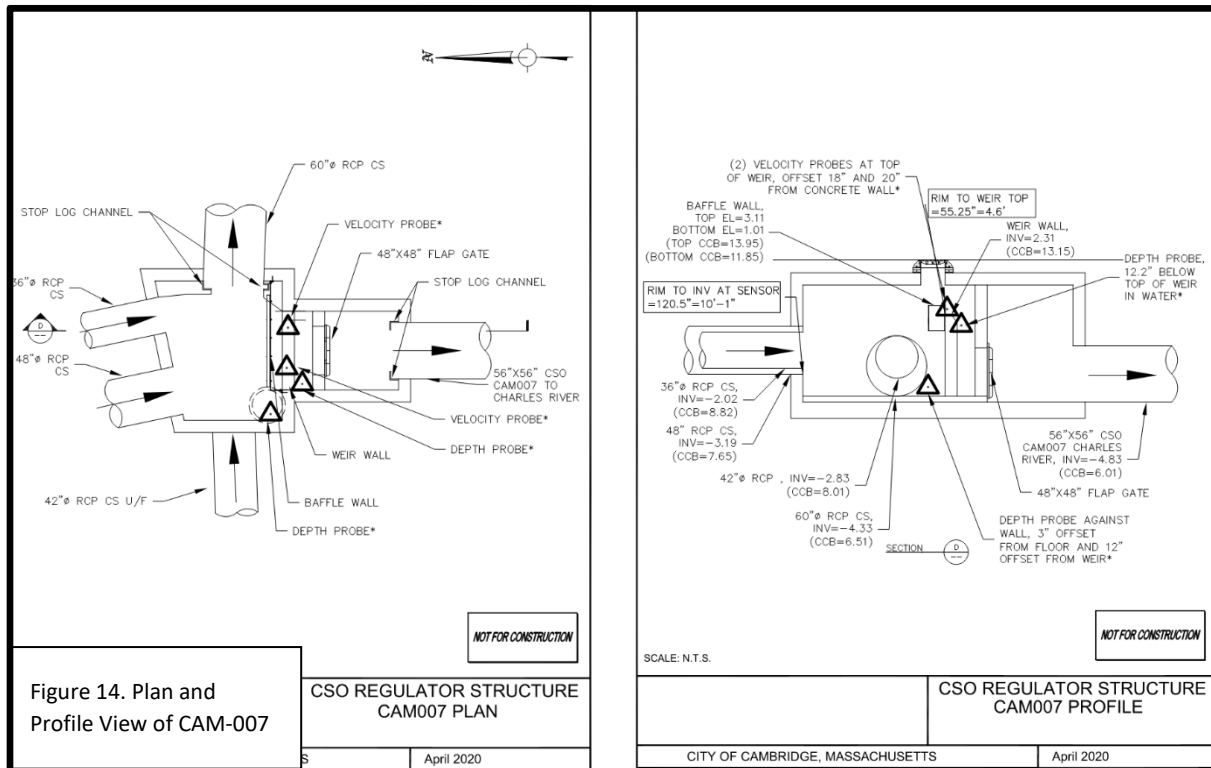
CAM-005 is located adjacent to the Charles River, behind 330 Mt Auburn Street. The regulator is shown below in Figure 13. Water from the Cambridge sewer system enters the structure through one 30" and one 54" pipe from the west. Water from the MWRA system enters the structure through a 24"x28" pipe from the west. During typical dry weather conditions, water travels east and exits the structure through an MWRA 42" pipe. During wet weather events, water travels over a weir (top of wall = 14.82) within the structure and enters a 56" CSO pipe (invert = 10.94) to the south that discharges to the Charles River. Annual discharges from 2020-2023 ranged from 0.16 – 3.34 MG. The CAM-005 regulator is located partially within the Mount Auburn Street right of way owned by the City of Cambridge and partially on land owned by Mount Auburn Hospital. The outfall is located on DCR land.

The MWRA is in the process of re-designing and updating the configuration of CAM-005 to reduce CSO overflows in the system. No odor complaints were submitted through the SeeClickFix app to the Cambridge DPW for the regulator between January 2017 and September 2023. However, elevated levels of hydrogen sulfide were detected in CAM-005 during an MWRA inspection of the regulator on September 14th, 2024. Between 11:00am and 11:40am, hydrogen sulfide concentrations were consistently measured between 6-8 ppm, with 2-3 readings exceeding 10 ppm.



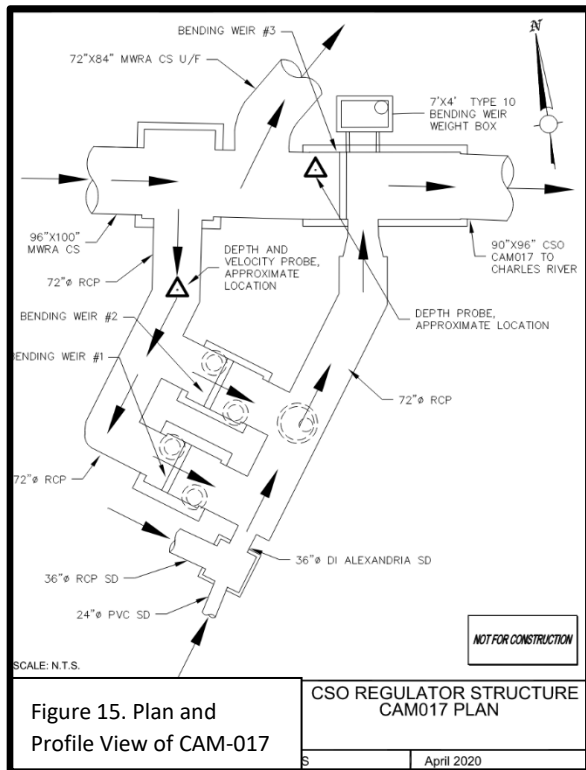
4.1.6 CAM-007

CAM-007 is located adjacent to the Charles River across the street from 993 Memorial Drive. The regulator is shown below in Figure 14. Water from the Cambridge sewer system enters the regulator through one 36" and one 48" pipe from the north. Water from the MWRA system enters the regulator through a 42" pipe from the west. During typical dry weather conditions, water travels east and exits the regulator through an MWRA 60" pipe. During wet weather events, water travels over a weir within the regulator and enters a 56" CSO pipe (invert = 2.21) that discharges to the Charles River. Annual discharges from 2020-2023 ranged from 0 – 3.91 MG. Both the CAM-007 regulator and outfall are located on land owned by DCR. No odor complaints were submitted to the Cambridge DPW through the SeeClickFix app for the regulator between January 2017 and September 2023.



4.1.7 CAM-017

CAM-017 is located adjacent to the Charles River across the street from 70 Cambridge Parkway. The regulator is shown below in Figure 15. The regulator controls both combined sewer and storm drain discharges. Combined sewer flow enters the regulator through one 96"x100" pipe from the west. During typical dry weather conditions, the combined sewer flow exits northeast through a 72"x84" MWRA underflow pipe. During wet weather events, combined sewer flow travels over three bending weirs into a 90"x96" CSO outfall pipe. Storm drain water flows north into the structure through one 24" pipe and one 36" pipe. The flow from the two storm drain pipes travels east and directly into the 90"x96" CSO outfall pipe. Annual discharges from 2020-2023 ranged from 0 – 13.00 MG. The CAM-017 regulator is within the right of way of the Land Boulevard and Binney Street intersection, which is owned by the City of Cambridge. The outfall is located on land owned by DCR. No odor complaints were submitted to the Cambridge DPW through the SeeClickFix app for the regulator between January 2017 and September 2023.



4.2 EXISTING ODOR CONTROL MEASURES

The City of Cambridge has implemented several odor control measures throughout the sewer system. Some of the measures target CSO outfalls, though most apply to the entire system.

To identify locations where odors exist, City of Cambridge collects odor complaints through the SeeClickFix smartphone application. Residents can use the application to report various issues throughout the city including sewer odor. Data from the application shows that the primary source of odor complaints in the Cambridge sewer system are catch basins connected to combined sewer pipes. Complaints are most common during summertime

dry weather periods. When a catch basin is reported in the system, the Department of Public Works inspects the catch basin for debris, cleans the catch basin if necessary, and adds deodorizer to the catch basin.

4.2.1 HOODS

Since catch basins are common odor sources, the City has installed hoods in all catch basins connected to combined sewer system. The hoods extend down to approximately one foot above the outlet invert of the catch basin. In typical conditions, the water level in the catch basin is higher than the bottom of the hood. This creates a water lock seal which prevents sewer gas from escaping through the catch basins from the sewer interceptors.

This BMP reduces odors throughout the system, including at CSO regulators. Since hoods are installed at all catch basins connected to regulator structures, they inhibit sewer odor from escaping the structures. Odor complaints are most common during dry summer periods because during these times, water evaporates from the bottom of the catch basin and the water level falls below the bottom of the hood.

4.2.2 MANHOLE INSERTS

The City has installed manhole inserts at all manholes within the FEMA flood plain. These inserts serve a dual purpose: they restrict the flow of water into the manhole and restrict the flow of sewer gas out of the manhole. The manhole inserts are specifically installed within the FEMA flood plain because these manholes are the most likely to flood and therefore the greatest need of flood protection.

4.2.3 VENTING

The City installed vents from manholes prone to odor issues. The vents are typically routed to a high elevation to release odors above head height. These are installed for either odor control at select locations or to assist with pressurization within the combined system.

4.2.4 CLEANING AND FLUSHING

The City performs systematic cleaning of the sewer system through an existing contract with a jetting company to clean portions of the system each year. In areas of the City with mostly flat topography, the City has implemented a flushing program. Since the pipes in this area are gradually sloped, sewer flows are less likely to achieve scouring velocity, resulting in debris build up within the pipes. In response, the City installed flushing chambers in this area of the system and regularly flushes the pipes to remove debris build up.

4.2.5 SYSTEM REPAIR

As part of the cleaning process, the contractor takes CCTV footage of all pipes and structures. This footage is used to identify necessary repairs to the system. Furthermore, catch basins are regularly inspected and any debris found is removed. Finally, CSO regulators are inspected monthly to identify any necessary repairs.

5 REGULATORY AND PERMITTING CONSIDERATIONS

The Cambridge sewer system is subject to existing permits that regulate CSO events and stormwater discharges. In addition to existing permits, construction permits may need to be obtained depending on the odor control measures installed.

5.1 EXISTING PERMITS

5.1.1 WATER QUALITY STANDARD VARIANCE

In line with the Clean Water Act, Massachusetts published the Massachusetts Surface Water Quality Standards. These standards are set forth in 314 CMR 400. The standard categorizes all water bodies into “classes” based on their intended use. Each class of water body must meet certain water quality metrics to safely support its intended use. MassDEP regulates the types and volumes of discharges into each water body to ensure that required water quality standards are met. The Charles River and Alewife Brook are Class B water bodies and as a result, CSOs are prohibited.

In instances where it is infeasible to meet discharge requirements, MassDEP provides a Water Quality Standard Variance. The City of Cambridge received a Water Quality Standard Variance for CSO discharges into the Alewife Brook and Charles River, since it is technically infeasible to eliminate CSO overflows in these locations at this time. As discussed in Section 2, the variances are the basis for this report.

As part of the Variance, the City must mitigate the effects of CSO outfalls and work to minimize CSO discharge volume and frequency. The Variance requires that the City research and report out on possible odor control measures to mitigate odor issues at each of the City’s CSO outfalls. It also requires that the City implement the most feasible odor control approach identified. The City will continue to meet the requirements set forth in the variance as they implement the recommendations contained herein.

5.1.2 NPDES

The National Pollutant Discharge Elimination System is a national program that regulates point-source pollutant discharges to waters of the United States. NPDES permits establish both acceptable pollutant levels in a discharge and establish specific technologies that must be used to limit a pollutant. The permits

also set forth monitoring and reporting requirements for discharges. In Massachusetts, the NPDES program is administered by the Environmental Protection Agency (EPA).

In 2009, the EPA issued a NPDES permit to the City of Cambridge for the City's CSOs. [3] Since the issuance of the CSO permit, two of the CSOs have been permanently closed (CAM-004 and CAM-400). An additional two CSOs are currently temporarily closed (CAM-007 and CAM-011). The CSO permit contains no requirements with the primary purpose of addressing odor control. However, there are requirements that may reduce odor generation as a secondary benefit. The permit sets specific CSO volume and frequency limits, and reduced CSO overflow volume in the Alewife Brook and Charles River will reduce odors at the outfalls. The permit also mandates that the City continue to implement the Nine Minimum Control measures and lists specific activities that must be undertaken to meet these measures. Furthermore, the NPDES permit requires monthly inspection of the CSO regulators. With such frequent inspection, the City can ensure organics do not build up within the regulators and reduce the risk of hydrogen sulfide generation within it. Finally, the NPDES permit orders that the City remain in compliance with Water Quality Standards Variances issued by MassDEP which mandates that odor control measures be identified and implemented.

The City is also required to adhere to a general NPDES permit issued by the EPA in 2016 as part of the Municipal Separated Storm Sewer System (MS4) program. [4] The MS4 NPDES permit includes requirements for pollution prevention and good housekeeping. As part of this requirement, the City conducts catch basin cleaning to keep all catch basins less than 50% full. This reduces the quantity of organic matter in the sewer system, reducing the likelihood of hydrogen sulfide generation.

5.2 LAND OWNERSHIP

The Wetlands Protection Act (310 CMR 10.00) requires projects within a 100-foot wetlands buffer or 200-foot riverfront buffer to submit a Notice of Intent to the local Conservation Commission. Except for CAM-401A and CAM-005, all CSO regulators are within these areas. As a result, any construction projects to improve odor control are required to file with the local Conservation Commission, unless the project occurs at CAM-401A and CAM-005.

The City of Cambridge must obtain permits from DCR to perform construction activities on regulators and outfalls located on DCR land. Regulators on DCR land include CAM-001, CAM-002, and CAM-007. Outfalls on DCR land include CAM-001, CAM-002, CAM-401B, CAM-005, CAM-007, CAM-017. Permit applications must include an access permit application form, complete engineering plans, documentation of any other

permits required for the work, traffic management plans, and any other information requested by DCR on the project.

Permits are obtained through the DCR online portal. In addition to the online application process, a plotted plan set must be mailed to DCR. The permit application fee is \$50. Additional fees are charged based on the project type and scope of the project work. There is no defined permit timeline in the DCR construction permit regulations.

The CAM-005 regulator is partially located under private property. Construction activities for this regulator may require easement negotiations with Mount Auburn Hospital, the landowner.

The discharge piping for CAM-401A and CAM-005 run under property owned by others and may require additional permitting and easement negotiations. For CAM-005A, easements may be needed from both Mount Auburn Hospital and 1010 Memorial Drive Tenants Corporation. For CAM-401A, easements may be needed from 15 or more properties, depending on where access is required. In addition, the CAM-401A discharge pipe passes under land owned by DCR, the Massachusetts Bay Transit Authority (MBTA), and the Massachusetts Department of Transportation (MassDOT). As such, work on that pipe may require permits from these entities.

6 ODOR CONTROL EVALUATION AND RECOMMENDATIONS

The City of Cambridge has already implemented several odor control measures that reduce odor throughout the system. Catch basins are the primary source of odor complaints. As described in **Section 4.2**, the City responds to all odor complaints at catch basins by cleaning and introducing a deodorizer into the catch basin. However, the City is committed to continuing to reduce odor issues and has evaluated additional BMPs to mitigate odors associated with CSOs. This evaluation is detailed below.

The first step is gathering more data on odor throughout the system. While that data is being obtained, low-cost alternatives are recommended to help mitigate any potential areas of stronger odor. After more data is available more robust odor control measures may be warranted at certain regulators or outfalls. This ensures that the areas that are the highest priority are remedied first, and that the recommended fix is appropriate to address the level of odor observed at the location.

6.1 ODOR CONTROL MEASURES ALREADY IN PLACE

The City has already implemented the following odor control measures. If future odor monitoring data suggests a need for additional odor controls some of the existing odor control measures may be expanded for additional impact as detailed below.

6.1.1 Hoods

Hoods are installed at all catch basins connected to combined sewer pipes. The reduced number of odor complaints during wet weather periods when the water lock seal is in place, indicate that hoods are an effective odor control measure. The City routinely inspects and cleans catch basins to keep hoods unclogged and eliminate odor generation within the catch basins. The City will continue this practice as a primary means of odor control throughout the system.

6.1.2 System Repair

The City identifies necessary system repairs in several ways. System wide inspections are completed through CCTV inspection of sewer pipes and structures. Furthermore, catch basin inspections and cleaning occur regularly in accordance with the requirements of the City's MS4 permit. CSO-specific inspections

occur monthly in accordance with the City's NPDES permit for CSO discharges. Issues identified during any of these inspections are repaired as soon as feasible.

6.1.3 I/I Manhole Inserts

The City has installed manhole inserts at all manholes within the FEMA flood plain. These inserts serve a dual purpose: they restrict the flow of water into the manhole and restrict the flow of sewer gas out of the manhole. The manhole inserts are specifically installed within the FEMA flood plain because these manholes are the most likely to flood and therefore the greatest need of inflow prevention. If other structures are identified to exhibit elevated levels of hydrogen sulfide, manhole inserts should be considered as a quick solution to seal off odor transmission to the surface environment. This is similar to recommendation to install manhole inserts in the area of the CAM-005 structure as detailed in **Section 6.1.3.**

6.1.4 Vents

The City has installed vents in sewer manholes throughout the system. Due to the current conditions not warranting additional odor control and there being no concerns about pressurization within the combined sewer system, additional venting is not recommended at this time. Any hydraulic analyses of the sewer system that includes the CSO regulators should be consider the impacts that rising hydraulic grade lines will have on air pressurization and odor transmission in the vicinity of the CSO regulators.

6.1.5 Airtight Frames and Covers

Currently, bolt-down frames and covers are installed at locations where manhole entry and/or safety is a concern. At the moment, airtight frame and covers do not appear necessary for odor control; however, if the current condition changes and more data obtained suggests otherwise, this could be evaluated further for more locations. However, this would require additional studies to examine the pressurization and hydraulic impacts that this would have on the system. Due to the current conditions, it is not recommended that this option is evaluated further at this time.

6.2 ODOR CONTROL MEASURES RECOMMENDED

6.2.1 Additional Observation and Monitoring

Odor issues are highly seasonal and, as a result, long term odor data is required to identify locations with persistent, intense odor issues. Due to the timing of this report, the City was unable to gather long-term odor data. In addition, the report is due prior to the dry summer months when odors are strongest and most frequent. To determine locations most in need of odor control measures and to determine which measures are best suited for these locations, the City requires additional data, especially from summer months.

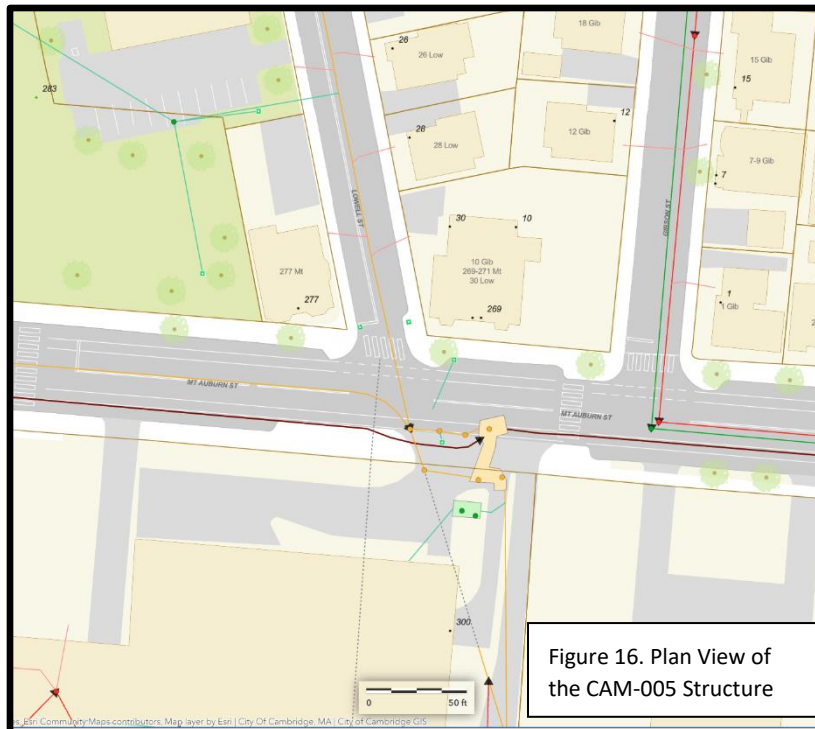
To address this challenge, the City will continue to investigate and monitor for odors emanating for the CSO regulators and outfall for an additional 6 months (June 2025 through November 2025). This odor monitoring will be incorporated into existing operations inspection procedures at the CSO regulators. Since CSO regulators are inspected monthly, the City will incorporate qualitative odor testing into monthly inspections starting in June 2025. This will provide consistent, long-term data for each CSO for minimal cost. Recorded data should include the severity of the odor (N/A, mild, strong, severe) prior to opening the regulator structure and after opening the regulator structure. Odor should also be tested at the outfall of each CSO. Odor testing can be completed as a sniff test. The City is considering the used of more quantitative odor logging equipment to accompany the inspection of outfalls or regulators. This equipment will have the ability to collect readings at concentrations of hydrogen sulfide below 1 part per million.

6.2.2 Mechanical Cleaning

The City will enhance the current cleaning schedule to include cleaning of the outfall pipes at CAM-002 and CAM-401B. Cleaning of these outfalls will reduce odor issues that result from debris build up within the pipes. These outfalls have been selected for additional cleaning as they are the only outfalls fully above the water line, allowing access for cleaning equipment. When cleaning the outfalls, the City will ensure that water used for cleaning is removed from the pipe and not allowed to discharge into the river. Cleaning of outfall pipes will start in the Summer of 2025 and occur up to three times annually between the months of April and October.

6.2.3 I/I Manhole Inserts

The City will install manhole insert lids within the 7 manholes associated with this regulator as a means of sealing potential odors within the CAM-005 structure area. This was recommended for this area due to elevated hydrogen sulfide concentrations detected as part of separate regulator improvement activities. Additionally, there are recent reports of deodorization activities in a catch basin located in the vicinity of the structure. This should be coordinated with MWRA as MWRA has a planned future improvement for the CAM-005 regulator structure. This area is shown in **FIGURE 16** below.



6.3 ODOR CONTROL MEASURES NOT CURRENTLY RECOMMENDED

The other alternative odor control measures evaluated as part of this report were not recommended for reasons detailed in Table 4.

Table 4. Odor Control Measures not Currently Recommended

ODOR CONTROL MEASURE	REASONS FOR NOT RECOMMENDING
Physical Modifications	<ul style="list-style-type: none"> - No indication of sediment builds up or hydraulic issues requiring structural modifications - Many structures lack locations suited for partition wall or curtain barrier installation
Duckbill Check Valves	<ul style="list-style-type: none"> - Structures with high-elevation outlets require additional hydraulic analysis to ensure that additional headloss does not cause backups - May lead to clogging in the system piping
Flap Check Valves	<ul style="list-style-type: none"> - Already installed in some structures - Some structures do not have appropriate configuration for installation - Increases likelihood of clogging
Passive Filtration Systems	<ul style="list-style-type: none"> - Passive airflow through structures does not appear to be present to support installing passive system -Further analysis required
Active Filtration Systems	<ul style="list-style-type: none"> - High cost for installation - High burden for operations and maintenance - Additional permitting required for installation at some structures
Chemical Addition	<ul style="list-style-type: none"> - Since odor issues are not system wide, a system wide solution unnecessary
Bioaugmentation	<ul style="list-style-type: none"> - Since odor issues are not system wide, a system wide solution unnecessary

The City will continue to investigate and mitigate odors within the sewer collection system and make adjustments as needed to existing odor control measures.

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- [3]

APPENDIX A

Final Determination to Adopt a Water Quality Standards Variance for Combined Sewer Overflow Discharges to Lower Charles River/Charles Basin



Department of Environmental Protection

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Bonnie Heiple
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FINAL DETERMINATION TO ADOPT A WATER QUALITY STANDARDS VARIANCE FOR COMBINED SEWER OVERFLOW DISCHARGES TO LOWER CHARLES RIVER/CHARLES BASIN

The Massachusetts Department of Environmental Protection (“MassDEP”) hereby adopts a Variance for Combined Sewer Overflow (“CSO”) Discharges to the Lower Charles River/Charles Basin, from September 1, 2024 to August 31, 2029. This discharger-specific Water Quality Standards Variance (“Variance”) authorizes limited CSO discharges from the Massachusetts Water Resources Authority (“MWRA”) and the City of Cambridge, which are subject to NPDES and Surface Water Discharge permits Nos. MA0103284 and MA0101974, respectively. During wet weather events where the limited CSO discharges are authorized, Class B requirements at 314 CMR 4.05(3)(b) for bacteria, solids, color and turbidity, and taste and odor may not be met. The Variance is a water quality standards revision subject to EPA review and approval under EPA’s regulations at 40 CFR Part 131. It is adopted pursuant to the Massachusetts Surface Water Quality Standards (“SWQS”) at 314 CMR 4.00 and the federal Water Quality Standards (“WQS”) regulations at 40 CFR Part 131, and subject to the specific conditions that follow. This Variance is intended to establish requirements to (1) achieve the highest attainable water quality conditions in the receiving water; (2) provide for an assessment of the level of CSO control achieved, and the associated water quality impacts of CSO and non-CSO sources; (3) continue public notification of CSO events and their impacts; and (4) continue to assess the costs and feasibility of achieving higher levels of CSO control beyond the requirements of this Variance. The Variance does not alter the underlying designated uses of the receiving water, nor authorize any backsliding of the current ambient water quality in these receiving waters. It serves to modify the water quality standard only for the discharges associated with the permittees noted above, which also serves as the basis for developing NPDES permits. MWRA remains subject to the orders of the United States District Court for the District of Massachusetts, Civil Action Nos. 85-0489-MA and 83-1614-MA, including amended Schedule Seven, dated October 19, 2011 (the “Federal Court Order”) regarding its implementation of the revised Long-Term CSO Control Plan (“LTCP”)¹.

¹ In the event of any future amendment by the court in the aforementioned actions, MassDEP will determine whether the court’s actions will require a change to the Variance requirements.

MassDEP adopts this Variance based on its determination described in the accompanying fact sheet that implementation of more stringent CSO controls to meet the underlying designated use and criteria at this time would result in substantial and widespread social and economic impact as specified in 314 CMR 4.03(4)(a)(6) and 40 CFR 131.10(g)(6). Further, implementation of the requirements that follow represent the highest attainable interim effluent conditions during the term of the Variance until such time as information to support further regulatory determinations is available. Information gathered during the term of the Variance is intended to be used to make a subsequent determination on the appropriate water quality standard for the Charles River segments that are currently affected by CSO discharges. Issuance of this Variance for CSO discharges to the Lower Charles River/Charles Basin is consistent with EPA's regulations at 40 CFR 131.14 and with the U.S. Environmental Protection Agency's Guidance (*Coordinating CSO Long-Term Planning with Water Quality Standard Reviews, July 31, 2001*), which states that longer term variances and renewal of variances are warranted given the extended duration necessary for implementation of long-term control plans.

In December 2015, MWRA and the City of Cambridge, in coordination with other municipal partners, completed the 35 CSO Control Projects in MWRA's LTCP, consistent with the requirements of the Federal Court Order. MWRA issued a Final CSO Post Construction Monitoring Program and Performance Assessment Report on December 30, 2021², also a requirement of the Federal Court Order, which documents the level of CSO control achieved. In addition, MWRA undertook a CSO/water quality assessment by first developing and then using a receiving water model³, to determine the impacts of CSO and non-CSO sources in the Charles River, pursuant to EPA's 1994 *Combined Sewer Overflow (CSO) Control Policy* ("EPA CSO Policy").

Once approved by EPA under federal Clean Water Act section 303(c), this Variance and its conditions will be incorporated into NPDES and Surface Water Discharge permits for the MWRA and the City of Cambridge at the time of reissuance of those permits, consistent with 40 CFR 131.14(c) and 314 CMR 4.03. Failure by the MWRA and/or the City of Cambridge to comply with the conditions of this Variance following its effective date and as implemented in their NPDES and Surface Water Discharge permits will constitute a violation of the permit, as well as the Massachusetts SWQS (314 CMR 4.00) and the Surface Water Discharge Permit Program regulations (314 CMR 3.00).

The Variance is a short-term modification of the Massachusetts SWQS, issued by MassDEP and subject to EPA approval. In order to develop Updated CSO Control Plans and complete activities identified in the Pollutant Minimization Program (PMP), MassDEP has concluded a five-year variance is necessary and appropriate. The Variance allows limited CSO discharges, as set forth in Exhibit C, from the outfalls along the Lower Charles River and Charles River Basin permitted to MWRA and the City of Cambridge, subject to specific conditions. Other standards and criteria of the receiving waters' Class B designation are unaffected and remain in force.

² <https://www.mwra.com/media/file/2021-12-task-6-final-cso-post-construction-monitoring-program-and-performance-assessment>

³ <https://www.mwra.com/media/file/cso-post-construction-monitoring-and-performance-assessment-task-52-receiving-water>

VARIANCE CONDITIONS

This Variance is conditioned upon MWRA and the City of Cambridge complying with their individual and joint requirements, as identified below:

A. Level of Required CSO Control During Variance

CSO activations and volumes shall be consistent with the requirements included in the “Second Stipulation of the United States and the Massachusetts Water Resources Authority on Responsibility and Legal Liability for Combined Sewer Overflow Control” (“Second Stipulation”), filed March 15, 2006, as amended in the aforementioned actions. Accordingly, CSO discharges to the Lower Charles River/Charles River Basin shall be limited to those set forth in attached Exhibit C (with allowance for any conditions that exceed Typical Year⁴ conditions). In the event of any future amendment by the court in the aforementioned actions, MassDEP will determine whether the court’s actions will require a change to Variance requirements. Further, this Variance requires additional actions set forth in Sections E and F below, which shall be implemented to reduce CSO pollutant loads and impacts during the term of this Variance. Consistent with 40 CFR 131.14(b)(1)(ii)(A)(3), these collective requirements reflect the greatest pollutant reduction achievable within the five-year term of this Variance.

B. Receiving Water Quality Monitoring

MWRA shall continue the water quality monitoring program in the Lower Charles River and Charles River Basin to demonstrate the effectiveness of CSO controls implemented in the watershed. The work shall be adequate to assess the water quality impacts of remaining CSO pollutant sources and loads over a range of storms events, and the associated level of attainment of water quality standards in the Lower Charles River and Charles River Basin.

On or before July 15 each year, for the duration of this Variance, MWRA shall submit to MassDEP and EPA a report on the previous year's sampling program. The report shall include a summary of the receiving water sampling data collected over the past calendar year, including sampling locations and parameters, and comparisons between results during wet and dry weather, a characterization of rainfall events for which wet weather sampling was done, and a correlation of the sampling data with CSO activations and volumes.

⁴ Typical Year" rainfall has been the basis for development, recommendation and approval of MWRA's LTCP, the establishment of the federal court mandated levels of control, and the assessment of system performance toward attainment of the LTCP levels of control. The Typical Year was developed from 40 years of rainfall records (1949-1987, plus 1992), and it includes 93 storms with a total precipitation of 46.8 inches. For the future Updated CSO Control Planning (See Section F), MWRA and Cambridge are developing a “Revised Typical Year” for the Variance Waterbodies, which incorporates anticipated precipitation changes and sea level rise due to climate change. Remedial alternatives for the “Revised Typical Year” will be evaluated in the Updated CSO Control Plans in Section F herein.

C. CSO Performance Assessment

1. CSO Activations and Volumes

Schedule Seven Compliance Order Number 250, dated February 18, 2022, Civil Action No. 83-1614-RGS requires that by December 31, 2024, MWRA shall file a supplemental report to MassDEP and EPA that contains:

- (i) The final Typical Year performance of all 86 outfalls as compared to 1992 system conditions and the LTCP; and
- (ii) The MWRA's final results and conclusions as to the 16 outfalls⁵, which shall include an alternatives analysis describing what further actions could be taken, and costs associated with those actions, to further reduce or meet LTCP activation and volume goals for any of the 16 outfalls that have not met their respective LTCP goals. This supplemental report, coupled with the performance assessment report and water quality assessment report filed in December 2021, will provide information to EPA, MassDEP, and the Court to make the final determinations as to attainment of the levels of control in the LTCP and draw any final conclusions.

2. Annual CSO Discharge Report

MWRA and the City of Cambridge shall continue to monitor CSO activations and volumes, and shall submit Annual CSO Discharge Reports as follows:

- (i) Beginning April 30, 2025, and each successive April for the duration of this CSO Variance, the City of Cambridge shall submit an Annual CSO Discharge Report to MassDEP and EPA that contains estimates of CSO activations and volumes for all their permitted CSO outfalls within the Variance waterbodies for the prior calendar year. The City shall include data from their CSO metering program, which may be supplemented by estimates generated using calibrated sewer system modeling. For each CSO event, the City shall also provide rainfall data associated with the CSO discharge, including the depth, duration, and intensity of the rain event, and an estimate of the storm recurrence interval, based on NOAA Atlas 14, Volume 10, or as updated.
- (ii) Beginning April 30, 2025, and each successive April for the duration of this Variance, MWRA shall submit an Annual CSO Discharge Report to MassDEP and EPA that contains estimates of CSO activations and volumes for all permitted CSO outfalls within the Variance waterbodies, for those owned and operated by MWRA, for the prior calendar year. MWRA shall include data from the MWRA CSO metering program, which may be supplemented by estimates generated using calibrated sewer system modeling. For each CSO event, MWRA shall also provide rainfall data associated with the CSO discharge, including the depth, duration, and intensity of the rain event, and an estimate of the storm recurrence interval, based on NOAA Atlas 14, Volume 10, or as updated.

⁵ The 16 outfalls are: SOM001A; SOM007A/MWR205A; MWR205; BOS014; BOS017; CHE008; BOS009; BOS003; BOS062; BOS065; BOS070/DBC; CAM005; MWR018; MWR019; MWR020; and MWR201.

D. Notification to the Public of CSO Discharges and Impacts

1. MWRA and the City of Cambridge shall issue a joint press release by April 15 of each year to watershed advocacy groups, local health agents, and newspapers of local circulation in the Charles River watershed, which shall include general information on CSOs, the location of outfalls in the Charles River watershed, potential health risks posed by exposure to CSO events, and information on how to receive public notifications, as required by 314 CMR 16.00, about CSO discharges.
2. MWRA and the City of Cambridge shall comply with their respective MassDEP approved CSO Public Notification Plans, approved August 23, 2023 and June 16, 2023, respectively, and any approved modifications to such plans, pursuant to 314 CMR 16.00.
3. By August 31, 2025, MWRA and the City of Cambridge shall complete an evaluation of the feasibility of installing and implementing a real time, on site public notification system for CSO discharges, such as a warning light system. The evaluation shall include, but not be limited to, an assessment of costs, coordination with property owners and abutting municipalities, power needs, permitting requirements, logistics of installation and implementation, and success of similar systems in other cities. Simultaneously, MWRA and the City of Cambridge shall identify and implement interim measures for enhanced notification to the public of CSO discharges. MWRA and the City of Cambridge shall consult with watershed advocacy groups to inform development of the scope of the evaluation and identification of interim measures.
4. MWRA and the City of Cambridge shall post all final reports and all draft reports that are going out for public notice, that are required by the Variance on a publicly accessible website at the same time they are submitted to MassDEP.

E. Other Actions to Minimize CSO Discharges

1. MWRA and the City of Cambridge shall continue to implement the Nine Minimum Controls, as set forth in their respective NPDES and Surface Water Discharge Permits and the Variance conditions; these must include the following components:
 - a. Proper operation and regular maintenance programs for the sewer system and the CSOs;
 - b. Maximum use of the collection system for storage;
 - c. Review and modification of the pretreatment program to assure CSO impacts are minimized;
 - d. Maximization of flow to the POTW for treatment;
 - e. Prohibition of dry weather overflows from CSOs;
 - f. Control of solid and floatable materials in CSOs;
 - g. Pollution prevention programs that focus on contaminant reduction activities.
 - h. Public notification to ensure that the public receives adequate notification of CSO occurrences and CSO impacts; and

- i. Monitoring to effectively characterize CSO and the efficacy of CSO controls.

Any enhancements to the MWRA and community Nine Minimum Controls programs identified by MassDEP or the permittees during the development of the Updated CSO Control Plans can and shall be implemented, after obtaining all the necessary approvals, as measures to further reduce CSO discharges so that highest attainable interim effluent conditions can be achieved and maintained during the Variance period.

2. Variance Pollutant Minimization Program as required by 40 CFR 131.14(b)(1)(ii)(A)(3): In addition to compliance with the provisions of Sections A, E, and F of this Variance, MWRA, and the City of Cambridge shall complete their respective actions included in Exhibits A and B of this Variance, which collectively shall comprise the Pollutant Minimization Program.

F. Updated CSO Control Planning

MWRA and the City of Cambridge shall implement their Scopes for Updated CSO Control Plans, which were submitted to MassDEP and EPA on April 1, 2022 and approved by MassDEP on July 22, 2022. The Updated CSO Control Plans shall conform to the EPA CSO Policy and MassDEP's 1997 *Guidance for Abatement of Pollution from CSO Discharges*, and shall specifically include the following elements:

1. A description of the existing level of CSO control.
2. An evaluation of the costs and water quality benefits of further CSO control alternatives, up to and including elimination of CSO discharges. Use of Green Infrastructure technologies shall be considered.
3. A public participation plan sufficient to provide ample opportunities for the public to be informed about the development of the Plans at critical junctures, and to have opportunities to provide informed comments on the CSO abatement alternatives and recommendations. In addition to public meetings already held, MWRA and the City of Cambridge shall hold public meetings to present on Alternatives Screening/Affordability Analysis (anticipated Fall 2024/Winter 2025) and Results of Alternative Analysis (anticipated Spring 2025). MWRA and the City of Cambridge shall conduct robust public outreach to Environmental Justice communities that abut the Variance waters.
4. An affordability analysis consistent with EPA's February 2023 Clean Water Act Financial Capability Assessment Guidance, along with any other relevant information to assess financial capacity. MWRA and the City of Cambridge shall each complete their own affordability analysis.
5. A Draft Updated CSO Control Plan, including a Recommended Plan, shall be submitted to MassDEP and EPA by December 31, 2025. The Plan, once implemented, shall achieve compliance with the federal Clean Water Act, the Massachusetts Clean Waters Act, the federal Water Quality Standards regulations (40 CFR Part 131) and the Massachusetts SWQS regulations (314 CMR 4.00), including any documentation needed to support issuance of a Variance, or for changing the classification of any CSO-impacted receiving waters with Use Attainability Analyses. This condition may be satisfied through

submittal of one joint Draft Updated CSO Control Plan or three separate Draft Updated CSO Control Plans. Concurrent with submittal to MassDEP and EPA, MWRA and the City of Cambridge shall commence a public comment period, which shall include a public meeting and public hearing.

6. A Final Updated CSO Control Plan, which addresses comments received on the Draft Updated CSO Control Plan, shall be submitted for MEPA review by January 31, 2027. This condition may be satisfied through submittal of one joint Final Updated CSO Control Plan or three separate Final Updated CSO Control Plans.

During the period between January 31, 2027 and August 31, 2029, MassDEP, in coordination with EPA, will review the Final Updated CSO Control Plan(s), review and consider public comments on the Plan(s), confer with the MEPA office on compliance with the Massachusetts Environmental Policy Act, and take action to approve or disapprove the Plan(s). MassDEP and EPA actions will include determinations on compliance with the Clean Water Act and Massachusetts Surface Water Quality Standards.

Subject to the conditions included in this Variance, MWRA and the City of Cambridge shall be authorized to discharge limited CSOs during wet weather events to the Lower Charles River/ Charles Basin.

8/30/2024

Date Issued

9/1/2024

Effective Date



Kathleen M. Baskin
Assistant Commissioner
Bureau of Water Resources

Exhibit A
MWRA Variance
Additional Pollutant Minimization Measures

Below is a summary of the specific Additional Pollutant Minimization Program Measures that MWRA shall undertake during the 5-year variance period beginning September 1, 2024. These activities are intended to further the goals of improving water quality in the Lower Charles River/Charles Basin by further identifying and removing pollutant loads. These measures are consistent with the requirements of 40 CFR 131.14, and allow for progress to be made towards attaining designated use(s) and water quality criteria. Collectively with Sections A, E, and F of the Variance, the following actions comprise the Pollutant Minimization Program to be implemented by MWRA during the course of the Variance.

1. Summary of Metering Data for CSO and SSO Events

Upon request by MassDEP or EPA, during the term of the Variance, for a wet weather event which results in a CSO discharge or MWRA wet weather Sanitary Sewer Overflow (SSO) in the Lower Charles River/Charles Basin watershed, MWRA shall, within 30 days of such request, provide a summary and interpretation of the following data for the storm event:

- a. Hourly rain gauge data (location, depth, peak intensity) and estimate of storm recurrence interval;
- b. CSO/MWRA SSO event estimated or verified start and stop times;
- c. Community meter data, for the service area upstream of the CSO/MWRA SSO location;
- d. Figures that depict the metered catchment areas with appropriate labels (e.g., streets, waterbodies, etc.); and
- e. A description of any flow restrictions in downstream collection system facilities which affected the CSO/SSO event.

Collection of such data will allow for more refined understanding of CSO events and therefore more targeted and effective future CSO abatement measures.

2. Regional Inflow and Infiltration Abatement Plan

MWRA shall continue to provide technical as well as financial assistance to member communities related to the identification and removal of Infiltration/Inflow (I/I). MWRA shall submit to MassDEP for review and approval, within 90 days of the effective date of this Variance, a scope and implementation plan for the following elements of MWRA's Regional Inflow and Infiltration Abatement Plan:

- a. Continued implementation of the Community Support Financial Assistance Program for member communities;
- b. Technical outreach to member communities on effective private inflow removal programs (e.g., sump pumps, roof leaders);

- c. Technical assistance on evaluation of improvements to local infrastructure that may reduce the risk of sewer backups and SSOs. MWRA will assist communities to determine if impacts from regional collection system(s) are adversely impacting the sewer conveyance system; and
- d. Public education on the impacts of excessive I/I on the sewer system.

This work to identify and remove I/I will result in fewer CSO and SSO events, and thus improved water quality.

3. Evaluation of Floatables Control

By October 1, 2025, complete an evaluation of floatables control for each of MWRA’s outfalls that discharges to the Lower Charles River/Charles Basin and submit a written report to MassDEP. The evaluation shall assess the effectiveness of the current controls and identify recommendations for improvements. MWRA shall implement the recommendations identified by the evaluation.

4. Evaluation of Odors

By June 1, 2025, 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. MWRA shall implement the most feasible BMPs identified by the evaluation.

5. Implement the following project during the term of the CSO Variance, in accordance with the project description:

Project Name	Potentially Impacted Outfall(s)/Regulator(s)	Project Description
CAM005 Weir Raising and Lengthening	CAM005	Further investigate through internal survey all physical dimensions in the CAM005 Regulator to determine if the CAM005 weir can be raised to reduce activations but also increased in length to minimize increases to upstream wastewater levels. Anticipated date of completion: December 2025

At the same time MWRA submits the Annual CSO Discharge Reports required by C.2(ii), MWRA shall submit a report describing progress on this project.

Exhibit B
City of Cambridge Variance
Additional Pollutant Minimization Measures

Below is a summary of the specific Additional Pollutant Minimization Program Measures that the City of Cambridge shall undertake during the 5-year variance period beginning September 1, 2024. These activities are intended to further the goals of improving water quality in the Lower Charles River/Charles Basin by further identifying and removing pollutant loads. These measures are consistent with the requirements of 40 CFR 131.14, and allow for progress to be made towards attaining designated use(s) and water quality criteria. Collectively with Sections A, E, and F of the Variance, the following actions comprise the Pollutant Minimization Program to be implemented by the City of Cambridge during the course of the Variance.

1. Summary of Metering Data for CSO and SSO Events

Upon request by MassDEP or EPA, during the term of the Variance, for a wet weather event which results in a CSO discharge or City of Cambridge wet weather SSO in the Lower Charles River/Charles River Basin, the City of Cambridge shall, within 30 days of such request, provide a summary and interpretation of the following data for the storm event:

- a. Hourly rain gauge data (location, depth, peak intensity) and estimate of storm recurrence interval;
- b. CSO/SSO event estimated or verified start and stop times;
- c. Meter data, in 15-minute increments from 24 hours prior to the CSO/SSO event, extending to 24 hours following cessation of the CSO/SSO event;
- d. Figures that depict the metered catchment areas with appropriate labels (e.g., streets, waterbodies, etc.); and
- e. A description of any flow restrictions in downstream collection system facilities which affected the CSO/SSO event.

Collection of such data will allow for more refined understanding of CSO events and therefore more targeted and effective future CSO abatement measures.

2. Evaluation of Floatables Control

By October 1, 2025, complete an evaluation of floatables control for each of the City of Cambridge's outfalls that discharges to the Lower Charles River/Charles Basin and submit a written report to MassDEP. The evaluation shall assess the effectiveness of the current controls and identify recommendations for improvements. The City of Cambridge shall implement the recommendations identified by the evaluation.

3. Evaluation of Odors

By June 1, 2025, complete and 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. The City of Cambridge shall implement any BMPs identified by the evaluation.

4. Implement the following projects during the term of the Variance, in accordance with the project description:

Project Name	Potentially Impacted Outfall(s)/Regulator(s)	Project Description
Willard Street Sewer Separation	CAM005, CAM007, Cottage Farm	Sewer separation of 20 acres of Combined Sewer tributary to MWRA's North Charles Sewer upstream of Cottage Farm. Anticipated date of completion: November 2024
River Street Sewer Separation	CAM005, CAM007, MWRA Cottage Farm	Sewer separation of 5 acres of Combined Sewer tributary to MWRA's North Charles Sewer upstream of Cottage Farm. Anticipated date of completion: September 2026
Land Boulevard Sewer Separation	CAM17, Prison Point	Developer I/I project for infiltration removal. Anticipated date of completion: December 2025

At the same time the City of Cambridge submits the Annual CSO Discharge Reports required by C.2(i), the City of Cambridge shall submit a report describing progress on each project.

EXHIBIT C

Long Term Control Plan Levels of Control

CSO OUTFALL	LONG TERM CONTROL PLAN	
	TYPICAL YEAR	
	Activation Frequency	Volume (MG)
UPPER CHARLES		
BOS032	Closed	N/A
BOS033	Closed	N/A
CAM005	3	0.84
CAM007	1	0.03
CAM009	2	0.01
CAM011	0	0.00
TOTAL		0.88
LOWER CHARLES		
BOS028	Closed	N/A
BOS042	Closed	N/A
BOS049	To be closed	N/A
CAM017	1	0.45
MWR010	0	0.00
MWR018	0	0.00
MWR019	0	0.00
MWR020	0	0.00
MWR021	Closed	N/A
MWR022	Closed	N/A
MWR201 (Cottage Farm)	2	6.30
MWR023	2	0.13
SOM010	Closed	N/A
TOTAL		6.88

APPENDIX B

Final Determination to Adopt a Water Quality Standards Variance for Combined Sewer Overflow Discharges to Alewife Brook/Upper Mystic River Basin



Department of Environmental Protection

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Maura T. Healey
Governor

Kimberley Driscoll
Lieutenant Governor

Rebecca L. Tepper
Secretary

Bonnie Heiple
Commissioner

FINAL DETERMINATION TO ADOPT A WATER QUALITY STANDARDS VARIANCE FOR COMBINED SEWER OVERFLOW DISCHARGES TO ALEWIFE BROOK/UPPER MYSTIC RIVER BASIN

The Massachusetts Department of Environmental Protection (“MassDEP”) hereby adopts a Variance for Combined Sewer Overflow (“CSO”) Discharges to the Alewife Brook/Upper Mystic River Basin, from September 1, 2024 to August 31, 2029. This discharger-specific Water Quality Standards Variance (“Variance”) authorizes limited CSO discharges from the Massachusetts Water Resources Authority (“MWRA”) and the Cities of Cambridge and Somerville, which are subject to NPDES and Surface Water Discharge permits Nos. MA0103284, MA0101974, and MA0101982, respectively. During wet weather events where the limited CSO discharges are authorized, Class B requirements at 314 CMR 4.05(3)(b) for bacteria, solids, color and turbidity, and taste and odor may not be met. The Variance is a water quality standards revision subject to EPA review and approval under EPA’s regulations at 40 CFR Part 131. It is adopted pursuant to the Massachusetts Surface Water Quality Standards (“SWQS”) at 314 CMR 4.00 and the federal Water Quality Standards (“WQS”) regulations at 40 CFR Part 131, and subject to the specific conditions that follow. This Variance is intended to establish requirements to (1) achieve the highest attainable water quality conditions in the receiving water; (2) provide for an assessment of the level of CSO control achieved, and the associated water quality impacts of CSO and non-CSO sources; (3) continue public notification of CSO events and their impacts; and (4) continue to assess the costs and feasibility of achieving higher levels of CSO control beyond the requirements of this Variance. The Variance does not alter the underlying designated uses of the receiving water, nor authorize any backsliding of the current ambient water quality in these receiving waters. It serves to modify the water quality standard only for the discharges associated with the permittees noted above, which also serves as the basis for developing NPDES permits. MWRA remains subject to the orders of the United States District Court for the District of Massachusetts, Civil Action Nos. 85-0489-MA and 83-1614-MA, including amended Schedule Seven, dated October 19, 2011 (the “Federal Court Order”) regarding its implementation of the revised Long-Term CSO Control Plan (“LTCP”)¹.

¹ In the event of any future amendment by the court in the aforementioned actions, MassDEP will determine whether the court’s actions will require a change to the Variance requirements.

MassDEP adopts this Variance based on its determination described in the accompanying fact sheet that implementation of more stringent CSO controls to meet the underlying designated use and criteria at this time would result in substantial and widespread social and economic impact as specified in 314 CMR 4.03(4)(a)(6) and 40 CFR 131.10(g)(6). Further, implementation of the requirements that follow represent the highest attainable interim effluent conditions during the term of the Variance, until such time as information to support further regulatory determinations is available. Information gathered during the term of the Variance is intended to be used to make a subsequent determination on the appropriate water quality standard for the Alewife Brook and the Upper Mystic River segments that are currently affected by CSO discharges. Issuance of this Variance for CSO discharges to the Alewife Brook/Upper Mystic River Basin is consistent with EPA's regulations at 40 CFR 131.14, and with the U.S. Environmental Protection Agency's Guidance (*Coordinating CSO Long-Term Planning with Water Quality Standard Reviews, July 31, 2001*), which states that longer term variances and renewal of variances are warranted given the extended duration necessary for implementation of long-term control plans.

In December 2015, MWRA and the Cities of Cambridge and Somerville, in coordination with other municipal partners, completed the 35 CSO Control Projects in MWRA's LTCP, consistent with the requirements of the Federal Court Order. MWRA issued a Final CSO Post Construction Monitoring Program and Performance Assessment Report on December 30, 2021², also a requirement of the Federal Court Order, which documents the level of CSO control achieved. In addition, MWRA undertook a CSO/water quality assessment by first developing and then using a receiving water model³, to determine the impacts of CSO and non-CSO sources in the Alewife Brook and Upper Mystic River, pursuant to EPA's 1994 *Combined Sewer Overflow (CSO) Control Policy* ("EPA CSO Policy").

Once approved by EPA under federal Clean Water Act section 303(c), this Variance and its conditions will be incorporated into NPDES and Surface Water Discharge permits for the MWRA and the Cities of Cambridge and Somerville at the time of reissuance of those permits, consistent with 40 CFR 131.14(c) and 314 CMR 4.03. Failure by the MWRA and/or the Cities of Cambridge or Somerville to comply with the conditions of this Variance following its effective date and as implemented in their NPDES and Surface Water Discharge permits will constitute a violation of the permit, as well as the Massachusetts SWQS (314 CMR 4.00) and the Surface Water Discharge Permit Program regulations (314 CMR 3.00).

The Variance is a short-term modification of the Massachusetts SWQS, issued by MassDEP and subject to EPA approval. In order to develop Updated CSO Control Plans and complete activities identified in the Pollutant Minimization Program (PMP), MassDEP has concluded a five-year variance is necessary and appropriate. The Variance allows limited CSO discharges, as set forth in Exhibit D, from the outfalls along the Alewife Brook and Upper Mystic River permitted to MWRA and the Cities of Cambridge and Somerville, subject to specific conditions. Other standards and criteria of the receiving waters' Class B designation are unaffected and remain in force.

² <https://www.mwra.com/media/file/2021-12-task-6-final-cso-post-construction-monitoring-program-and-performance-assessment>

³ <https://www.mwra.com/media/file/cso-post-construction-monitoring-and-performance-assessment-task-52-receiving-water>

VARIANCE CONDITIONS

This Variance is conditioned upon MWRA and the Cities of Cambridge and Somerville complying with their individual and joint requirements, as identified below:

A. Level of Required CSO Control During Variance

CSO activations and volumes shall be consistent with the requirements included in the “Second Stipulation of the United States and the Massachusetts Water Resources Authority on Responsibility and Legal Liability for Combined Sewer Overflow Control” (“Second Stipulation”), filed March 15, 2006, as amended in the aforementioned actions. Accordingly, CSO discharges to the Alewife Brook/Upper Mystic River Basin shall be limited to those set forth in attached Exhibit D (with allowance for any conditions that exceed Typical Year⁴ conditions). In the event of any future amendment by the court in the aforementioned actions, MassDEP will determine whether the court’s actions will require a change to Variance requirements. Further, this Variance requires additional actions set forth in Sections E and F below, which shall be implemented to reduce CSO pollutant loads and impacts during the term of this Variance. Consistent with 40 CFR 131.14(b)(1)(ii)(A)(3), these collective requirements reflect the greatest pollutant reduction achievable within the five-year term of this Variance.

B. Receiving Water Quality Monitoring

MWRA shall continue the water quality monitoring program in the Alewife Brook and Upper Mystic River to demonstrate the effectiveness of CSO controls implemented in the watershed. The work shall be adequate to assess the water quality impacts of remaining CSO pollutant sources and loads over a range of storms events, and the associated level of attainment of water quality standards in the Alewife Brook and Upper Mystic River.

On or before July 15 each year, for the duration of this Variance, MWRA shall submit to MassDEP and EPA a report on the previous year's sampling program. The report shall include a summary of the receiving water sampling data collected over the past calendar year, including sampling locations and parameters, and comparisons between results during wet and dry weather, a characterization of rainfall events for which wet weather sampling was done, and a correlation of the sampling data with CSO activations and volumes.

⁴ “Typical Year” rainfall has been the basis for development, recommendation and approval of MWRA’s LTCP, the establishment of the federal court mandated levels of control, and the assessment of system performance toward attainment of the LTCP levels of control. The Typical Year was developed from 40 years of rainfall records (1949-1987, plus 1992), and it includes 93 storms with a total precipitation of 46.8 inches. For the future Updated CSO Control Planning (see Section F), MWRA, Cambridge, and Somerville are developing a “Revised Typical Year” for the Variance waterbodies, which incorporates anticipated precipitation changes and sea level rise due to climate change. Remedial alternatives for the “Revised Typical Year” will be evaluated in the Updated CSO Control Plans in Section F herein.

C. CSO Performance Assessment

1. CSO Activations and Volumes

Schedule Seven Compliance Order Number 250, dated February 18, 2022, Civil Action No. 83-1614-RGS requires that by December 31, 2024, MWRA shall file a supplemental report to MassDEP and EPA that contains:

- (i) The final Typical Year performance of all 86 outfalls as compared to 1992 system conditions and the LTCP; and
- (ii) The MWRA's final results and conclusions as to the 16 outfalls⁵, which shall include an alternatives analysis describing what further actions could be taken, and costs associated with those actions, to further reduce or meet LTCP activation and volume goals for any of the 16 outfalls that have not met their respective LTCP goals. This supplemental report, coupled with the performance assessment report and water quality assessment report filed in December 2021, will provide information to EPA, MassDEP, and the Court to make the final determinations as to attainment of the levels of control in the LTCP and draw any final conclusions.

2. Annual CSO Discharge Report

MWRA and the Cities of Cambridge and Somerville shall continue to monitor CSO activations and volumes, and shall submit Annual CSO Discharge Reports as follows:

- (i) Beginning April 30, 2025, and each successive April for the duration of this Variance, the Cities of Cambridge and Somerville each shall submit an Annual CSO Discharge Report to MassDEP and EPA that contains estimates of CSO activations and volumes for all their permitted CSO outfalls within the Variance waterbodies for the prior calendar year. The Cities shall include data from their CSO metering programs, which may be supplemented by estimates generated using calibrated sewer system modeling. For each CSO event, the Cities shall also provide rainfall data associated with the CSO discharge, including the depth, duration, and intensity of the rain event, and an estimate of the storm recurrence interval, based on NOAA Atlas 14, Volume 10, or as updated.
- (ii) Beginning April 30, 2025, and each successive April for the duration of this Variance, MWRA shall submit an Annual CSO Discharge Report to MassDEP and EPA that contains estimates of CSO activations and volumes for all permitted CSO outfalls within the Variance waterbodies, for those owned and operated by MWRA, for the prior calendar year. MWRA shall include data from the MWRA CSO metering program, which may be supplemented by estimates generated using calibrated sewer system modeling. For each CSO event, MWRA shall also provide rainfall data associated with the CSO discharge, including the depth, duration, and intensity of the rain event, and an estimate of the storm recurrence interval, based on NOAA, Atlas 14, Volume 10, or as updated.

⁵ The 16 outfalls are: SOM001A; SOM007A/MWR205A; MWR205; BOS014; BOS017; CHE008; BOS009; BOS003; BOS062; BOS065; BOS070/DBC; CAM005; MWR018; MWR019; MWR020; and MWR201.

D. Notification to the Public of CSO Discharges and Impacts

1. MWRA and the Cities of Cambridge and Somerville shall issue a joint press release by April 15 of each year to watershed advocacy groups, local health agents, and newspapers of local circulation in the Alewife Brook/Upper Mystic River watershed, which shall include general information on CSOs, the location of outfalls in the Alewife Brook/Upper Mystic River watershed, potential health risks posed by exposure to CSO events, and information on how to receive public notifications, as required by 314 CMR 16.00, about CSO discharges.
2. MWRA and the Cities of Cambridge and Somerville shall comply with their respective MassDEP-approved CSO Public Notification Plans, approved August 23, 2023, June 16, 2023 and July 25, 2023, respectively, and any approved modifications to such plans, pursuant to 314 CMR 16.00.
3. By August 31, 2025, MWRA and the Cities of Cambridge and Somerville shall complete an evaluation of the feasibility of installing and implementing a real time, on site public notification system for CSO discharges, such as a warning light system. The evaluation shall include, but not be limited to, an assessment of costs, coordination with property owners and abutting municipalities, power needs, permitting requirements, logistics of installation and implementation, and success of similar systems in other cities. Simultaneously, MWRA and the Cities of Cambridge and Somerville shall identify and implement interim measures for enhanced notification to the public of CSO discharges. MWRA and the Cities of Cambridge and Somerville shall consult with watershed advocacy groups to inform development of the scope of the evaluation and identification of interim measures.
4. MWRA and the Cities of Cambridge and Somerville shall post all final reports and all draft reports that are going out for public notice, that are required by the Variance on a publicly accessible website at the same time they are submitted to MassDEP.

E. Other Actions to Minimize CSO Discharges

- a. MWRA and the Cities of Cambridge and Somerville shall continue to implement the Nine Minimum Controls, as set forth in their respective NPDES and Surface Water Discharge Permits and the Variance conditions; these must include the following components:
 - a. Proper operation and regular maintenance programs for the sewer system and the CSOs;
 - b. Maximum use of the collection system for storage;
 - c. Review and modification of the pretreatment program to assure CSO impacts are minimized;
 - d. Maximization of flow to the POTW for treatment;
 - e. Prohibition of dry weather overflows from CSOs;

- f. Control of solid and floatable materials in CSOs;
- g. Pollution prevention programs that focus on contaminant reduction activities
- h. Public notification to ensure that the public receives adequate notification of CSO occurrences and CSO impacts; and
- i. Monitoring to effectively characterize CSO and the efficacy of CSO controls.

Any enhancements to the MWRA and communities' Nine Minimum Controls programs identified by MassDEP or the permittees during the development of the Updated CSO Control Plans can and shall be implemented, after obtaining all the necessary approvals, as measures to further reduce CSO discharges so that highest attainable interim effluent conditions can be achieved and maintained during the Variance period.

- b. Variance Pollutant Minimization Program as required by 40 CFR 131.14(b)(1)(ii)(A)(3): In addition to compliance with the provisions of Sections A, E, and F of this Variance, MWRA, and the Cities of Cambridge and Somerville shall complete their respective actions included in Exhibits A, B, and C of this Variance, which collectively shall comprise the Pollutant Minimization Program.

F. Updated CSO Control Planning

MWRA and the Cities of Cambridge and Somerville shall implement their Scopes for Updated CSO Control Plans, which were submitted to MassDEP and EPA on April 1, 2022 and approved by MassDEP on July 22, 2022. The Updated CSO Control Plans shall conform to the EPA CSO Policy and MassDEP's 1997 *Guidance for Abatement of Pollution from CSO Discharges*, and shall specifically include the following elements:

1. A description of the existing level of CSO control.
2. An evaluation of the costs and water quality benefits of further CSO control alternatives, up to and including elimination of CSO discharges. Use of Green Infrastructure technologies shall be considered.
3. A public participation plan sufficient to provide ample opportunities for the public to be informed about the development of the Plans at critical junctures, and to have opportunities to provide informed comments on the CSO abatement alternatives and recommendations. In addition to public meetings already held, MWRA and the Cities of Cambridge and Somerville shall hold public meetings to present on Alternatives Screening/Affordability Analysis (anticipated Fall 2024/Winter 2025) and Results of Alternative Analysis (anticipated Spring 2025). MWRA and the Cities of Cambridge and Somerville shall conduct robust public outreach to Environmental Justice communities that abut the Variance waters.
4. An affordability analysis consistent with EPA's February 2023 Clean Water Act Financial Capability Assessment Guidance, along with any other relevant information to assess financial capacity. MWRA and the Cities of Cambridge, and Somerville shall each complete their own affordability analysis.
5. A Draft Updated CSO Control Plan, including a Recommended Plan, shall be submitted to MassDEP and EPA by December 31, 2025. The Plan, once implemented, shall achieve

compliance with the federal Clean Water Act, the Massachusetts Clean Waters Act, the federal Water Quality Standards regulations (40 CFR Part 131) and the Massachusetts SWQS regulations (314 CMR 4.00), including any documentation needed to support issuance of a Variance, or for changing the classification of any CSO-impacted receiving waters with Use Attainability Analyses. This condition may be satisfied through submittal of one joint Draft Updated CSO Control Plan or three separate Draft Updated CSO Control Plans. Concurrent with submittal to MassDEP and EPA, MWRA and the Cities of Cambridge and Somerville shall commence a public comment period, which shall include a public meeting and public hearing.

6. A Final Updated CSO Control Plan, which addresses comments received on the Draft Updated CSO Control Plan, shall be submitted for MEPA review by January 31, 2027. This condition may be satisfied through submittal of one joint Final Updated CSO Control Plan or three separate Final Updated CSO Control Plans.

During the period between January 31, 2027 and August 31, 2029, MassDEP, in coordination with EPA, will review the Final Updated CSO Control Plan(s), review and consider public comments on the Plan(s), confer with the MEPA office on compliance with the Massachusetts Environmental Policy Act, and take action to approve or disapprove the Plan(s). MassDEP and EPA actions will include determinations on compliance with the Clean Water Act and Massachusetts Surface Water Quality Standards.

Subject to the conditions included in this Variance, MWRA, and the Cities of Cambridge and Somerville shall be authorized to discharge limited CSOs during wet weather events to the Alewife Brook/Upper Mystic River Basin.

8/30/2024

Date Issued

9/1/2024

Effective Date



Kathleen M. Baskin
Assistant Commissioner
Bureau of Water Resources

Exhibit A
MWRA Variance
Additional Pollutant Minimization Measures

Below is a summary of the specific Additional Pollutant Minimization Program Measures that MWRA shall undertake during the 5-year variance period beginning September 1, 2024. These activities are intended to further the goals of improving water quality in the Alewife Brook/Upper Mystic River Basin by further identifying and removing pollutant loads. These measures are consistent with the requirements of 40 CFR 131.14, and allow for progress to be made towards attaining designated use(s) and water quality criteria. Collectively with Sections A, E, and F of the Variance, the following actions comprise the Pollutant Minimization Program to be implemented by MWRA during the course of the Variance.

1. Summary of Metering Data for CSO and SSO Events

Upon request by MassDEP or EPA, during the term of the Variance, for a wet weather event which results in a CSO discharge or MWRA wet weather sanitary sewer overflow (SSO) in the Alewife/Upper Mystic Basin, MWRA shall, within 30 days of such request, provide a summary and interpretation of the following data for the storm event:

- a. Hourly rain gauge data (location, depth, peak intensity) and estimate of storm recurrence interval;
- b. CSO/MWRA SSO event estimated or verified start and stop times;
- c. Community meter data, for the service area upstream of the CSO/MWRA SSO location;
- d. Figures that depict the metered catchment areas with appropriate labels (e.g., streets, waterbodies, etc.); and
- e. A description of any flow restrictions in downstream collection system facilities which affected the CSO/SSO event.

Collection of such data will allow for more refined understanding of CSO events and therefore more targeted and effective future CSO abatement measures.

2. Regional Inflow and Infiltration Abatement Plan

MWRA shall continue to provide technical as well as financial assistance to member communities related to the identification and removal of Infiltration/Inflow (I/I). MWRA shall submit to MassDEP for review and approval, within 90 days of the effective date of this Variance, a scope and implementation plan for the following elements of MWRA's Regional Inflow and Infiltration Abatement Plan:

- a. Continued implementation of the Community Support Financial Assistance Program for member communities;
- b. Technical outreach to member communities on effective private inflow removal programs (e.g., sump pumps, roof leaders);

- c. Technical assistance on evaluation of improvements to local infrastructure that may reduce the risk of sewer backups and SSOs. MWRA will assist communities to determine if impacts from regional collection system(s) are adversely impacting the sewer conveyance system; and
- d. Public education on the impacts of excessive I/I on the sewer system.

This work to identify and remove I/I will result in fewer CSO and SSO events, and thus improved water quality.

3. Evaluation of Floatables Control

By October 1, 2025, complete an evaluation of floatables control for each of MWRA’s outfalls that discharges to Alewife Brook or the Upper Mystic River and submit a written report to MassDEP. The evaluation shall assess the effectiveness of the current controls and identify recommendations for improvements. MWRA shall implement the recommendations identified by the evaluation.

4. Evaluation of Odors

By June 1, 2025, 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. MWRA shall implement the most feasible BMPs identified by the evaluation.

5. Implement the following projects during the term of the Variance, in accordance with the project description:

Project Name	Potentially Impacted Outfall(s)/Regulator(s)	Project Description
Somerville Marginal CSO Facility - New Connection and gate structure	MWR205/SOM007A	Design and installation of gate structure from Somerville Marginal CSO facility influent line to MWRA Section 35 to maximize flows within interceptor. Anticipated date of completion: December 2025
Somerville Marginal CSO Facility Rehab Design	MWR205/SOM007A	Complete Design of Facility Rehab to ensure reliable treatment of remaining CSO discharges. Anticipated date of completion: February 2028
Further CAM401A Metering and Model Calibration	CAM401A	Working with the City of Cambridge, perform further system metering and hydraulic model calibration to improve CAM401A system understanding and address differences in current hydraulic models. Anticipated date of completion: October 2024

At the same time MWRA submits the Annual CSO Discharge Reports required by C.2.(ii), MWRA shall submit a report describing progress on each project.

Exhibit B
City of Cambridge Variance
Additional Pollutant Minimization Measures

Below is a summary of the specific Additional Pollutant Minimization Program Measures that the City of Cambridge shall undertake during the 5-year variance period beginning September 1, 2024. These activities are intended to further the goals of improving water quality in the Alewife Brook/Upper Mystic River Basin by further identifying and removing pollutant loads. These measures are consistent with the requirements of 40 CFR 131.14, and allow for progress to be made towards attaining designated use(s) and water quality criteria. Collectively with Sections A, E, and F of the Variance, the following actions comprise the Pollutant Minimization Program to be implemented by the City of Cambridge during the course of the Variance.

1. Summary of Metering Data for CSO and SSO Events

Upon request by MassDEP or EPA, during the term of the Variance, for a wet weather event which results in a CSO discharge or City of Cambridge wet weather SSO in the Alewife Brook/Upper Mystic River Basin, the City of Cambridge shall, within 30 days of such request, provide a summary and interpretation of the following data for the storm event:

- a. Hourly rain gauge data (location, depth, peak intensity) and estimate of storm recurrence interval;
- b. CSO/SSO event estimated or verified start and stop times;
- c. Meter data, in 15-minute increments from 24 hours prior to the CSO/SSO event, extending to 24 hours following cessation of the CSO/SSO event;
- d. Figures that depict the metered catchment areas with appropriate labels (e.g., streets, waterbodies, etc.); and
- e. A description of any flow restrictions in downstream collection system facilities which affected the CSO/SSO event.

Collection of such data will allow for more refined understanding of CSO events and therefore more targeted and effective future CSO abatement measures.

2. Evaluation of Floatables Control

By October 1, 2025, complete an evaluation of floatables control for each of the City of Cambridge's outfalls that discharges to Alewife Brook or the Upper Mystic River and submit a written report to MassDEP. The evaluation shall assess the effectiveness of the current controls and identify recommendations for improvements. The City of Cambridge shall implement the recommendations identified by the evaluation.

3. Evaluation of Odors

By June 1, 2025, 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. The City of Cambridge shall implement the most feasible BMPs identified by the evaluation.

4. Implement the following projects during the term of the Variance, in accordance with the project description:

Project Name	Potentially Impacted Outfall(s)/Regulator(s)	Project Description
Further CAM401A Metering and Model Calibration	CAM401A	Working with MWRA, perform further system metering and hydraulic model calibration to improve CAM401A system understanding and address differences in current hydraulic models. Work will improve upon ability to evaluate alternative under Updated CSO Control Plan. Anticipated date of completion: October 2024
Tobin Stormwater Storage Tank	Formerly CAM004	A legacy project necessary due to the CAM004 separation is a 1.25 MG stormwater flood storage facility and 100K gallon green stormwater infrastructure surface storage at Tobin School. Anticipated date of completion: December 2025

At the same time the City of Cambridge submits the Annual CSO Discharge Reports required by C.2.(i), the City of Cambridge shall submit a report describing progress on each project.

Exhibit C
City of Somerville Variance
Additional Pollutant Minimization Measures

Below is a summary of the specific Additional Pollutant Minimization Program Measures that the City of Somerville shall undertake during the 5-year variance period beginning September 1, 2024. These activities are intended to further the goals of improving water quality in the Alewife Brook/Upper Mystic River Basin by further identifying and removing pollutant loads. These measures are consistent with the requirements of 40 CFR 131.14, and allow for progress to be made towards attaining designated use(s) and water quality criteria. Collectively with Sections A, E, and F of the Variance, the following actions comprise the Pollutant Minimization Program to be implemented by the City of Somerville during the course of the Variance.

1. Summary of Metering Data for CSO and SSO Events

Upon request by MassDEP or EPA, during the term of the Variance, for a wet weather event which results in a CSO discharge or City of Somerville wet weather SSO in the Alewife Brook/Upper Mystic River Basin, the City of Somerville shall, within 30 days of such request, provide a summary and interpretation of the following data for the storm event:

- a. Hourly rain gauge data (location, depth, peak intensity) and estimate of storm recurrence interval;
- b. CSO/SSO event estimated or verified start and stop times;
- c. Meter data, in 15-minute increments from 24 hours prior to the CSO/SSO event, extending to 24 hours following cessation of the CSO/SSO event;
- d. Figures that depict the metered catchment areas with appropriate labels (e.g., streets, waterbodies, etc.); and
- e. A description of any flow restrictions in downstream collection system facilities which affected the CSO/SSO event.

Collection of such data will allow for more refined understanding of CSO events and therefore more targeted and effective future CSO abatement measures.

2. Evaluation of Floatables Control

By October 1, 2025, complete an evaluation of floatables control for each of the City of Somerville's outfalls that discharges to Alewife Brook or the Upper Mystic River and submit a written report to MassDEP. The evaluation shall assess the effectiveness of the current controls and identify recommendations for improvements. The City of Somerville shall implement the recommendations identified by the evaluation.

3. Evaluation of Odors

By June 1, 2025, 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. The City of Somerville shall implement the most feasible BMPs identified by the evaluation.

4. Implement the following projects during the term of the Variance, in accordance with the project description:

Project Name	Potentially Impacted Outfall(s)/Regulator(s)	Project Description
Spring Hill Sewer Separation Phase 1	SOM009(internal regulator), Prison Point, CAM017, MWR018, MWR019, MWR020; Somerville Marginal Facility	Project includes separation of approximately 65 acres of Combined Sewer with stormwater directed to the Somerville Ave Utility and Surface Improvements (SAUSI) and ultimately Poplar St. Pump Station. Anticipated date of substantial completion: Summer 2025
Poplar St Pump Station	SOM009(internal regulator), Prison Point, CAM017, MWR018, MWR019, MWR020; Somerville Marginal Facility	Stormwater pump station with a 4 MG stormwater storage tank and up to 50 MGD pumping capacity. Separated stormwater received from Union Square and Spring Hill and discharges through MBTA's stormwater system to Millers River/Charles River. Anticipated date of substantial completion: Fall 2026

At the same time the City of Somerville submits the Annual CSO Discharge Reports required by C.2.(i), the City of Somerville shall submit a report describing progress on each project.

EXHIBIT D

Long Term Control Plan Levels of Control from Second Stipulation

CSO OUTFALL	LONG TERM CONTROL PLAN	
	TYPICAL YEAR	
	Activation Frequency	Volume (MG)
ALEWIFE BROOK		
CAM001	5	0.19
CAM002	4	0.69
MWR003	5	0.98
CAM004	To be closed	N/A
CAM400	To be closed	N/A
CAM401A	5	1.61
CAM401B	7	2.15
SOM001A	3	1.67
SOM001	Closed	N/A
SOM002A	Closed	N/A
SOM003	Closed	N/A
SOM004	Closed	N/A
TOTAL		7.29
UPPER MYSTIC RIVER		
SOM007A/MWR205A (Somerville Marginal)	3	3.48
SOM007	Closed	N/A
TOTAL		3.48

APPENDIX C

SeeClickFix Odor Complaints



PUBLIC WORKS
CATCHBASIN DEODORIZER TASKS
4/6/2025

