
# City of Somerville Final Illicit Discharge Detection and Elimination (IDDE) Plan

Updated September 2022

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# Revisions

| Revision Date | Description |
|---|---|
| June 2020 | Preliminary IDDE Plan |
| December 2021 | Final IDDE Plan |
| September 2022 | IDDE Plan Update (current) |
| | |

# List of Acronyms

| Abbreviation | Definition |
|---|---|
| 2016 MS4 Permit | 2016 General Permit for Stormwater Discharges from Small Municipal Separate Storm Sewer System in Massachusetts |
| COC | Chain-of-Custody |
| CSO | Combined Sewer Overflow |
| DCR | Department of Conservation and Recreation |
| EPA | United States Environmental Protection Agency |
| GIS | Geographic Information System |
| IAM | Department of Infrastructure and Asset Management |
| IDDE | Illicit Discharge Detection and Elimination |
| MassDEP | Massachusetts Department of Environmental Protection |
| MassDOT | Massachusetts Department of Transportation |
| MS4 | Municipal Separate Storm Sewer System |
| NPDES | National Pollution Discharge Elimination System |
| SSO | Sanitary Sewer Overflow |

# 1. Introduction

This Illicit Discharge Detection and Elimination (IDDE) Plan has been developed by the City of Somerville to address the requirements of the United States Environmental Protection Agency's (EPA's) National Pollution Discharge Elimination System (NPDES) 2016 General Permit for Stormwater Discharges from Small Municipal Separate Storm Sewer System in Massachusetts (2016 MS4 Permit), Permit ID# MAR041082 and Administrative Compliance Order (AO), Docket # CWA-AO-R01-FY19-27.

The 2016 MS4 Permit requires that the City implement the following six minimum control measures:

1. Public Education and Outreach
2. Public Involvement and Participation
3. Illicit Discharge Detection and Elimination Program
4. Construction Site Stormwater Runoff Control
5. Stormwater Management in New Development and Redevelopment (Post Construction Stormwater Management)
6. Good House Keeping and Pollution Prevention for Permittee Owned Operations

Under minimum control measure 3, the City is required to implement an IDDE program to systematically find and eliminate sources of non-stormwater to its MS4 area and implement procedures to prevent such discharges.

## 1.1 Illicit Discharge Definition

The 2016 MS4 Permit defines an illicit discharge as "any discharge to a municipal separate storm sewer that is not composed entirely of stormwater except discharges pursuant to a NPDES permit (other than the NPDES permit for discharges from the municipal separate storm sewer) and discharges resulting from fire fighting activities."

An illicit discharge can be caused by either a direct or indirect connection into a drainage system and an intentional or unintentional action. A direct connection is a physical tie-in to a drainage system such as a cross-connection of a sewer service to a storm drain line. An indirect connection can be more difficult to identify. Examples of indirect connections include runoff from a commercial vehicle washing operation, the improper use of a sump pump, or seepage of contaminated groundwater into a drain line.

Some illicit discharges are intentional, such as dumping used oil (or other pollutant) into catch basins, a resident or contractor illegally tapping a new sewer lateral into a storm drain pipe to avoid the costs of a sewer connection fee and service, and illegal dumping of yard wastes into surface waters. Some illicit discharges are related to the unsuitability of original infrastructure to the modern regulatory environment. Examples of illicit discharges in this category include connected floor drains in old buildings, as well as sanitary sewer overflows (SSOs) that enter the drainage system. Sump pumps legally connected to the storm drain system may be used inappropriately, such as for the disposal of floor washwater or old household products. In many cases such inappropriate use is due to a lack of understanding on the part of the homeowner. Elimination of some discharges may require substantial costs and efforts, such as funding

and designing a project to reconnect sanitary sewer laterals. Others, such as improving self-policing of dog waste management, can be accomplished by outreach in conjunction with the installation of dog waste bins. Regardless of the intention, when not addressed, illicit discharges can contribute high levels of pollutants, such as heavy metals, toxics, oil, grease, solvents, nutrients, and pathogens to surface waters.

### 1.1.1 Allowable Non-Stormwater Discharges

The 2016 MS4 Permit defines the following categories as allowable non-stormwater discharges. If the EPA or Massachusetts Department of Environmental Protection (MassDEP) identify any category or individual discharge as a contributor of pollutants to the MS4, that discharge will be deemed an illicit discharge.

- Water line flushing
- Landscape irrigation
- Diverted stream flows
- Rising ground water
- Uncontaminated ground water infiltration (as defined at 40 CFR § 35.2005(20))
- Uncontaminated pumped ground water
- Discharge from potable water sources
- Foundation drains
- Residential building wash waters without detergents
- Air conditioning condensation
- Irrigation water, springs
- Water from crawl space pumps
- Footing drains
- Lawn watering
- Individual resident, non-commercial car washing
- Flows from riparian habitats and wetlands
- De-chlorinated swimming pool discharges
- Street wash waters

## 1.2 Receiving Waters

**Table 1-1** is a summary of the impaired waters within the City of Somerville that receive stormwater discharges from the MS4, based on the 2016 Massachusetts Integrated List of Waters from MassDEP. The MS4 Permit defines an impaired water as a waterbody that "does not meet one or more of its designated use(s)." A map of the City of Somerville MS4 area and receiving waters is included in **Appendix A**.

**Table 1-1: Impaired Receiving Waters**

| Outfall ID | Segment ID | Receiving Water | Impairment (2018/2020 List) | Monitoring Parameter (Appendix G, 2016 MS4 Permit) |
|---|---|---|---|---|
| 4 | MA71-20 (updated from MA71-04 based on 2018/2020 Impairment List) | Alewife Brook | Debris* | No Monitoring Requirement |
| | | | Chloride | Chloride |
| | | | Water Chestnut | No Monitoring Requirement |
| 6 | | | Trash* | No Monitoring Requirement |
| 7 | | | Copper in Sediment | Copper, Total |
| | | | Dissolved Oxygen | Dissolved Oxygen, Temperature, BOD5, Total Phosphorus |
| 8 | | | E. Coli | E. Coli |
| | | | Flocculant Masses | Contact MassDEP |
| 9 | | | Lead in Sediment | Lead, Total |
| | | | Odor | No Monitoring Requirement |
| 10 | | | Oil and Grease | Oil and Grease |
| | | | PCBs in Fish Tissue | No Monitoring Requirement |
| 11 | | | Phosphorus (Total) | Phosphorus, Total |
| | | | Scum/Foam | Contact MassDEP |
| | | | Sediment Bioassay (chronic Toxicity fresh water) | Contact MassDEP |
| | | | Transparency/Clarity | TSS |
| 12 | MA71-02 | Mystic River | Fish Passage Barrier* | No Monitoring Requirement |
| | | | Eurasian Water Milfoil, Myriophyllum Spicatum | No Monitoring Requirement |
| | | | Non-Native Aquatic Plants* | No Monitoring Requirement |
| 19 | | | Water Chestnut | No Monitoring Requirement |
| | | | Arsenic | Arsenic, Total |
| 21 | | | Chlordane in Fish Tissue | No Monitoring Requirement |
| | | | Chlorophyll-a | Total Phosphorus |
| 25 | | | DDT in Fish Tissue | No Monitoring Requirement |
| | | | Dissolved Oxygen | Dissolved Oxygen, |
| 26 | | | Dissolved Oxygen Supersaturation | Dissolved Oxygen, Temperature, BOD5, Total Phosphorus |
| 28 | | | E. Coli | E. Coli |
| | | | PCBs in Fish Tissue | No Monitoring Requirement |
| 29 | | | pH, High | pH |
| | | | Phosphorus (Total) | Phosphorus, Total |
| 31[1] | | | Sediment Bioassay (chronic Toxicity fresh water) | Contact MassDEP |
| | | | Transparency/Clarity | TSS |
| 32 | MA71-03 | Mystic River | Ammonia (Un-ionized) | Ammonia - Nitrogen |
| | | | Cause Unknown (Contaminants in Fish and/or Shellfish; Sediment Screening Value(Exceedance)) | No Monitoring Requirement |
| | | | Dissolved Oxygen | Dissolved Oxygen, Temperature, BOD5, Total Phosphorus |
| | | | Fecal Coliform | Fecal Coliform |
| | | | Flocculant Masses | Contact MassDEP |
| | | | Nutrient/Eutrophication Biological Indicators | Total Phosphorus |
| | | | Odor | No Monitoring Requirement |
| | | | Oil and Grease | Oil and Grease |
| | | | PCBs in Fish Tissue | No Monitoring Requirement |
| | | | Petroleum Hydrocarbons, Scum/Foam | Oil and Grease |
| | | | Scum/Foam | Contact MassDEP |

[1] Interconnection with City of Medford

## 1.3 IDDE Program Goals and Timeline

The purpose of the IDDE program is to set up a framework for the detection and elimination of illicit discharges within the City of Somerville's MS4 and outline procedures to prevent such connections in the future. The major components of this program are summarized below.

- Legal authority
- Stormwater system mapping
- Inventory and ranking of outfalls
- Dry weather outfall screening and sampling
- Catchment investigations
- Identification and confirmation of illicit sources
- Illicit discharge removal
- Follow up screening
- Employee training.

A preliminary timeline of program implementation is outlined in **Table 1-2**.

**Table 1-2: IDDE Program Implementation Schedule**

| Milestone | 2016 MS4 Permit or AO Deadlines | Completed |
|---|---|---|
| Perform Training for City of Somerville Staff | Annual | On Going |
| Implement IDDE Ordinance | June 2020 | May 2020 |
| Submit Preliminary IDDE Plan to Regulatory Agencies | June 2020 | June 2020 |
| Phase I Mapping | June 2020 | June 2020 |
| Perform Dry Weather Outfall Screening and Sampling | June 2021 | October 2020 |
| Update Outfall Ranking | June 2021 | June 2021 |
| Perform Catchment Investigations for Problem Outfalls | June 2025 | May 2021 |
| Perform Wet Weather Outfall Screening and Sampling | June 2028 | August 2021 |
| Perform Catchment Investigations for Remaining Outfalls | June 2028 | In Progress |
| Phase II Mapping | June 2028 | In Progress |
| Submit Final IDDE Plan to Regulatory Agencies[1] | December 2021 | December 2021 |

[1] This written IDDE Program Plan must be updated in accordance with milestones of the permit (year 7, and year 10)

# 2. Authority and Statement of IDDE Responsibilities

## 2.1 Legal Authority

The City of Somerville has adopted Ordinance 2020-11, dated May 14, 2020. A copy of Ordinance 2020-11 is provided in **Appendix B**. The ordinance grants the City of Somerville adequate legal authority as required per the 2016 MS4 Permit. The ordinance prohibits illicit connections and unauthorized discharges to the MS4 and establishes enforcement authority.

## 2.2 Statement of Responsibilities

The Department of Infrastructure and Asset Management (IAM) is the lead municipal department responsible for implementing and documenting efforts associated with the IDDE program for the City of Somerville. The Engineering Division of the IAM Department will be responsible for the day-to day implementation, supervision, and reporting of the IDDE program. The Stormwater Program Manager in the Engineering Division is responsible for the coordination of all the work needed to implement the IDDE program. Other departments or divisions with responsibility for aspects of the program include:

- Water and Sewer Department – operation, inspection, maintenance, and repairs to the City's MS4; notification of SSOs; potential use of hydrants during dye testing
- Inspectoral Services Department – enforcement of State plumbing code
- Law Department - ordinance and drainage use regulations
- Parking Department – no parking signs for manhole inspections
- Somerville Police Department – police details

The 311 Service Center is a tool available to residents and can be used to report potential illicit connections. This service is available 24/7 by phone at 311 (617-666-3311 outside Somerville), on the City's website (https://www.somervillema.gov/311), or email (311updates@somervillema.gov).

# 3. Stormwater Mapping and Delineation

A preliminary delineation of tributary areas to each MS4 outfall was performed in June 2020, in order to assist in identifying sources of illicit discharges to the City of Somerville's municipal separate storm sewer system (MS4). The delineation was performed using the City's geographic information system (GIS) data as an initial desktop analysis. As the City continues to develop and implement this IDDE program as required in the 2016 MS4 Permit and AO, the delineation will be updated based on field investigations and other data to be collected.

The 2016 MS4 Permit requires the storm system map to be updated in two phases as outlined below. The City has already completed all Phase I and Phase II mapping requirements. The DPW is responsible for continuing to update the stormwater system mapping based on information collected during the permit term. The City will report on the progress of updates to the storm system map in each annual report. Updates to the stormwater mapping will be included in **Appendix A**.

## 3.1 Phase I

The Phase I system map has been completed as required in the 2016 MS4 Permit (see **Appendix A**) and includes the following elements:

- Outfalls and receiving waters (previously required by the MS4-2003 permit)
- Open channel conveyances (swales, ditches, etc.)
- Interconnections with other MS4s and other storm sewer systems
- Municipally-owned stormwater treatment structures
- Waterbodies identified by name and indication of all use impairments as identified on the most recent EPA approved Massachusetts Integrated List of Waters report
- Initial catchment delineations.

### 3.1.1 Catchment Delineation

An initial catchment delineation was completed in June 2020. By delineating the areas that are tributary to the MS4 and associating those areas with an MS4 outfall, the City of Somerville can develop plans to identify sources of illicit discharges within the delineated drainage areas when issues are observed at the outfalls. The preliminary delineation was completed using the City of Somerville's existing sewer and drain system GIS data. The purpose of this section is to describe the methodology used to complete the preliminary delineation.

GIS layers that were used in the delineation include storm discharge points (outfalls), stormwater and sewer piping, manholes, and catch basins.

The delineation was performed according to the following process:

1. Identification of all stormwater outfalls in GIS. Outfalls were identified from the "storm discharge point" GIS layer, and labeled with the "facility ID" contained in the attributes.

2. Starting at the drain outfalls, stormwater gravity main piping was traced upstream to determine the mapped extent of the separate drain system.

3. If a connection between the stormwater and combined sewer system was identified, the downstream outfall (CSO) and tributary pipe network was not included in the delineation (since the combined sewer system is not included in the IDDE program).

4. A drainage area boundary was drawn around the stormwater pipe network tributary to each stormwater outfall. The drainage area boundary was drawn by considering the placement of drainage infrastructure (as indicated by GIS), topography, natural boundaries (such as open water, wooded/grassed area, etc.), and artificial boundaries (street, buildings, and other infrastructure).

The delineation only includes storm drainage networks that terminate with a defined/permitted outfall along the Mystic River or Alewife Brook, or that connect to another municipal system (Medford). As such, various storm drainage networks that do not terminate at a defined outfall/municipal connection were not included in the initial delineation. Field investigations may confirm that these isolated networks do not currently terminate at a defined outfall. If it is found that these networks terminate at an outfall (stormwater discharge point), they will be included in the updates to the catchment delineations.

As of September 2022, the catchment delineations have been updated. The updated delineations are included in this updated IDDE Plan System Map in **Appendix A**. As the IDDE program is further developed and implemented, the drainage area delineation will be updated based on the results of field investigations. Field investigations will verify pipe connectivity (as currently shown in GIS) and be used to refine drainage area boundaries. Field investigation procedures and work conducted to date are discussed further in **Section 7**.

## 3.2 Phase II

Phase II mapping must be completed within ten (10) years of the effective date of the 2016 MS4 Permit (July 1, 2028) and include the following elements (in addition to the elements already included in Phase I mapping):

- Outfall spatial location (latitude and longitude with a minimum accuracy of +/-30 feet)
- Pipes
- Manholes
- Catch basins
- Refined catchment delineations. Catchment delineations shall be updated to reflect information collected during catchment investigations
- Municipal sanitary sewer system
- Municipal combined sewer system

The City stated making updates to its stormwater mapping to meet the Phase II requirements, as reflected in **Appendix A**. The City will continue to update its stormwater mapping to include updates to stormwater infrastructure and further refined catchment delineations based on information collected during future catchment investigations.

## 3.3 Additional Recommended Mapping Elements

Although not required in the 2016 MS4 Permit, additional recommended items will be included in the MS4 system map as information becomes available:

- Storm sewer material, size, and age
- Sanitary sewer system material, size, and age
- Privately-owned stormwater treatment structures
- Seasonal high water table elevations impacting sanitary alignments
- Topography
- Orthophotography
- Alignments, dates and representation of work completed (with legend) of past illicit discharge investigations (e.g., flow isolation, dye testing, CCTV)
- Locations of suspected, confirmed and resolved illicit discharges

# 4. Sanitary Sewer Overflows

The 2016 MS4 Permit requires municipalities to prohibit illicit discharges, including sanitary sewer overflows (SSOs), to the separate storm drain system. A sanitary sewer overflow (SSO) is the discharge of untreated wastewater from a sanitary sewer to a separate storm sewer system or surface water due to something other than a direct physical connection. SSOs can be caused by blockages, pipe breaks, or system capacity limitations.

The City of Somerville has compiled a list of the SSOs that have discharged to the MS4 within the five years prior to the issuance of the 2016 MS4 Permit based on available records. The SSO inventory is included in **Table 4-1.**

Upon detection of an SSO, the City will eliminate it as expeditiously as possible and take interim measures to minimize the discharge of pollutants to and from its MS4 until the SSO is eliminated. Upon becoming aware of an SSO to the MS4, the City will provide oral notice to EPA, MassDEP, and others as applicable within 24 hours, and written notice to EPA and MassDEP within five (5) days of becoming aware of the SSO occurrence.

**Report SSOs by Phone withing 24 hours (Oral Notice)**

| Agency | Contact | Requirements |
|---|---|---|
| MassDEP | During Business Hours: (978) 694-3215, or 24-Hour Emergency Line: (888) 304-1133 | Report all SSO events |
| EPA | EPA New England: (617) 918-1510, or Northeast Region, Douglas Koopman (617) 918-1747 | Report all SSO events |
| Local Board of Health | Somerville Health and Human Services Department: (617) 625 - 6600 | Report all SSO events where impacts may occur |
| Department of Conservation and Recreation | State House Ranger Base: (617) 722-1188 | Where DCR beaches or parks are affected |
| MA Division of Marine Fisheries | Boston/Northeast: (617) 727-3336 x 165 | Where shellfish resources may be affected |
| Somerville Water and Sewer Department | Drinking Water System Primary Operator: internal communication | Where drinking water distribution system may be affected |

How to submit a written notice within five (5) calendar days:

- Complete MassDEP Sanitary Sewer Overflow (SSO)/Bypass notification form (**Appendix C**)
- Send Notification Form by Fax:
    - Massachusetts Department of Environmental Protection, Northeast Regional Office, 205B Lowell Street, Wilmington, MA 01887. **Fax: 978-694-3499**, and
    - US EPA Water Technical Unit (OES 04-4), 5 Post Office Square, Suite 100, Boston, MA 02109-3912. Attn: Douglas Koopman. **Fax: 617-918-0747**.

**Table 4-1: Sanitary Sewer Overflow 5-Year Inventory (as of September 2022)**

| SSO Location | Discharge Statement | Date | Time Start | Time End | Estimated Volume | Description | Mitigation Completed | Mitigation Planned |
|---|---|---|---|---|---|---|---|---|
| 570 Somerville Ave (Conway Rink aka Veterans Memorial Skating Rink)[1] | Unknown | 1/16/2018 | 2:00 PM | 3:00 PM | 45 gallons | Frozen force main at pump station. | Yes | Thawing via steam injection |
| 311 Medford Street | From sanitary sewer MH to ground surface | 4/12/2022 | 11:00 AM | 12:00 PM | 109 gallons | Sewer system blockage | Yes | Jetted main to release blockage and cleaned area |

[1]SSO was caused by force main service connection that is owned by the City of Somerville.

# 5. Prioritization of Outfalls

In order to guide IDDE investigations, the City of Somerville's MS4 outfalls are prioritized in terms of their illicit discharge potential. The prioritization/ranking of outfalls considers several factors, including the location of the outfall, potential to impact public health, and drainage area characteristics. As IDDE investigations are implemented, and as the City of Somerville refines its understanding of the MS4 and separated stormwater drainage areas, this ranking will continue to be revised and updated.

## 5.1 Ranking and Prioritization

Using the scoring system described in Section 5.2, an updated ranking of outfalls/tributary areas was developed to inform IDDE field investigations. The data used to develop this ranking is both "desktop level" (not field verified) and information gathered from field investigations completed to date. As additional evidence of illicit discharges is discovered (sampling, visual evidence, odor complaints, etc.), the information will be incorporated and used to revise the ranking.

Outfalls are identified by the Facility ID contained in the City's GIS database. The "Score" column contains the raw score each outfall received by summing the score for each criterion. The "Ranking" column ranks each outfall by its raw score relative to all other outfalls. The "Category" column describes the resulting prioritization of each outfall. An outfall was grouped into one of three priorities as described below:

- **Problem** – Outfalls/interconnections with known or suspected contributions of illicit discharges based on existing information shall be designated as Problem Outfalls. This shall include any outfalls/interconnections where previous screening indicates likely sewer input. Likely sewer input indicators are any of the following:
    - Olfactory or visual evidence of sewage,
    - Ammonia ≥ 0.5 mg/L, surfactants ≥ 0.25 mg/L, and bacteria levels greater than the water quality criteria applicable to the receiving water, or
    - Ammonia ≥ 0.5 mg/L, surfactants ≥ 0.25 mg/L, and detectable levels of chlorine.

  Dry weather screening and sampling, as described in Section 0 of this IDDE Plan and Part 2.3.4.7.b of the 2016 MS4 Permit, is not required for Problem Outfalls.
- **High Priority –** Outfalls/interconnections that have not been classified as Problem Outfalls and that are:
    - Discharging to an area of concern to public health due to proximity of public beaches, recreational areas, drinking water supplies or shellfish beds.
    - Determined by the permittee as high priority based on the characteristics listed below or other available information.

- **Low Priority –** Outfalls/interconnections determined by the permittee as low priority based on the characteristics listed below or other available information.
- **Excluded** - Outfalls/interconnections with no potential for illicit discharges may be excluded from the IDDE program.

## 5.2 Prioritization Methodology

A numerical scoring system was developed to inform the initial outfall prioritization. This scoring system was developed to account for downstream impacts (in/around receiving waters) and upstream drainage area characteristics that could impact the probability of illicit discharges occurring. The following criteria were used to update the priority ranking of outfalls:

- **Previous screening results** – previous screening/sampling results indicate likely sewer input
- **Discharge to area of public health concern –** outfalls/interconnections that discharge to or in the vicinity of the following areas:
    - Public beaches
    - Recreational areas
    - Drinking water supplies
    - Shellfish beds
- **Past discharge complaints and reports.**
- **Poor receiving water quality** – the following guidelines are recommended to identify waters as having a high illicit discharge potential:
    - exceeding water quality standards for bacteria;
    - ammonia levels above 0.5 mg/l;
    - surfactants levels greater than or equal to 0.25 mg/l;
    - impaired waters list.
- **Density of generating sites** – Generating sites are those places, including institutional, municipal, commercial, or industrial sites, with a potential to generate pollutants that could contribute to illicit discharges. Examples of these sites include, but are not limited to, car dealers; car washes; gas stations; garden centers; and industrial manufacturing areas.
- **Age of development and infrastructure** – Industrial areas greater than 40 years old and areas where the sanitary sewer system is more than 40 years old will probably have a high illicit discharge potential. Developments 20 years or newer are more likely to have a low illicit discharge potential.

- **Historic combined sewer**– contributing areas that were once serviced by a combined sewer but have been separated or converted to sewer connections may have a high illicit discharge potential.
- **Extended stream culverts** – any river or stream that is conveyed underground for distances greater than a simple roadway crossing may have a high illicit discharge potential.
- **Water quality limited waterbodies** – receive a discharge from the MS4 or waters with approved TMDLs applicable to the permittee, where illicit discharges have the potential to contain the pollutant identified as the cause of the water quality impairment.

**Table 5-1** is a summary of the scoring methodology used in the ranking of outfalls. A higher score corresponds with a higher probability of an outfall/tributary area having an illicit discharge and with a greater risk of negative public health impacts.

The initial ranking was used to inform preliminary field investigation efforts. A revised ranking has been completed to reflect information gathered during dry weather outfall screening and sampling conducted in October 2020 and catchment investigations conducted during Spring 2021. As system connectivity is better understood, the ranking will continue to be revised based on drainage areas modifications. **Table 5-2** contains the raw scoring and ranking of each outfall/tributary area.

**Table 5-1: Outfall Ranking and Prioritization Scoring**

| Criteria | Information Source | Scoring Criteria |
|---|---|---|
| Previous Screening Results Indicate Likely Sewer Input? | Outfall inspections and sample results | Yes = 1 (auto Problem)<br>No = 0 |
| Discharging to Area of Concern to Public Health? | GIS Maps | Yes = 1<br>No = 0 |
| Frequency of Past Discharge Complaints | City Staff | More than 5 discharge complaints= 3<br>1 to 4 discharge complaints = 2<br>No discharge complaints = 0 |
| Receiving Water Quality | Impaired Waters List | Yes = 1 (auto High)<br>No = 0 |
| Density of Generating Sites | Land Use/GIS Maps, Aerial Photography | Industrial = 3<br>Commercial = 2<br>Residential = 1 |
| Age of Development/ Infrastructure | Land Use Information, Visual Observation | Age over 40 years = 3<br>Age between 20 and 40 years = 2<br>Age under 20 years = 1<br>Insufficient Information = 0 |
| Historic Combined Sewers? | City Staff, GIS Maps | Yes = 1<br>No = 0 |
| Culverted Streams | Land Use, City Staff | Yes = 1<br>No = 0 |

**Table 5-2: MS4 Outfall Ranking**

| Outfall ID | Receiving Water | Segment ID | Previous Screening Results Indicate Likely Sewer Input? | Discharging to Area of Concern to Public Health? | Frequency of Past Discharge Complaints | Receiving Water Quality | Density of Generating Sites | Age of Development/ Infrastructure | Historic Combined Sewers? | Culverted Streams | Total Outfall Score | Priority Ranking |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 31 (Interconnection with City of Medford) | Mystic River | MA71-02 | 1 | 1 | 0 | 1 | 2 | 3 | 1 | 0 | 9 | Problem Outfall |
| 28 | Mystic River | MA71-02 | 1 | 1 | 0 | 1 | 1 | 3 | 1 | 0 | 8 | Problem Outfall |
| 25 | Mystic River | MA71-02 | 1 | 1 | 0 | 1 | 2 | 0 | 1 | 0 | 6 | Problem Outfall |
| 32 | Mystic River | MA71-03 | 1 | 1 | 0 | 1 | 2 | 0 | 1 | 0 | 6 | Problem Outfall |
| 7 | Alewife Brook | MA71-20 | 0 | 1 | 0 | 1 | 2 | 3 | 1 | 0 | 8 | High Priority |
| 10 | Alewife Brook | MA71-20 | 0 | 1 | 0 | 1 | 1 | 3 | 1 | 0 | 7 | High Priority |
| 19 | Mystic River | MA71-02 | 0 | 1 | 0 | 1 | 2 | 3 | 0 | 0 | 7 | High Priority |
| 26 | Mystic River | MA71-02 | 0 | 1 | 0 | 1 | 1 | 3 | 1 | 0 | 7 | High Priority |
| 29 | Mystic River | MA71-02 | 0 | 1 | 0 | 1 | 1 | 3 | 1 | 0 | 7 | High Priority |
| 4 | Alewife Brook | MA71-20 | 0 | 1 | 0 | 1 | 1 | 3 | 0 | 0 | 6 | High Priority |
| 8 | Alewife Brook | MA71-20 | 0 | 1 | 0 | 1 | 1 | 3 | 0 | 0 | 6 | High Priority |
| 9 | Alewife Brook | MA71-20 | 0 | 1 | 0 | 1 | 1 | 3 | 0 | 0 | 6 | High Priority |
| 11 | Alewife Brook | MA71-20 | 0 | 1 | 0 | 1 | 1 | 3 | 0 | 0 | 6 | High Priority |
| 21 | Mystic River | MA71-02 | 0 | 1 | 0 | 1 | 1 | 3 | 0 | 0 | 6 | High Priority |
| 6 | Alewife Brook | MA71-20 | 0 | 1 | 0 | 1 | 0 | 3 | 0 | 0 | 5 | High Priority |
| 12 | Mystic River | MA71-02 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 3 | High Priority |

# 6. Dry Weather Outfall Screening and Sampling

Dry weather sampling is an important tool in illicit discharge detection within an MS4, as the presence of flow in the stormwater system at a time when it is not raining may indicate an illicit discharge. This section summarizes the general sampling procedure and analysis of results for dry weather outfall screening.

## 6.1 Weather Conditions

Dry weather screening and sampling will only proceed when no more than 0.1 inches of rainfall have occurred in the previous 24-hour period and no significant snowmelt is occurring as required in the 2016 General Permit. Weather station Boston, MA US (Station ID: GHCND:USW00014739) located at Boston Logan International Airport will be used as the primary source for precipitation data to determine dry weather conditions. If current weather data from Boston, MA US is unavailable, weather station Jamaica Plain, MA US (Station ID: GHCND:USC00193890) located at the Arnold Arboretum will be used as a back-up.

## 6.2 Dry Weather Screening and Sampling Procedure

### 6.2.1 Sampling Procedure

The dry weather outfall inspection and sampling procedure will be consistent with the AO and EPA's *Draft Bacterial Source Tracking Protocol (2012)* and will consist of the following general steps:

1. Identify outfall(s) to be screened/sampled based on initial outfall inventory and priority ranking
2. Acquire the necessary staff, mapping, and field equipment (see **Table 6-1** for list of potential field equipment).
3. Conduct the outfall inspection during dry weather.
4. Photograph the outfall
5. Record the inspection information and outfall characteristics (digital form using a tablet or similar device)
6. Look for and record visual/olfactory evidence of pollutants in flowing outfalls including odor, color, turbidity, and floatable matter (suds, bubbles, excrement, toilet paper or sanitary products). Also observe outfalls for deposits and stains, vegetation, and damage to outfall structures.
7. If flow is observed, sample and test the flow following the procedures described in the following sections.
8. If no flow is observed, but evidence of illicit flow exists (illicit discharges are often intermittent or transitory), revisit the outfall during dry weather within one week of the initial observation, if practicable, to perform a second dry weather screening and sample any observed flow. Other techniques can be used to detect intermittent or transitory flows including conducting inspections during evenings or weekends and using optical brighteners.

9. Input results from screening and sampling into spreadsheet/database. Include pertinent information in the outfall/interconnection inventory and priority ranking.
10. Include all screening data in the annual report.

### 6.2.2 Field Equipment

**Table 6-1** is a summary of the field equipment to be used during IDDE investigations.

**Table 6-1: Field Equipment – Dry and Wet Weather Outfall Screening and Sampling**

| Equipment | Use/Notes |
|---|---|
| Clipboard | For organization of field sheets and writing surface. |
| Field log books | For documentation/note taking. |
| Field Sheets (if not using tablet/phone) | Field sheets for both dry weather inspection and dry weather sampling should be available with extras. |
| Laboratory Specific Chain of Custody Forms | To ensure proper handling of all samples. |
| Pens/Pencils/Permanent Markers | For proper labeling and notes. |
| Nitrile Gloves | To protect the sampler as well as the sample from contamination. |
| Flashlight/headlamp w/batteries | For looking in outfalls or manholes, helpful in early mornings as well. |
| Cooler with Ice and/or Cold Packs | For transporting samples to the laboratory. |
| Mobile data collector (phone or tablet) | For collecting dry weather screening and sampling results. |
| Digital Camera (or phone) | For documenting field conditions at time of inspection. |
| Personal Protective Equipment (PPE) | Reflective vest, safety glasses and boots at a minimum. |
| Bug Spray | For protection. |
| Poison ivy wash (e.g. Tecnu, Zanfel) | For protection. |
| GPS Receiver (phone/tablet or handheld GPS) | For taking spatial location data. |
| Handheld Water Quality Meter | For sampling specific conductivity, salinity, temperature, and pH. |
| Ammonia test kits (or strips) | For field testing for ammonia. Have extra kits on hand to sample more outfalls than are anticipated to be screened in a single day. |
| Chlorine test kits | For field testing for chlorine. Have extra kits on hand to sample more outfalls than are anticipated to be screened in a single day. |
| Photometer | For chlorine test kit, as needed. |
| Surfactants (MBAS) test kits | For field testing for surfactants. Have extra kits on hand to sample more outfalls than are anticipated to be screened in a single day. |
| Disposal Receptacles | Appropriate containers for disposing of used test kits as well as garbage. |
| Label Tape (or labels provided by laboratory) | For labeling sample containers. |

| Equipment | Use/Notes |
|---|---|
| Sample Containers | Make sure all sample containers are clean.<br>Keep extra sample containers on hand at all times.<br>Make sure there are proper sample containers for what is being sampled for (i.e., bacteria require sterile 120mL containers). |
| Manhole hook | For opening manholes. |
| Pry Bar or Pick | For opening catch basins and manholes, when necessary. |
| Shovel | For opening, propping, prying manholes and catch basins, as necessary. |
| Sandbags | For damming low flows in order to take samples. |
| Small Mallet or Hammer | To helping free stuck manhole and catch basin covers. |
| Utility Knife | Multiple uses. |
| Measuring Tape | Measuring distances and depth of flow. |
| Safety Cones | For safety. |
| Hand Sanitizer | For disinfectant/decontamination. |
| Zip Ties/Duct Tape | For making field repairs. |
| Rubber Boots/Waders | For accessing shallow streams/areas. |
| Paper towels | For cleaning. |
| Distilled water | For rinsing equipment. |
| Sampling Pole/Dipper/Sampling Cage | For accessing hard to reach outfalls and manholes. |

### 6.2.3 Sample Collection and Analysis

The following sampling procedure will be used to acquire samples for in-situ and laboratory testing (for detailed SOPs see **Appendix D**):

1. At least one day prior to sampling, coordinate with appropriate laboratories to schedule the laboratory analysis. This coordination will include estimated time of sample delivery and estimated number of samples expected.
2. Visit the designated locations for outfall screening in a two-person crew.
3. Prior to the start of sampling, create a trip blank by filling a laboratory provided container with clean bottled water. The trip blank will have its own unique label and will be kept in a cooler with all other samples collected during that sampling event.
4. Upon arrival at an approved sampling location, record all pertinent observations in electronic format. Pertinent observations include, but are not limited to: flow velocity, approximate depth of water, water color, odor, observed floatables, and sediment or debris deposits. Fill out a comments field with any observations which cannot adequately be described using predefined categories on the field form.
5. If using laboratory provided bottle labels, fill out all sampling information on bottle labels and field sheets (if not using mobile data collection device). If writing directly on laboratory provided sample bottles, skip to Step 6.
6. Put on protective gloves (nitrile/latex/other) before sampling.

7. Collect sample with dipper or directly in sample containers. If possible, collect water from the center of flow directly in the sample bottle. Be careful not to disturb sediments.
8. For samples requiring laboratory analyses, open a sterile container provided by the laboratory. Use caution to ensure that only the outside of the container and its cap are handled to prevent contamination. Fill the sterile container with the sampled water and then seal. Take care to confirm that the sample container is sealed properly and does not leak. The container will be labeled with a unique identifier, the date and time the sample was taken and the analysis that is required.
9. If a dipper is required, a clean grab container will be placed in the approximate middle of observed flow. After the container has been filled, retrieve and swirl its contents to ensure that all surfaces of the container are covered and rinsed thoroughly and then dumped out downstream of the sampling location. Follow this method for a total of three times, ensuring that the grab container is fully rinsed.
10. Use grab container a fourth time to collect a final sample for analysis.
11. Place laboratory sample containers for bacteria and pollutants of concern into a cooler filled with ice.
12. Fill out chain-of-custody (COC) form for laboratory samples including the unique identifier, date, time, sample matrix, sampler's initials, and required test information. The COC will remain with the samples at all times.
13. Conduct in-situ field tests using the remaining water in the grab container. Use test kits, test strips and field meter (rinse similar to dipper) for most parameters (See **Table 6-2).** All results will be recorded.
14. Samples for laboratory analysis will remain on ice until they are accepted by the laboratory. Samples must be analyzed within specific hold times for each parameter, as specified by the laboratory.
15. Upon completion of all sampling, or portion of sampling as the 8-hour bacteria hold time allows, the samples will be delivered to the laboratory. The samples must be signed over to the laboratory using the COC. Retain a carbon copy of the COC while the original will remain with the samples.
16. Dispose of used test kit ampules properly.
17. Decontaminate all testing personnel and equipment.

In the event that an outfall is submerged, either partially or completely, or inaccessible, field staff will proceed to the first accessible upstream manhole or structure for the observation and sampling and report the location with the screening results. Field staff will continue to the next upstream structure until there is no longer an influence from the receiving water on the visual inspection or sampling.

Field test kits or field instrumentation are permitted for all parameters except indicator bacteria and any pollutants of concern. Field kits need to have appropriate detection limits and ranges. **Table 6-2** lists various field test kits and field instruments that can be used for outfall sampling associated with the 2016 MS4 Permit parameters, other than indicator bacteria and any pollutants of concern. Analytic procedures and user's manuals for field test kits and field instrumentation are provided in **Appendix E**.

**Table 6-2: Sampling Parameters and Analysis Methods**

| Analyte or Parameter | Instrumentation (Portable Meter) | Field Test Kit |
|---|---|---|
| Ammonia | CHEMetrics™ V-2000 Colorimeter<br>Hach™ DR/890 Colorimeter<br><br>Hach™ Pocket Colorimeter™ II | CHEMetrics™ K-1410<br><br>CHEMetrics™ K-1510 (series)<br><br>Hach™ NI-SA<br><br>Hach™ Ammonia Test Strips |
| Surfactants (Detergents) | CHEMetrics™ I-2017 | CHEMetrics™ K-9400 and K-9404 Hach™ DE-2 |
| Chlorine | CHEMetrics™ V-2000, K-2513, I-2001<br><br>Hach™ Pocket Colorimeter™ II | NA |
| Conductivity | CHEMetrics™ I-1200<br>YSI Pro30<br>YSI EC300A<br>Oakton 450<br><br>Oakton PCTSTestr 50 | NA |
| Temperature | YSI Pro30<br>YSI EC300A<br>Oakton 450<br><br>Oakton PCTSTestr 50 | NA |
| Salinity | YSI Pro30<br>YSI EC300A<br>Oakton 450<br><br>Oakton PCTSTestr 50 | NA |
| Indicator Bacteria:<br><br>*E. coli* (freshwater) or Enterococcus (saline water) | EPA certified laboratory procedure (40 CFR § 136) | NA |
| Pollutants of Concern[1] | EPA certified laboratory procedure (40 CFR § 136) | NA |

[1] Where the discharge is directly to impaired waters the sample must be analyzed for the pollutant(s) of concern identified as the cause of the water quality impairment. For this plan, outfalls discharging within 350' of impaired waters segments (as mapped by MassDEP) are considered direct discharges.

Testing for indicator bacteria and any pollutants of concern must be conducted using analytical methods and procedures found in 40 CFR § 136.[1]Samples for laboratory analysis must also be stored and preserved in accordance with procedures found in 40 CFR § 136.

**Table 6-3** lists analytical methods, detection limits, hold times, and preservatives for laboratory analysis of dry weather sampling parameters

**Table 6-3: Required Analytical Methods, Detection Limits, Hold Times, and Preservatives**

| Analyte or Parameter | Analytical Method | Detection Limit | Max. Hold Time | Preservative |
|---|---|---|---|---|
| Ammonia | Direct Nesslerization | 0.05 mg/L | 28 days | Cool ≤6°C, $H_2SO_4$ to pH <2, No preservative required if analyzed immediately |
| Surfactants | Methylene Blue | 0.01 mg/L | 48 hours | Cool ≤6°C |
| Chlorine | DPD | 0.02 mg/L | Analyze within 15 minutes | None Required |
| Temperature | **N/A** | N/A | Immediate | None Required |
| Specific Conductance | **N/A** | 0.2 µs/cm | 28 days | Cool ≤6°C |
| Salinity | **N/A** | N/A | 28 days | Cool ≤6°C |
| Indicator Bacteria:<br>*E. coli*<br><br><br>Enterococcus | *E. coli*<br>**EPA**: 1603<br>**SM**: 9221B, 9221F, 9223 B<br>**Other**: Colilert®, Colilert-18®<br>*Enterococcus*<br>**EPA**: 1600<br>**SM**: 9230 C<br>**Other**: Enterolert® | *E. coli*<br>**EPA**: 1 cfu/100mL<br>**SM**: 2 MPN/100mL<br>**Other**: 1 MPN/100mL<br>*Enterococcus*<br>**EPA**: 1 cfu/100mL<br>**SM**: 1 MPN/100mL<br>**Other**: 1 MPN/100mL | 8 hours | Cool ≤10°C, 0.0008% $Na_2S_2O_3$ |
| Total Phosphorus | **EPA**: Manual-365.3, Automated Ascorbic acid digestion-365.1 Rev. 2, ICP/AES4-200.7 Rev. 4.4<br><br>**SM**: 4500-P E-F | **EPA**: 0.01 mg/L<br>**SM** : 0.01 mg/L | 28 days | Cool ≤6°C, $H_2SO_4$ to pH <2 |
| Total Nitrogen* | **EPA**: Cadmium reduction (automated)-353.2 Rev. 2.0, **SM**: 4500-$NO_3$ E-F | **EPA**: 0.05 mg/L<br>**SM**: 0.05 mg/L | 28 days | Cool ≤6°C, $H_2SO_4$ to pH <2 |

SM = Standard Methods
* Ammonia + Nitrate/Nitrite, methods are for Nitrate-Nitrite and need to be combined with Ammonia listed above.

[1] 40 CFR § 136: http://www.ecfr.gov/cgi-bin/text-idx?SID=b3b41fdea0b7b0b8cd6c4304d86271b7&mc=true&node=pt40.25.136&rgn=div5

Documents and Records:

Data quality objectives are as follows:

- Data must have sufficient detail in order to assess water quality at each of the sampling locations.
- Data should be representative of the actual conditions at the sampling location.
- Data should be generated through accepted sampling methodologies.
- Data must be duplicable and accurate.

*Precision:* Precision is the ability of a measurement to be consistently reproduced. The overall sampling precision will be determined by the collection and analysis of field duplicate samples that are not identified as such to the analytical laboratory. Duplicate samples will be taken every tenth sample at the same time as the parent sample and will be assigned a unique identifier. Due to the living nature of bacteria, they may reproduce and die after sample collection. With this in mind, a degree of disparity between the duplicate sample and the original sample is expected and is not necessarily reflective of sample collection or laboratory error.

*Accuracy:* Accuracy is the degree to which the result of a measurement, calculation, or specification conforms to its "true" value. In order to provide sufficient accuracy, minimization of false positive and false negative analytical data is attempted. The potential for false positive data values will be assessed through the analysis of laboratory blanks. All sample events will be analyzed with a laboratory blank. Blank samples must have results of less than the method detection limit (MDL) or instrument detection limit. Laboratory control samples and calibration standards will be used by the laboratory, as needed.

*Representativeness:* Sample collection is intended to provide data representative of actual conditions at particular sampling locations. To achieve representativeness, sampling is carried out so as to eliminate, as much as possible, the possibility of cross-contamination between the sampled locations and non-sampled locations as well as between multiple sampling locations. However, grab samples are only representative of a snapshot of water quality conditions at a given time. As such, they may not be representative of long-term conditions. Data collected must be evaluated with this limitation in mind.

*Calibration:* The multi-parameter meters will be calibrated in accordance with the manufacturer's specifications.

*Trip Blank:* One blank sample will be collected per trip to the laboratory. Before any samples are taken, a trip blank will be created, using clean water, and will remain in the same cooler as the samples for the duration of their trip to the laboratory.

*QC Criteria*: QC criteria are specified in **Table 6-4**. Data not meeting the criteria will be reviewed by the Sampling Project Manager. Data that does not meet laboratory QA/QC criteria will be flagged by the laboratory.

*Instrument/Equipment Testing and Maintenance*: Sampling supplies will be inspected prior to mobilization to ensure that everything is in good working order and that it is properly calibrated.

The pH, temperature and specific conductivity measurements will be collected using an Oakton Multi-Parameter PCTSTestr 50 Series. See **Appendix E** for calibration procedures.

**Table 6-4 Analytical References and Quality Control Goals**

| Parameter | Lab/Equipment | Reporting Limits | Method | Water Quality Criteria or Guidelines | Precision | Accuracy | Completeness |
|---|---|---|---|---|---|---|---|
| pH | Oakton Multi-Parameter PCTSTestr 50 | 0 - 14 | NA | 6.5 – 8.3 | 0.02 | +/- 0.1 | 90% |
| Temperature | Oakton Multi-Parameter PCTSTestr 50 | 0 – 50 °C | NA | 28.3 | 0.1 °C | +/- 0.5 °C | 90% |
| Specific Conductivity | Oakton Multi-Parameter PCTSTestr 50 | 0 - 1999 µS/cm<br>2.00 to 20.00 mS/cm | NA | NA | 5 µS/cm | +/- 1% F.S. | 90% |
| Salinity | Oakton Multi-Parameter PCTSTestr 50 | 0 – 999 ppm<br>1.00 – 10.00 ppt | NA | NA | 30% RPD | +/- 1% F.S. | 90% |
| Ammonia | CHEMets Kit K-1510 | 0.02 mg/L | NA | 0.5 mg/L | 0.05 mg/L | +/- 20% | 90% |
| Chlorine | CHEMets Kit I-2001 | 0.02 mg/L | NA | NA | 0.02 mg/L | +/- 20% | 90% |
| Surfactants | CHEMets Kit K-9400 | 0.125 mg/L | NA | 0.25 mg/L | 0.125 mg/L | +/- 20% | 90% |
| E. Coli | Laboratory | >10 CFU/ 100 mL | 1603 | 235 CFU/100 mL | 30% RPD | NA | 90% |
| Enterococcus | Laboratory | 10 CFU / 100 mL | 1600 | 104 CFU/100 mL | 30% RPD | NA | 90% |

NA = Not Applicable
CFU = Colony Forming Unit
F.S. = Full scale
mL = Millilieter
mg/L = Milligrams per Liter
NTU = Nephelometric Turbidity Units
RPD = Relative Percent Difference

## 6.3 Dry Weather Sampling Results and Follow-Up

Outfall analytical data from dry weather sampling will be compared to the benchmark values summarized in **Table 6-5**. Screening results that exceed the benchmark values for the parameters below may indicate the presence of an illicit connection and will require further investigation.

**Table 6-5: Benchmark Field Measurements**

| Parameter | Benchmark |
|---|---|
| Ammonia | 0.5 mg/L |
| Conductivity | 2,000 µS/cm |
| Surfactants | 0.25 mg/L |
| Chlorine | 0.02 mg/L |
| Indicator Bacteria:<br>E. Coli<br>Enterococcus | E.Coli: 235 cfu/100 ml in Class A or B Waters<br>Enterococcus: 61 cfu/100 ml in Class A or B Waters, 104 cfu/100 ml in Class SA or SB Waters |

See **Appendix F** for the results of dry weather outfall screening and sampling conducted in October 2020. Note, the dry weather outfall screening and sampling for Outfall 26 was conducted on 7/29/2021 as a result of coordination with Department of Conservation and Recreation (DCR) and field mapping efforts.

# 7. Catchment Investigations

This section provides a summary of the procedure to locate illicit discharges through catchment investigations.

Once stormwater outfalls with evidence of illicit discharges have been identified, various methods can be used to trace the source of the potential discharge within the outfall catchment area. Catchment investigation techniques include but are not limited to review of maps, historic plans, and records; manhole observation; dry and wet weather sampling; video inspection; and dye testing. This section outlines a systematic procedure to investigate outfall catchments to trace the source of potential illicit discharges. Catchments are investigated in order of priority, with catchments draining to Problem Outfalls investigated first, followed by High Priority and then Low Priority Outfalls. Within each category the catchments are investigated in the order they are ranked. Work can be ongoing in multiple catchments simultaneously to expedite the process.

All data collected as part of the catchment investigations will be recorded and reported in each annual report. A summary of the catchment investigation progress to date is presented in **Appendix G**.

## 7.1 System Vulnerability Factors

The City of Somerville used historical information and mapping to identify system vulnerability factors (SVFs) for each identified catchment. A list of the SVFs identified in the 2016 MS4 Permit are outlined below.

- History of SSOs, including, but not limited to, those resulting from wet weather, high water table, or fat/oil/grease blockages;
- Common or twin-invert manholes serving storm and sanitary sewer alignments;
- Common trench construction serving both storm and sanitary sewer alignments;
- Crossings of storm and sanitary sewer alignments where the sanitary system is shallower than the storm drain system;
- Sanitary sewer alignments known or suspected to have been constructed with an underdrain system;
- Inadequate sanitary sewer level of service (LOS) resulting in regular surcharging, customer back-ups, or frequent customer complaints;
- Areas formerly served by combined sewer systems;
- Sanitary sewer infrastructure defects such as leaking service laterals, cracked, broken, or offset sanitary infrastructure, directly piped connections between storm drain and sanitary sewer infrastructure, or other vulnerability factors identified through Inflow/Infiltration Analyses, Sanitary Sewer Evaluation Surveys, or other infrastructure investigations.

SVFs will continue to be updated in **Table 7-1** as new information is gathered during catchment investigations. Wet weather sampling is required at the outfall of catchments with at least one (1) identified SVF per the 2016 MS4 Permit.

**Table 7-1 System Vulnerability Factor Inventory**

| Outfall ID | Receiving Water | Segment ID | History of SSOs | Common or Twin Invert Manholes | Common Trench Construction | High Crossing Density or Long Pipe Runs | Storm / Sanitary Crossing where Sanitary is Above | Sanitary Constructed with Underdrain | Inadequate Sanitary Sewer Level of Service | Formerly Combined Sewer | Sanitary Infrastructure Defects | Greater Than 40 Years Old | Wet Weather Outfall Screening? | Number of SVFs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | Alewife Brook | MA71-20 | No | Yes | Yes | Yes | No | Yes | No | No | Insufficient Information | Yes | Yes | 5 |
| 9 | Alewife Brook | MA71-20 | No | Yes | Yes | Yes | No | Yes | No | No | Insufficient Information | Yes | Yes | 5 |
| 10 | Alewife Brook | MA71-20 | No | No | Yes | Yes | No | Yes | No | Yes | Insufficient Information | Yes | Yes | 5 |
| 26 | Mystic River | MA71-02 | No | Yes | No | Yes | No | No | Yes | Yes | Insufficient Information | Yes | Yes | 5 |
| 31 | Mystic River | MA71-02 | No | Yes | Yes | No | No | Yes | No | Yes | Insufficient Information | Yes | Yes | 5 |
| 19 | Mystic River | MA71-02 | No | No | Yes | Yes | No | Yes | No | No | Insufficient Information | Yes | Yes | 4 |
| 7 | Alewife Brook | MA71-20 | No | No | No | No | No | Yes | No | Yes | Insufficient Information | Yes | Yes | 3 |
| 21 | Mystic River | MA71-02 | No | No | Yes | No | No | Yes | No | No | Insufficient Information | Yes | Yes | 3 |
| 28 | Mystic River | MA71-02 | No | No | No | Yes | No | No | No | Yes | Insufficient Information | Yes | Yes | 3 |
| 6 | Alewife Brook | MA71-20 | No | No | No | No | No | Yes | No | No | Insufficient Information | Yes | Yes | 2 |
| 8 | Alewife Brook | MA71-20 | No | No | No | No | No | Yes | No | No | Insufficient Information | Yes | Yes | 2 |
| 11 | Alewife Brook | MA71-20 | No | No | Yes | No | No | No | No | No | Insufficient Information | Yes | Yes | 2 |
| 32 | Mystic River | MA71-03 | No | No | No | No | No | Yes | No | Yes | Insufficient Information | No | Yes | 2 |
| 29 | Mystic River | MA71-02 | No | No | No | No | No | No | No | Yes | Insufficient Information | No | Yes | 1 |
| 25 | Mystic River | MA71-02 | No | No | No | No | No | No | No | Yes | Insufficient Information | No | Yes | 1 |
| 12 | Mystic River | MA71-02 | No | No | No | No | No | No | No | No | Insufficient Information | No | No | 0 |

## 7.2 Dry Weather Manhole Inspections

Several important terms related to the dry weather manhole inspection program are defined by the 2016 MS4 Permit as follows:

- **Junction Manhole** is a manhole or structure with two or more inlets accepting flow from two or more MS4 alignments. Manholes with inlets solely from private storm drains, individual catch basins, or both are not considered junction manholes for these purposes.
- **Key Junction Manholes** are those junction manholes that can represent one or more junction manholes without compromising adequate implementation of the illicit discharge program. Adequate implementation of the illicit discharge program would not be compromised if the exclusion of a particular junction manhole as a key junction manhole would not affect the permittee's ability to determine the possible presence of an upstream illicit discharge. A permittee may exclude a junction manhole located upstream from another located in the immediate vicinity or that is serving a drainage alignment with no potential for illicit connections.

For all catchments identified for investigation, during dry weather, field crews will systematically inspect **key junction manholes** for evidence of illicit discharges. This program involves progressive inspection and sampling at manholes in the storm drain network to isolate and eliminate illicit discharges.

The manhole inspection methodology will be conducted in one of two ways (or a combination of both):

- By working progressively up from the outfall and inspecting key junction manholes along the way, or
- By working progressively down from the upper parts of the catchment toward the outfall.

For most catchments, manhole inspections will proceed from the upper parts of the catchment moving down the system towards the outfall.

However, the decision to move up or down the system depends on the nature of the drainage system and the surrounding land use, the availability of information on the catchment and drainage system, and the location of dry weather flow.

Moving up the system can begin immediately when an illicit discharge is detected at an outfall, and only a map of the storm drain system is required. Moving down the system requires more advance preparation and reliable drainage system information on the upstream segments of the storm drain system but may be more efficient if the sources of illicit discharges are believed to be located in the upstream portions of the catchment area.

Once a manhole inspection methodology has been selected, investigations will continue systematically through the catchment. Generalized catchment investigation procedures follow below. Detailed investigation procedures will be reviewed before catchment investigations are scheduled to begin.

1. Gather data. Identify maps, historic plans and records, and other sources of data about the catchment. This data should be used to refine the catchment delineation and to identify system vulnerability factors within each catchment.

Data might include but are not limited to: current GIS information; plans related to the construction of storm and sanitary sewers, Board of Health data on septic systems; complaint records; sanitary sewer surcharges; and septic system breakouts.

For each catchment, these data will be recorded digitally. When the presence of a System Vulnerability Factor is noted, the field crew will move to the next section ("For catchments with a minimum of one SVF identified").

2. Inspect the catchment's key junction manhole. During dry weather, open key junction manholes in the catchment and inspect. If no key junction manholes are present in the catchment, record this information and proceed to *For Catchments not Containing Junction Manholes* below.
    a. Conduct a rapid visual and olfactory inspection to attempt to identify source(s) of illicit connections.
    b. If visual evidence of a direct illicit discharge is identified skip to step e.
    c. If flow is observed, a sample will be collected and analyzed at a minimum for ammonia, chlorine, and surfactants. Field test kits can be used for these analyses. In-situ screening should also be conducted for specific conductivity, pH, temperature and salinity. Record the results.
    d. If flow is not observed, an obstruction (sandbag) will be placed in the manhole to capture intermittent flows. After at least 48 hours the sandbag will be checked. If flow is captured, then it will be analyzed for the same parameters listed above.
    e. Record any evidence of illicit connections, such as visual evidence of toilet paper or sewage, bacterial growth, odor, etc. If evidence is observed, flag the area draining to the junction manhole for further investigation.
    f. Continue the process of key junction manhole inspections until a sample result indicates suspected illicit discharges are isolated to as short a pipe segment as possible, ideally a single segment between two manholes.
    g. After identifying a pipe segment with suspected illicit discharges, additional key junction manhole inspections can be conducted downstream to confirm that there are not significant increases in pollutant indicators present. If there are significant increases this could be indicative of additional illicit connections.
    h. Conduct investigations in other "tributary" portions of the collection system.
    i. Identify any System Vulnerability Factors present at the manhole, if any manholes are present. If an SVF is identified, continue to *Wet Weather Outfall Screening and Sampling*.

Key junction and subsequent manhole investigations will proceed until the location of suspected illicit discharges or SSOs can be isolated to a pipe segment between two manholes.

If no evidence of an illicit discharge is found, catchment investigation will be considered complete upon completion of key junction manhole sampling.

For catchments that do not contain junction manholes, dry weather screening and sampling will satisfy permit requirements for catchment investigation. If dry weather screening reveals no dry weather flow, no evidence of illicit discharges or SSOs is indicated through sampling results or visual or olfactory means,

and no wet weather System Vulnerability Factors are identified, investigations in these catchments may be considered complete.

## 7.3 Wet Weather Outfall Screening and Sampling

If flow is observed during wet weather, the sample will be analyzed for the following parameters (see MS4 permit p. 36 for details). EPA recommends sampling during Spring when groundwater levels are relatively high. There is no required minimum rainfall event for wet weather screening as long as runoff is produced, but screening should be avoided during the initial discharge period (i.e., "first flush").

- Ammonia
- Chlorine
- Conductivity
- Salinity
- E. coli or enterococcus
- Surfactants
- Temperature
- pH
- Pollutants of concern

See **Appendix H** for the results of wet weather outfall screening and sampling conducted in July 2021.

## 7.4 Source Confirmation

In general, the process of identifying, tracing, and locating a potential illicit discharge will follow the flow shown in **Figure 7-1**.

Move upstream from the point of observation to identify the source of the discharge, using the system mapping to determine infrastructure, tributary pipes, and drainage areas that contribute. At each point, survey the general area and surrounding properties to identify potential sources of the illicit discharge. Document observations at each point. Photographs may also be useful documentation.

Continue this process until the illicit discharge is no longer observed, which will define the boundaries of the likely source. For example, if the illicit discharge is present in manhole 137 but not the next upstream manhole, 138, the source of the illicit discharge is between these two structures.

Once the source of an illicit discharge is approximated between two manholes, more detailed investigation techniques will be used to isolate and confirm the source of the illicit discharge. The following methods may be used in isolating and confirming the source of illicit discharges:

- Sandbagging
- Smoke Testing
- Dye Testing
- CCTV/Video Inspections
- Optical Brightener Monitoring

These methods are described in more detail in this section.

Public notification is an important aspect of a detailed source investigation program. Prior to smoke testing, dye testing, or TV inspections, the City will notify property owners in the affected area. Notification may include letters, door hangers, reverse 911 calls, or other methods for single family homes and businesses. Additional notification will be posted in building lobbies for multi-family dwellings.

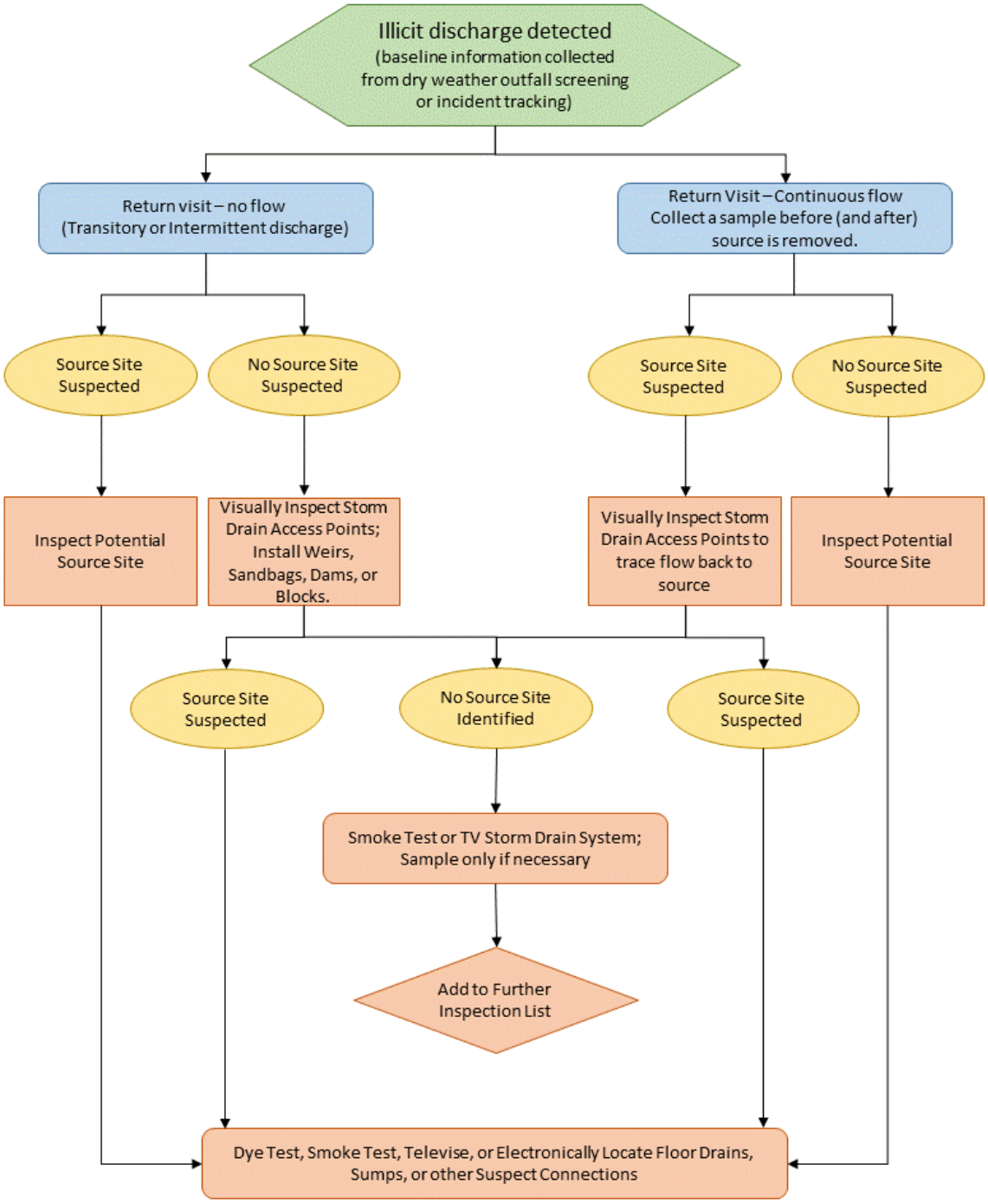


**Figure 7-1 : Flow Chart to Select Tracing Techniques (Courtesy of CMRSC SOP 10)**

### 7.4.1 Sandbagging

This technique can be particularly useful when attempting to isolate intermittent illicit discharges or those with very little perceptible flow. The technique involves placing sandbags or similar barriers (e.g., caulking, weirs/plates, or other temporary barriers) within inlets to manholes to form a temporary dam that collects any intermittent flows that may occur. Following 24 hours of dry weather, sandbags are typically installed and left in place for 48 hours. Because at least 72 hours of dry weather are required for sandbagging, sandbags should only be installed when dry weather is forecasted.

If flow has collected behind the sandbags/barriers after 48 hours, the flow can be assessed using visual observations or by sampling. If no flow collects behind the sandbag, the upstream pipe network can be ruled out as a source of the intermittent discharge. Finding appropriate durations of dry weather and the need for multiple trips to each manhole makes this method both time-consuming and somewhat limiting.

### 7.4.2 Smoke Testing

Smoke testing involves injecting non-toxic smoke into drain lines and noting the emergence of smoke from sanitary sewer vents in illegally connected buildings or from cracks and leaks in the system itself. Typically, a smoke bomb or smoke generator is used to inject the smoke into the system at a catch basin or manhole and air is then forced through the system. Test personnel are placed in areas where there are suspected illegal connections or cracks/leaks, noting any escape of smoke (indicating an illicit connection or damaged storm drain infrastructure). It is important when using this technique to make proper notifications to area residents and business owners as well as local police and fire departments.

If the initial test of the storm drain system is unsuccessful, then a more thorough smoke test of the sanitary sewer lines can also be performed. Unlike storm drain smoke tests, buildings that do not emit smoke during sanitary sewer smoke tests may have problem connections and may also have sewer gas venting inside, which is hazardous.

It should be noted that smoke may cause minor irritation of respiratory passages. Residents with respiratory conditions may need to be monitored or evacuated from the area of testing altogether to ensure safety during testing.

### 7.4.3 Dye Testing

Dye testing involves flushing non-toxic dye into plumbing fixtures such as toilets, showers, and sinks and observing nearby storm drains and sewer manholes as well as stormwater outfalls for the presence of the dye. Similar to smoke testing, it is important to inform local residents and business owners. Police, fire, and local public health staff should also be notified prior to testing in preparation of responding to citizen phone calls concerning the dye and their presence in local surface waters.

A team of two or more people is needed to perform dye testing (ideally, all with two-way radios). One person is inside the building, while the others are stationed at the appropriate storm sewer and sanitary sewer manholes (which should be opened) and/or outfalls. The person inside the building adds dye into a plumbing fixture (i.e., toilet or sink) and runs a sufficient amount of water to move the dye through the plumbing system. The person inside the building then radios to the outside crew that the dye has been

dropped, and the outside crew watches for the dye in the storm sewer and sanitary sewer, recording the presence or absence of the dye.

#### 7.4.4 CCTV/Video Inspection

Another method of source isolation involves the use of mobile video cameras that are guided remotely through stormwater drain lines to observe possible illicit discharges. IDDE program staff can review the videos and note any visible illicit discharges or connections of unknown origin. While this tool is both effective and usually definitive, it can be costly and time consuming when compared to other source isolation techniques.

#### 7.4.5 Optical Brightener Monitoring

Optical brighteners are fluorescent dyes that are used in detergents and paper products to enhance their appearance. The presence of optical brighteners in surface waters or dry weather discharges suggests there is a possible illicit discharge or insufficient removal through adsorption in nearby septic systems or wastewater treatment. Optical brightener monitoring can be done in two ways. The most common, and least expensive methodology involves placing a cotton pad in a wire cage and securing it in a pipe, manhole, catch basin, or inlet to capture intermittent dry weather flows. The pad is retrieved at a later date and placed under UV light to determine the presence/absence of brighteners during the monitoring period. A second methodology uses handheld fluorometers to detect optical brighteners in water samples collected from outfalls or ambient surface waters. Use of a fluorometer, while more quantitative, is typically more costly and is not as effective at isolating intermittent discharges as other source isolation techniques.

### 7.5 Illicit Discharge Removal and Abatement

When an illicit connection is identified, the City of Somerville will take immediate steps to remove the discharge as outlined in the AO. The City of Somerville will have sixty days from the date of verification or effective date to remove the illicit discharge, except when an alternative schedule is required. If the illicit discharge cannot be removed within sixty days, a schedule for removal will be submitted to the EPA as expeditiously as possible.

Unless a revised schedule is required by the EPA, the City of Somerville will meet the milestones outlined in the proposed schedule. The removal schedule for illicit discharges will be consistent with the AO and the milestones summarized below.

- If the removal of an illicit discharge is determined to be the responsibility of the property owner, the City will notify the property owner of their responsibility to remove the illicit discharge via certified and regular mail.
    - If the property owner has not removed the illicit discharge within sixty days from the date of verification or effective date, the City of Somerville will send a follow-up letter. The

letter will notify the owner of their responsibility to remove the illicit connection and outline the legal ramifications per the City of Somerville's ordinance.

- If the property owner has not removed the illicit discharge within 90 days from the date of verification or effective date, another letter will be sent. This letter will notify the owner of the fines to be applied to the water and sewer bill and outline the next steps the City of Somerville will take if the illicit connection is not removed. If action is taken, the City of Somerville will report enforcement actions taken.

- If investigation determines infrastructure repair will not eliminate the illicit discharge, the City will implement appropriate green infrastructure/low impact development best management practices as defined in the AO.

The annual report will include the status of IDDE investigation and removal activities including the following information for each confirmed source:

- The location of the discharge and its source(s)
- A description of the discharge
- The method of discovery
- Date of discovery
- Date of elimination, mitigation or enforcement action, OR planned corrective measures, and a schedule for completing the illicit discharge removal
- Estimate of the volume of flow removed.

The volume of flow can be estimated using an assumed volume of sewage from a typical house or can be based on water use. If only a portion of the building is illicitly connected, the volume of sewage must be proportionally reduced.

A list of illicit connection that the City has discovered to date is provided in Table 7-3.

**Table 7-3 Verified Illicit Connections to Date**

| ID | Illicit Discharge Status | Type of Discharge | Street Name | Street No. | Catchment Area | Watershed | Estimated Flow (gpd) | Verification Date | Verification Method | 1st Notice Date | 2nd Notice Date | Removal Date | Date Confirmatory Sampling Completed | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Abatement Complete, Confirmatory Sampling Pending | 3-Family Residential Leaking Lateral | Broadway | 1241 | 7 | Alewife Brook | 165 | 6/6/2022 | Dye Test | 6/14/2022 | 6/24/2022 | 7/4/2022 | | SDE completed dye test in Unit 2 on 6/6/2022. The result was dye in both storm and sewer. The dye was first seen in the sewer and then seen in the drain about 10 minutes later. Two notices were sent to the owner. On July 4, 2022, a three-alarm fire broke out at the property and the three-apartment house has been uninhabitable since. The City has flagged this address in the permitting system: when a demolition permit comes through the conditions on that permit will be to cut and cap all existing utilities at their respective mains; when a building permit comes through the applicant will be required to create a new sewer connection before a Certificate of Occupancy is issued. For these reasons, the City considers that this illicit connection has been removed as of July 4th, 2022. The City plans to conduct confirmatory dye testing at this location at the time the Certificate of Occupancy is issued, additional dye testing in the upstream and downstream sewer manholes and resample storm drains to confirm that no additional illicit connections exist in that segment of the pipe. |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |

Notes:
1) For residential properties, flow is estimated based on 310 CMR 15.203 "System Sewage Flow Design Criteria" of 110 gallons per day per bedroom

### 7.5.1 Confirmatory Outfall Screening

After the removal of identified illicit discharges within a catchment, a confirmatory dry weather outfall screening will be conducted within sixty days per the AO. If a catchment has identified SVFs, then both dry weather and wet weather outfall screening will be performed. If confirmatory screening finds evidence of illicit discharges, additional catchment investigations will be scheduled.

## 7.6 Ongoing Screening

Upon completion of all catchment investigations and illicit discharge removal and confirmation (if necessary), each outfall or interconnection will be re-prioritized for screening and scheduled for ongoing screening once every five (5) years. Ongoing screening will consist of dry weather screening and sampling consistent with the procedures described in **Section 6** of this plan. Ongoing wet weather screening and sampling will also be conducted at outfalls where wet weather screening was required due to SVFs, and will be conducted in accordance with the procedures described in **Section 7.3**. All sampling results will be reported in the annual report.

# 8. Training

The City of Somerville will hold an annual training for all employees involved in the IDDE program. The training will include an office and field component and focus on how to identify illicit discharges and SSOs. **Table 8-1** is a summary of the training that has been conducted for City employees to date. Training records will be maintained in **Appendix I**. The frequency and type of training will be included in the annual report.

**Table 8-1: Training Record**

| Training Date | Training Location |
|---|---|
| September 24, 2020 | Outfall 25 |
| October 1, 2020 | Outfall 10 |

# 9. Progress Reporting

The progress success of the IDDE program will be evaluated on an annual basis. The evaluation will be documented in the annual report and will include the following indicators of program progress:

- number of SSOs and illicit discharges identified and removed,
- number and percent of outfall catchments evaluated per the catchment investigation procedure,
- number of dry weather outfall inspections/screenings
- number of wet weather outfall inspections/sampling events
- number of enforcement notices issues
- all dry and wet weather screening and sampling results,
- estimate of the volume of sewage removed, as applicable
- number of employees trained annually.

The success of the IDDE program will be measured by the IDDE activities completed within the required permit timelines.

# 10. Next Steps

The City of Somerville will continue to implement and develop this IDDE program in compliance with the 2016 General Permit and Administrative Order. Next steps for the IDDE program are summarized in the bullets below.

- Stormwater System Mapping
    - Continued field investigation efforts in MS4 areas to update GIS system mapping.
    - Additional mapping required for Catchment 32 (ongoing construction in Assembly Square).
    - Continued coordination with neighboring governmental agencies (DCR and MassDOT) to better understand MS4 system interconnections.
- Catchment Investigations
    - Additional IDDE investigation needed for Catchment 11 as a result of field mapping findings.
- Illicit Discharge Removal

- Continue efforts dye testing in areas where catchment investigations have found dry weather flow that met the likely sewer indicator criteria outlined in the 2016 MS4 Permit.

# Appendix A: City of Somerville Phase I System Map

# Appendix B:  City of Somerville Ordinance

# Appendix C: MassDEP SSO Notification Form

# Appendix D: Field Test Kits and Intrumentation Manuals

# Appendix E: Oakton Multi-Parameter PCTSTestr 50 Series Calibration Procedure

# Appendix F: Dry Weather Outfall Screening and Sampling Results

# Appendix G: Catchment Investigation Progress Summary

# Appendix H: Wet Weather Outfall Screening and Sampling Results

# Appendix I: IDDE Training Materials

# Appendix J: Catchment Investigation Memo