Illicit Discharge Detection and Elimination Program

Town of Mendon

June 2019

Tighe&Bond

Engineers | Environmental Specialists

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Commonly Used Abbreviations	Definitions
CFR	Code of Federal Regulations
CMRSWC	Central Massachusetts Regional Stormwater Coalition
EPA	Environmental Protection Agency
GIS	Geographic Information System
GPS	Global Positioning System
IDDE	Illicit Discharge Detection and Elimination
MassDEP	Massachusetts Department of Environmental Protection
MassDOT	Massachusetts Department of Transportation
MCM	Minimum Control Measure
MS4	Municipal Separate Storm Sewer System
NPDES	National Pollutant Discharge Elimination System
SOP	Standard Operating Procedure
SSO	Sanitary Sewer Overflow
SWMP	Stormwater Management Program
TMDL	Total Maximum Daily Load

Section 1 Introduction

1.1 Purpose & Scope

The Environmental Protection Agency (EPA) nationally regulates the discharge of stormwater runoff that is transported into local water bodies through Municipal Separate Storm Sewer Systems (MS4) that are located in Urbanized Areas (also known as "Regulated Areas"). The Town of Mendon meets EPA's regulatory threshold, and therefore is required to obtain coverage under the National Pollutant Discharge Elimination System (NPDES) permit for its stormwater discharges from the MS4 in its Urbanized Area. In Massachusetts, the EPA Region 1 and the Massachusetts Department of Environmental Protection (MassDEP) jointly administer the municipal stormwater program and authorize Mendon to discharge stormwater under the *NPDES General Permit for Storm Water Discharges from Small Municipal Separate Storm Sewer Systems*, known as the "Small MS4 General Permit." The permit was first issued in 2003 and an updated permit was issued in 2016. Under this program, the Town has developed and implemented a Stormwater Management Program (SWMP) to reduce the contamination of stormwater runoff and prohibit illicit discharges. The Small MS4 Program contains six elements called *minimum control measures* (MCMs) that, when implemented, should result in a significant reduction in pollutants discharged into receiving waters. The MCMs are:

1. Public education and outreach
2. Public involvement and participation
3. Illicit discharge detection and elimination
4. Construction site storm water runoff control
5. Post construction management in new development
6. Pollution prevention and good housekeeping

This Illicit Discharge Detection and Elimination (IDDE) Plan was developed to fulfill one of the BMP requirements for MCM 3 above.

The purpose of the IDDE Plan is to develop a written program to detect and effectively eliminate illicit discharges and connections to the storm water sewer system within the Town. The IDDE Plan includes methods and steps to locate, prioritize, eliminate, and document the illicit discharges or illicit connections within the Town of Mendon and to comply with the 2016 Small MS4 General Permit.

1.2 Plan Applicability

This IDDE Plan should be implemented throughout the MS4 in Mendon's Regulated Area. Regulated Areas are defined by the latest Urbanized Area delineated in the United States decennial census. Figure 1, below, includes EPA's map showing Mendon's Regulated Area based on the 2000 and 2010 censuses.

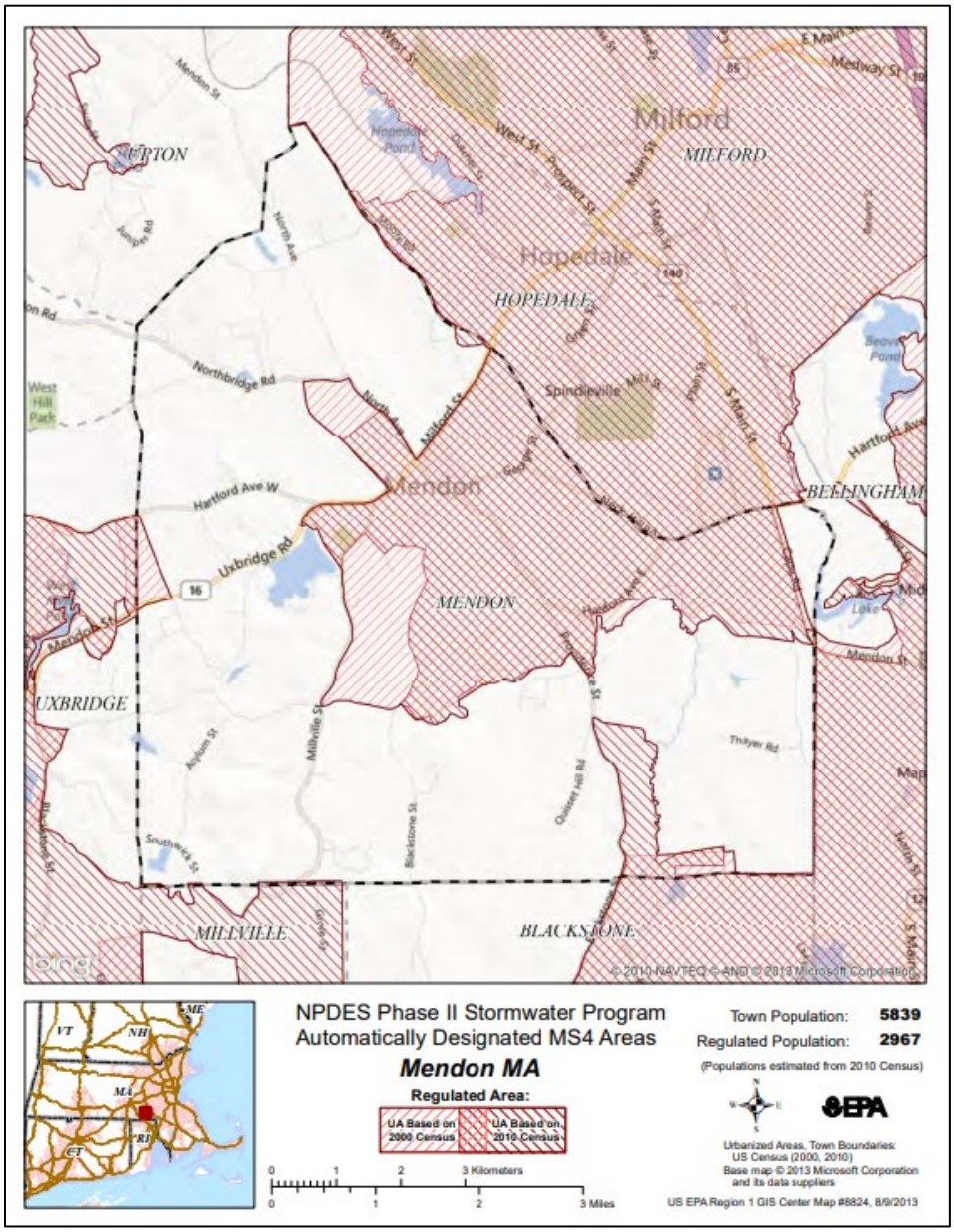
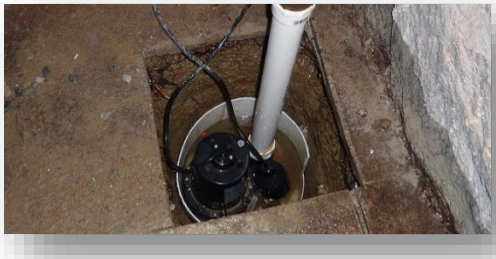


Figure 1: Town of Mendon's Urbanized Area

1.3 Definitions

Illicit Discharge: Defined by 40 CFR 122.26(b)(2) as any discharge to a MS4 that is not composed entirely of stormwater. Exceptions include allowable discharges pursuant to a NPDES permit, and discharges that are not anticipated to introduce pollutants into the storm drain system. Under the Small MS4 General Permit and the Town's *Non-Storm Water Discharge* Bylaw, the following discharges are ***allowed***:

- Municipal waterline flushing;
- landscape irrigation or lawn watering;
- diverted stream flow;
- rising groundwater;
- uncontaminated groundwater infiltration as defined in 40 CFR 35.2005(20);
- uncontaminated groundwater from a sump pump with verbal notification and a permit from the Highway Department;
- discharge from potable water sources;
- foundation and footing drains, provided verbal notification is given to the Highway Department;



Sump pumps may discharge to the MS4 provided the flow is "uncontaminated pumped groundwater."

- air conditioning condensation, provided verbal notification is given to the Highway Department;
- irrigation water;
- springs;
- water from crawl space pumps, provided verbal notification is given to the Highway Department;
- individual resident car washing and wetlands and temporary fundraising car wash events;
- flows from riparian habitats;
- dechlorinated swimming pool discharges[1];
- street wash water and residential building wash waters, without detergents;
- discharges or flows from firefighting activities, unless the Highway Department determines that the discharge is a significant contributor of pollutants to the storm drain system;
- dye testing, provided verbal notification is given to the Highway Department prior to the time of the test; and
- non-stormwater discharges permitted under an NPDES permit, waiver, or waste discharge order administered under the authority of the EPA, provided that the discharger is in full compliance with the requirements of the permit, waiver, or order and applicable laws and regulations, and provided that written approval has been granted by the Highway Department for any discharge to the storm drain system.

[1] Per the Town's *Non-Storm Water Discharge* Bylaw, dechlorinated swimming pool discharges are exempt, provided the pool water is allowed to stand for one week prior to draining, or tested for chlorine levels with a pool test kit prior to draining (less than one parts per million chlorine), and the pool is drained in such a way as not to cause a nuisance.

A copy of the Town's *Non-Storm Water Discharge* Bylaw is provided in **Appendix A**.

Examples of illicit discharges include:

- sanitary sewage, which should be connected to the sanitary sewer but are inappropriately connected to the storm sewer
- effluent from improperly designed and /or operated septic systems
- sanitary sewer overflows
- waste products that are improperly disposed:
    - emptying a mobile home holding tank into a catch basin
    - pouring used motor oil into a catch basin
    - discharging car wash wastewaters
    - disposing radiator flushing wastes
    - discharging laundry wastewaters
    - spills from roadway accidents
    - other discharges not composed entirely of storm water

Illicit connection: An improper physical connection of illicit discharges to the storm water drainage system, or other connections not authorized by the local authority (where required), to the storm water drainage system, also referred to as a direct connection.

Examples of illicit connections are:

- A floor drain in an automobile repair shop that is connected to the storm sewer rather than the sanitary sewer
- A septic tank discharge line that has been connected to the storm sewer
- An improper connection of a source of storm water to the sanitary sewer would also be considered an illicit connection, for example, a parking lot catch basin that is tapped into the sanitary sewer

Illicit connections refer to a physical connection to the drainage system that either conveys illicit discharges into the storm sewer system, or is not authorized or permitted by the Town, as required.

Indirect Discharge: An illicit discharge that is not a direct physical connection to the drainage system. An indirect discharge may come from a wide variety of sources, such as infiltration into the drainage system from failed septic systems, or hazardous waste spills collected by storm drains. Grass clippings, leaf litter, and other solid material dumped or otherwise deposited in the storm drain system are also considered indirect illicit discharges.

Grass clippings, leaf litter, and other solid material dumped or otherwise deposited in the storm drain system are considered illicit discharges.

Dry weather conditions: As defined by the 2016 General Permit, dry weather conditions are when no more than 0.1 inches of rainfall has occurred in the previous 24-hour period and no significant snow melt is occurring. Conducting dry weather screening and sampling is recommended when there has been no precipitation or snow melt in the previous 72 hours.

Outfall: A location where the municipal separate storm sewer discharges to the waters of the United States.

1.4 Illicit Discharges and Water Quality

Illicit discharges contribute elevated levels of pollutants to surface water bodies and can potentially enter groundwater. These pollutants can include heavy metals, toxics, oil and grease, solvents, nutrients such as nitrogen and phosphorus, pesticides and fertilizers from lawns, sediment from construction sites, viruses, and bacteria. When these pollutants enter water bodies, they can contaminate drinking water supplies, hinder recreation activities, and harm aquatic and other wildlife habitats.

1.5 Summary of EPA Requirements

Per the 2003 Small MS4 General Permit, the Town of Mendon was required to develop, implement, and enforce a program to detect and eliminate illicit discharges. As required by Part II.B.3 of the 2003 General Permit, this illicit discharge program must contain the elements listed below. Requirements related to the municipal sanitary sewer system are not included in this Plan since they are not applicable to the Town of Mendon.

1. A **storm drain system map** that shows at a minimum, the location of all outfalls and the names of all waters that receive discharges from those outfalls. Additional elements may be included on the map, such as, location of catch basins, location of manholes, and location of pipes within the system. Initial mapping should be based on all existing information available to the Town including project plans, Town records and drainage maps. **Mendon has developed system map included in Appendix C.**
2. To the extent allowable under state law, the Town must effectively prohibit, through a **regulatory mechanism** (such as a local bylaw), non-stormwater discharges into the system and implement appropriate enforcement procedures and actions. **The Town has met this requirement through the adoption of the *Non-Storm Water Discharge* Bylaw.**
3. The Town must **develop and implement a plan** to detect and address non-stormwater discharges, including illegal dumping, into the system. The illicit discharge plan must contain the following elements:
    a. Procedures to identify priority areas. This includes areas suspected of having illicit discharges, for example: older areas of the Town, areas of high public complaints and areas of high recreational value or high environmental value such as beaches and drinking water sources.
    b. Procedures for locating illicit discharges (visual screening of outfalls for dry weather discharges, dye or smoke testing).
    c. Procedures for locating the source of the discharge and procedures for the removal of the source.

d. Procedures for documenting actions and evaluating impacts on the storm drain system subsequent to the removal.

The Town's 2015 IDDE Plan was written to meet these requirements. This Plan has been updated to meet the requirements of the 2016 General Permit.

4. The Town must **inform users of the system and the general public** of hazards associated with illegal discharges and improper waste disposal. The Town must **train field inspectors** to recognize illicit discharges. **The Town will meet these requirements through Public Education and Outreach through Minimum Control Measure 1 and Annual IDDE Employee Training.**

5. The **non-stormwater discharges** listed in Section 1.3 must be addressed if they are identified as being significant contributors of pollutants. **If identified as a significant contributor of pollutants during dry weather screening and catchment investigations, non-stormwater discharges listed in Section 1.3 will be addressed.**

The 2003 General Permit expired in April 2008 but was administratively continued and remained in effect until the 2016 General Permit was adopted on July 1, 2018. Applicable Sections from the 2016 MS4 permit are included in **Appendix B.**

The new IDDE requirements in the 2016 MS4 Permit include the following elements, as fully described in General Permit Section 2.3.4, that build on the 2003 requirements:

1. The Town must develop an **inventory of known locations of SSO**s that occurred within the previous five years within 120 days of the effective date of the permit. In the Annual Report SSOs must be documented and summarized. **The Town of Mendon has no municipal sewer and therefore, this requirement is not applicable.**

2. An **inventory of all MS4 outfalls and interconnections** must be developed within one (1) year of the effective date of the permit. **The Town of Mendon has developed an inventory of all MS4 outfalls and interconnections, included in Appendix C.**

3. Additional items must be added to the existing **stormwater map**, including all outfalls, interconnections with other MS4s, catch basins, manholes, pipes, flow direction, catchment delineations, and public and private BMPs. This additional mapping must be complete within two (2) years of the effective date of the permit.

   Additional items must be added for all outfalls within ten (10) years of the effective date of the permit: latitude and longitude for all outfalls, pipes, manholes, catch basins, refined catchment delineations, and municipal sanitary/combined sewer system (if applicable). **Mendon's stormwater mapping includes many of these elements and will be updated to meet these requirements by June 30, 2020 and June 30, 2028, respectively.**

4. A **written IDDE Plan** must be developed within one (1) year of the effective date of the permit. **This document was prepared to meet this requirement.**

5. The Town must **sample during dry weather at all outfalls** where flow is present, and test the flow for signs of illicit discharges within three (3) years of the permit

effective date. **Mendon has completed dry weather inspections for all outfalls. Results are included in Appendix E.**

6. Based on the results of sampling and characteristics of the catchment areas, the Town must **rank all MS4 catchments for potential of illicit discharges** into the following categories: "**Problem", "High Priority", "Low Priority**", and **"Excluded"**. The initial ranking shall be completed by June 30, 2019. The ranking will be updated based on information gathered during dry weather screening and finalized by June 30, 2021. **The Town of Mendon has developed an initial ranking of all MS4 outfalls and interconnections, included in Appendix C.**
7. Develop and implement a **catchment investigation procedure** that includes a systematic investigation of prioritized catchments, screening of key junction manholes, and wet weather outfall screening in catchments with system vulnerability factors. **The Town of Mendon will finalize their catchment investigation procedure, including the identification of key junction manholes by December 30, 2019.**
8. An **annual training** must be provided for all employees involved in the IDDE program on how to recognize illicit discharges. **Annual IDDE Employee Training Logs will be included in Appendix G.**
9. Evaluate annual program progress and effectiveness and include in Annual Reports.

Section 2 Stormwater System Mapping

Storm drain system mapping is an essential tool in identifying illicit discharges. At a minimum, mapping elements required by the 2016 permit include two phases.

Phase I (required within two years of the effective date of the permit) - the following elements are required:

- outfalls and receiving waters (required by MS4-2003 permit);
- open channel conveyances (swales, ditches, etc.);
- interconnections with other MS4s and other storm drain systems;
- municipally-owned stormwater treatment structures (e.g., detention and retention basins, infiltration systems, bioretention areas, water quality swales, gross particle separators, oil/water separators, or other proprietary systems);
- Waterbodies identified by name and indication of all use impairments as identified on the most recent EPA approved Massachusetts Integrated List of waters report pursuant to Clean Water Act Section 303(d) and 305(b); and
- Initial catchment delineations. A catchment is the area that drains to an individual outfall or interconnection.

Phase II (required within ten years of the effective date of the permit) - the following elements are required:

- Outfall spatial location (latitude and longitude with a minimum accuracy of +/- 30 feet);
- Pipes;
- catch basins;
- manholes;
- Refined catchment delineations;
- Municipal sanitary sewer system (if applicable); and
- Municipal combined sewer system (if applicable).

In addition to these, the following elements are recommended:

- Storm sewer material, size and age;
- Sanitary sewer system material, size, and age;
- Privately owned stormwater treatment structures;
- Area where the Town's MS4 has been or could be influenced by septic system discharges (e.g., areas with poor soils, or high ground water elevations unsuitable for conventional subsurface disposal systems);
- 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., closed circuit television (CCTV), flow isolation, dye testing); and
- Locations of suspected, confirmed and corrected illicit discharges (with dates and flow estimates).

2.1 MS4 Mapping Status

The Town of Mendon has partially completed mapping the MS4, using existing plans and Global Positioning System (GPS). As of the date of this report, the following elements are mapped:

- Receiving waterbodies
- 209 known outfalls
- Catch basins
- Drainage manholes
- Pipe connectivity
- Catchment delineations
- All major watersheds and sub-basins

The mapping requirements of the 2003 General Permit have been met, and many of the revised requirements (included above) have been completed or are underway. Additional mapping is needed to meet the Phase I mapping requirements by June 30, 2020.

A working draft copy of the drainage system map is included as part of this program in **Appendix C**. Up-to-date mapping is available electronically through the Mendon GIS Department. As the mapping effort progresses, **Appendix C** should be periodically updated to reflect any changes and additions to the system mapping and inventory.

2.2 Outfall Inventory

The Town must develop and maintain an inventory of all of the Town's outfalls. This inventory identifies each outfall discharging from the MS4, records its location and condition, and provides a framework for tracking inspections, screenings, and other activities under the Town's IDDE program. Refer to the map and the Initial Outfall and Interconnection Inventory and Priority Ranking in **Appendix C**.

According to Section 2.3.4.7.b.iii of the 2016 permit, the inventory shall include the following information:

- unique identifier
- receiving water
- date of most recent inspection
- dimensions
- shape

- material
- spatial location (latitude and longitude with a minimum accuracy of +/-30 feet)
- physical condition
- indicators of potential non-stormwater discharges (including presence or evidence of suspect flow and sensory observations such as odor, color, turbidity, floatables, or oil sheen) as of the most recent inspection.

The initial inventory and ranking in **Appendix C** were created from existing GIS data and results of dry weather outfall inspections. Dry weather inspection results are included in **Appendix E**.

2.3 Action Plan

Action Items: Stormwater System Mapping	
1. Maintain Outfall Inventory	The inventory shall be updated annually to include data collected in connection with the dry weather screening and other relevant inspections conducted by the Town or consultants. The inventory shall be included with each annual report.
2. Continue to Improve Drainage Mapping and Asset Inventory	Phase 1 mapping will be completed within two years of the effective date of the permit. Phase 2 mapping will be completed within ten years of the effective date of the permit. Throughout the 2016 Massachusetts Small MS4 General Permit term, update the map as necessary to reflect newly discovered information, corrections or modifications, significant changes, and progress made. Updated maps may be added to **Appendix C** annually or kept electronically. When Annual Reports are prepared, the Town should print or save a pdf of the most up-to-date system map to document progress.
3. Map Availability and Data Management	The Storm Sewer System Map is critical for the IDDE program, the outfall monitoring program, MS4 maintenance activities, and spill response. Therefore, this map should be accessible to multiple Town departments, including Highway, Planning, Parks & Recreation, Conservation, Fire, Police, and Board of Health. The Storm Sewer System Map will need to be **readily available to all Town personnel** in a usable format (e.g., paper field maps or electronic on handheld device). All personnel should be encouraged to **report mapping errors, omissions, or other updates to the Highway Department.**

Section 3 Non-Stormwater Discharge Bylaw

The Town of Mendon Highway Department has developed a general bylaw to regulate non-stormwater discharges to the MS4. The *Non-Storm Water Discharge* Bylaw was adopted in 2009. A complete copy of the *Non-Storm Water Discharge* Bylaw, Chapter XXIII of the General Bylaws, is included in **Appendix A**. The Highway Department is designated to administer, implement, and enforce this bylaw.

The Bylaw meets the requirements of the 2016 General Permit.

3.1 Action Plan

Action Items: Illicit Discharge Bylaw	
1. Implement Bylaw.	No further action necessary. The Town's *Non-Storm Water Discharge* Bylaw shall be enforced when necessary.

Section 4 Statement of IDDE Program Responsibilities

The Highway Department is responsible for overseeing and implementing the IDDE Program. Additional authority for prohibition of illicit discharges and illegal dumping to the MS4 and water bodies in Mendon is granted to the Conservation Commission through the Massachusetts Wetlands Protection Act and Wetlands Protection Bylaw.

Establishing procedures to coordinate Town personnel and departments is an important component of the IDDE Program and is required under Section 2.3.4.6.b of the permit. Mendon's protocol for IDDE Program responsibilities is provided in **Appendix F**. As the Bylaw is implemented and Town staff's roles and responsibilities evolve, this statement may need to be updated or amended. This statement is written in accordance with the requirements of the General Permit. It includes an explanation of specific areas of responsibility and it formalizes a process for coordination and data sharing among various Town departments and personnel.

4.1 Action Plan

Action Items: Statement of IDDE Program Responsibilities	
1. Update Protocol for IDDE Program Responsibilities as Needed	The Highway Department and/or Conservation Commission, with assistance from other relevant staff, may update or amend the written statement that identifies responsibilities with regard to eliminating illicit discharges. The most up-to-date Protocol for IDDE Program Responsibilities should be maintained in **Appendix F**.
2. Employee Training (see Section 8)	Train responsible Town personnel on the written IDDE protocol as part of the Annual Employee Trainings. Include logs of the Annual Employee Trainings in **Appendix G**.

Section 5 Assessment and Priority Ranking of Outfalls & Interconnections

In assessing the storm drain system for illicit connections and discharges, prioritization helps focus energies on areas of greatest concern or where the greatest impact would be achieved. Under the 2016 Permit, EPA requires a more rigorous assessment of illicit discharge potential and related public health significance.

Additionally, per the permit, "the ranking will determine the priority order for the screening of outfalls and interconnections pursuant to part 2.3.4.7.b", and the compliance schedule for catchment investigations is based on this ranking.

5.1 Priority Ranking

Outfalls and interconnections, and their associated catchments, must be assessed in terms of their potential to have illicit discharges and the related public health significance. The illicit discharge potential assessment and priority ranking will determine the order of outfall and interconnection screening and schedule for catchment investigations for evidence of illicit discharges. This assessment also provides the basis for determining IDDE program milestones.

Tighe & Bond ranked outfalls and their associated catchments into the following categories based on potential for illicit discharges:

- **Excluded Outfalls**: This category is limited to roadway drainage in undeveloped areas with no dwellings and no sanitary sewers; drainage for athletic fields, parks or undeveloped green space and associated parking without services; and cross-country drainage alignments (that neither cross nor are in proximity to sanitary sewer alignments) through undeveloped land.
- **Problem Outfalls**: Outfalls/interconnections with known or suspected contributions of illicit discharges based on existing information. This shall include any outfalls/interconnections where previous screening indicates likely sewer input.
- **High Priority Outfalls**: Outfalls/interconnections that have not been classified as Problem Outfalls and that are: 1) discharging to an area of concern for public health due to proximity of public beaches, recreational areas, drinking water supplies or shellfish beds; or 2) determined by the permittee as high priority based on the characteristics listed in the General Permit or other available information.
- **Low Priority Outfalls**: Outfalls/interconnections determined by the permittee as low priority based on the characteristics listed in the General Permit or other available information.

The characteristics of each of these categories have been defined by EPA in the 2016 General Permit Section 2.3.4.7.a.ii and iii.

Within each of these four categories, the catchments will also be ranked based on screening factors. EPA's **minimum screening factors** include:

- 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
- 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 surrounding development and infrastructure – Industrial areas greater than 40 years old will probably have a high illicit discharge potential. Developments 20 years or younger will probably have a low illicit discharge potential.
- Density of aging septic systems – Septic systems thirty years or older in residential land use areas are prone to have failures and may have a high illicit discharge potential.
- Culverted streams – Any river or stream that is culverted for distances greater than a simple roadway crossing may be considered "high."
- Water quality limited waterbodies that 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.

Tighe & Bond completed an initial priority ranking of catchment areas included in **Appendix C**.

5.2 Action Plan

Action Items: Assessment and Priority Ranking of Outfalls/Interconnections	
1. Update Illicit Discharge Potential Assessment and Priority Ranking	An initial illicit discharge potential assessment and priority ranking based on existing information was completed as part of this Plan and is located in **Appendix C**. The Town shall update its assessment and priority ranking continuously based on catchment delineations, the results of screening, and other new relevant information. The updated ranking **shall be complete within three years of the effective date of the permit** according to section 2.3.4.7.c of the permit.

Section 6 Identification of Illicit Discharges

The Town's IDDE program must include a written, systematic procedure for catchment investigation that includes:

1. A review of mapping and historic plans and records for the catchment;
2. A manhole inspection methodology; and
3. Procedures to isolate and confirm sources of illicit discharges.

A key component of the catchment investigation is written procedures for screening and sampling outfalls and interconnections from the MS4 in dry and wet weather for evidence of illicit discharges. This section summarizes the written procedures that the Town should use to identify illicit discharges and makes recommendations for prioritizing catchment investigations. These procedures heavily rely on the January 2012 Draft EPA New England Bacterial Source Tracking Protocol as well as guidelines from the Center for Watershed Protection.

6.1 Dry Weather Outfall and Interconnection Screening and Sampling

The Town will screen and sample outfalls and interconnections in accordance with the requirements in the 2016 Massachusetts Small MS4 General Permit. The Permit requires that all outfalls excluding **Problem** and **Excluded** outfalls shall be inspected for the presence of dry weather flow within three years of the effective permit date.

The following procedures and guidance are included in **Appendix D.**

- Mendon Sampling Protocol and Field Equipment Checklist
- Chapter 11 of the Center for Watershed Protection's IDDE Manual, "Outfall Reconnaissance Inventory"
- Chapter 13 of the Center for Watershed Protection's IDDE Manual, "Tracking Discharges to a Source"
- EPA New England Bacterial Source Tracking Protocol, Draft 2012

Additionally, where an outfall discharges directly to an impaired water or water subject to an approved TMDL, the sample should be analyzed for the pollutants identified as the cause of the impairment. This information is included in the Mendon Sampling Protocol. This Protocol also includes the information specified in section 2.3.4.7.i of the 2016 permit. Mendon has completed dry weather screening for all outfalls. Results of screening and sampling are included in **Appendix E**.

6.2 Catchment Investigation Procedure

Mendon will use the following procedure to develop a written procedure to evaluate and investigate each catchment according to section 2.3.4.8 of the General Permit.

6.2.1 Review of Mapping and Historic Plans

Tighe & Bond evaluated System Vulnerability Factors relevant to the Town of Mendon. Due to the lack of municipal sanitary sewers in Mendon, none of the System Vulnerability Factors apply. The Town of Mendon is, therefore, not required to conduct wet weather sampling in any catchments. EPA recommends including widespread code-required septic system upgrades required at property transfers, and history of multiple Board of Health actions addressing widespread septic system failures as System Vulnerability Factors, although not required.

Strategically identifying and limiting the number of "key junction manholes" is essential to minimizing the IDDE Program level of effort and cost.

6.2.2 Manhole Inspection Methodology

The Town shall systematically and progressively observe, sample, and evaluate all **key junction manholes** to locate evidence of illicit discharges. Key junction manholes are defined as junction manholes that can represent one or more junction manholes without compromising adequate implementation of the illicit discharge program. A junction manhole is defined as a manhole or manhole structure with two or more inlets accepting flow from two or more MS4 alignments. The schedule to complete catchment investigations, including key junction manhole investigations, depends on the catchment priority ranking as updated after dry weather screening.

The Town will begin at the most downstream key junction manhole (nearest to the outfall) and work upstream. Catchment investigations will be done in dry weather. For manhole inspections, the Town will rely on in situ water quality screening (refer to Mendon's Sampling Protocol and Chapter 13 of the Center for Watershed Protection IDDE Manual in **Appendix D**). A sample will be collected only if field screening indicates a possible illicit discharge. Laboratory analysis will include parameters identified in Mendon's Sampling Protocol in **Appendix D** depending on receiving water.

Where water quality screening, sampling results, and/or visual and olfactory observations indicate a potential illicit discharge, the upstream area will be flagged for additional investigation and/or isolation and confirmation of sources.

6.2.3 Procedures to Isolate and Confirm Sources

Chapter 13 of the Center for Watershed Protection IDDE Manual, "Tracking Discharges to a Source" is included in **Appendix D.** The Town will use this chapter as a guide for isolating and confirming sources of illicit discharges.

6.3 Catchment Investigation Timeline

According to the 2016 permit section 2.3.4.8.a, the following schedule is applicable to the Town of Mendon's investigation of catchments.

- A written catchment investigation procedure shall be developed within 18 months from the effective date of the permit (December 30, 2019) upon completion of Priority Ranking, including the identification of key junction manholes.

- Investigations associated with **Problem** outfalls shall begin within two years from the effective date of the permit (June 30, 2020).
- Investigations of catchments associated with **Low** and **High Priority** outfalls shall follow the ranking of outfalls.
- Investigations of catchments associated with **Problem** outfalls shall be completed within seven years from the effective date of the permit (June 30, 2025).
- Investigations of catchments where any information gathered on the outfall/interconnection identifies sanitary flow shall be completed within seven years from the effective date of the permit (June 30, 2025).
- Investigations of catchments associated with all **Problem, High- and Low-Priority** outfalls shall be completed within 10 years from the effective date of the permit (June 30, 2028).

6.4 Action Plan

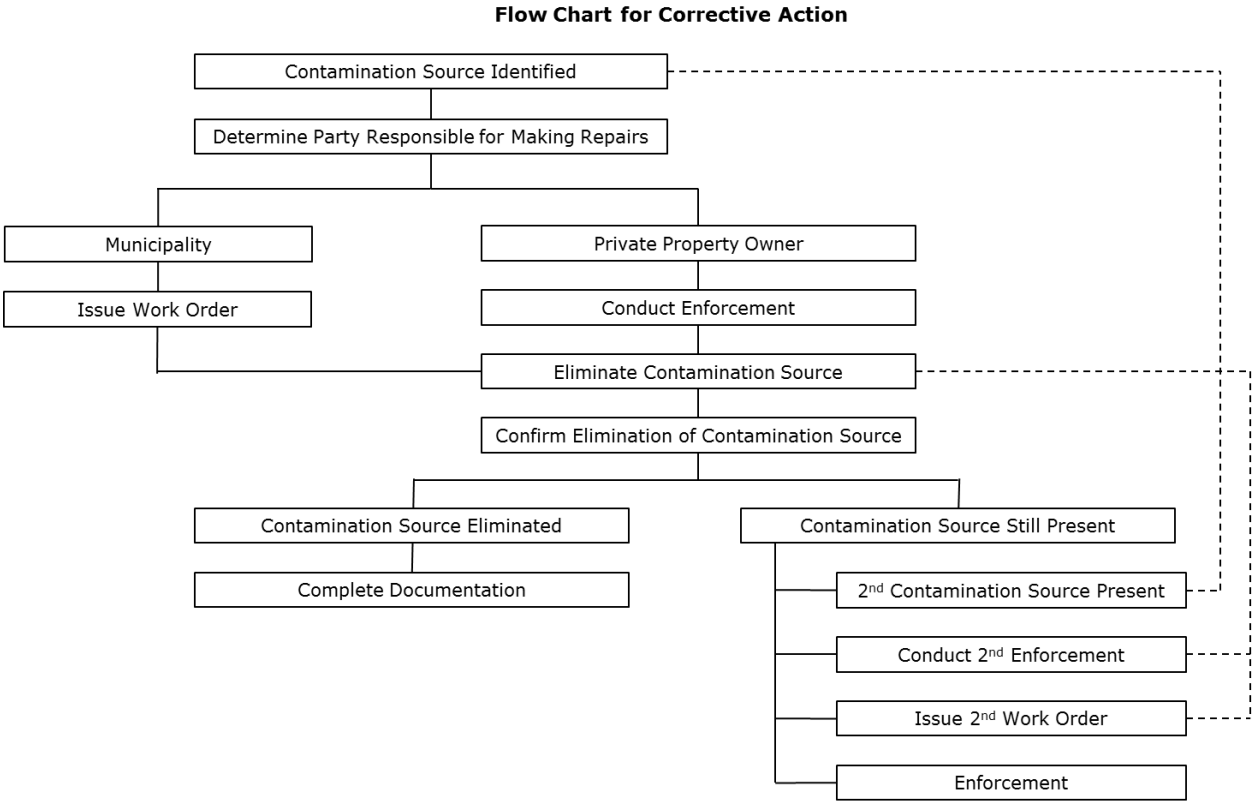
Action Items: Identification of Illicit Discharges	
1. Baseline Outfall and Interconnection Screening	The Town has completed dry weather screening and sampling (where flowing) for all outfalls. Mendon will continue conducting dry weather screening as new outfalls are added to the system. Catchments where screening indicates possible sanitary flow shall be ranked at the top of the **High Priority Catchments** category for investigation.
2. Identify Key Junction Manholes	The Town must identify **key junction manholes**, as defined in the General Permit, within each catchment area beginning with **Problem** and **High Priority Catchments**. To the extent allowed, the Town should minimize the number of **key junction manholes. Key junction manholes should be included in the Catchment Investigation Procedure within 18 months of the effective date of the permit.**
3. Develop and Implement Catchment Investigation Procedure	The Town will develop and implement the Catchment Investigation Procedure described in Section 6.2 according to EPA's prioritization and schedule outlined in the *Program Implementation Goals and Milestones* section of the final Massachusetts Small MS4 General Permit. Documentation that tracks progress towards these goals should be kept in **Appendix H;** large reports may be filed separately.
4. Ongoing Manhole Investigations and Outfall Monitoring Program	The Town will continue to perform dry and wet weather outfall and interconnection screening required in the General Permit in conjunction with the Catchment Investigation Procedure, such as confirmatory screenings and follow-up screenings. Documentation for Outfall Screening and Sampling should be added to **Appendix E** as it is available.

Section 7 Removal and Confirmation

7.1 Removal of Illicit Discharges

Most corrective actions for an illicit discharge, once isolated, will involve some kind of infrastructure modification or repair. Structural repairs can range from simple plumbing projects to replacement of septic systems. Non-structural repairs may also eliminate illicit discharges, such as establishing proper spill containment and clean-up procedures. A process for addressing illicit discharges that focuses on identifying the responsible party and enforcement procedures is presented the *Flow Chart for Corrective Action* below.[2]

Figure 2:



7.1.1 Enforcement Procedures for Private Property Owners

Upon confirmation of an illicit discharge and/or an illicit connection originating from a private property, the Mendon Highway Surveyor or his/her designee will coordinate enforcement action. In most cases, the Highway Department will carry out the enforcement, but the Highway Surveyor may refer a matter to the Board of Health if the

[2] Section 7.1 text and flow chart are adapted from the Center for Watershed Protection's 2004 *Illicit Discharge Detection and Elimination* guidance manual.

nature of the illicit discharge is such that the Board of Health is better equipped to address the issue (for example, a failing septic system).

The power of the Highway Department to carry out enforcement of the *Non-Storm Water* Bylaw is set forth in Section 11.1 of the Bylaw.

7.1.2 Reporting to EPA

For each confirmed source the Town shall include in the Annual Report the following information: 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, and an estimate of the volume of flow removed.

7.2 Confirmation Screening

Within one year of removal of all identified illicit discharge, confirmatory outfall or interconnection, screening shall be conducted according to the General Permit requirements. The confirmatory screening shall be conducted in dry weather unless System Vulnerability Factors have been identified in the catchment, in which case both dry weather and wet weather confirmatory screening shall be conducted. If confirmatory screening indicates evidence of additional illicit discharges, the catchment shall be scheduled for additional investigation. Confirmatory screening is not required in catchments where no illicit discharges or System Vulnerability Factors have been identified and no previous screening indicated suspicious flows.

7.3 Ongoing Screening

Upon completion of catchment investigation and illicit discharge removal and confirmation (if necessary) pursuant to this Section, EPA requires that "each outfall or interconnection shall be reprioritized for screening in accordance with part 2.3.4.8.a and scheduled for ongoing screening once every five years." Follow-up screening shall consist of dry weather screening and sampling except that wet weather screening and sampling shall also be required in catchments where wet weather screening was previously required.

7.4 Action Plan

Action Items: Removal and Confirmation	
1. Follow Protocol and Document Actions	If an illicit connection or discharge is discovered, it is critical that the Town carefully adhere to protocol for removal, enforcement, and documentation described in this section and in the General Permit.

Section 8 Illicit Discharge Prevention Procedures

Elimination and ongoing prevention is the ultimate goal of the IDDE program. This section describes Mendon's Public Response System for collecting and responding to resident reports of potential illicit discharges and employee training for illicit discharge detection and reporting. Further information on public education related to illicit discharges is included in the Town's Stormwater Management Plan.

8.1 Public Response System

The Town of Mendon will create a system to properly respond to citizen's pollution complaints. The system will include:

- Establishing and maintaining a public complaint hotline at the Highway Department
- Tracking the following information from public complaints:
  - name of reporting citizen, if willing to give (anonymous reports will be accepted)
  - date and time of call
  - location of the problem area
  - description of the problem
  - proposed response action (i.e., who will inspect, etc.)
- Providing follow-up notifications and making a summary of corrective actions available to the reporting citizen

Training Highway staff and contractors that clean catch basins is a cost-efficient way to identify and report illicit discharges.

8.2 Annual Employee Training

The Town shall, at a minimum, annually provide training to employees involved in the IDDE program, including how to recognize illicit discharges and procedures to detect and eliminate illicit discharges in accordance with this Plan. Town employees, particularly those that spend time doing site visits and drain system inspections, should be trained. Town departments that should receive training include, but are not limited to, Highway Department, Planning, Conservation, Parks and Recreation, and Board of Health. The Town shall report on the frequency and type of employee training in the Annual Report and include a log of employee trainings in **Appendix G**. Trainings can be either conducted for Mendon staff only or key Town personnel may attend outside training to meet this requirement.

Training may include the following topics:

- Definition of an illicit discharge and an illicit connection

- Techniques for finding and identifying illicit discharges, illicit connections and evidence of failing septic systems, including:
    - Visual inspection
    - Screening for high bacteria levels
    - Public complaints
- Techniques for sampling, analyzing, and recording water quality data
- Dye-tracing or smoke-tracing methods to locate an outfall or point source
- Methods for reporting illicit discharges and connections when detected
- Recognizing naturally occurring phenomena and their sources (bacterial sheens, slimes and films, bryozoans, pollen, blue-green algae and green algae, tannins and foams)
- Methods and procedures for eliminating the illicit discharges and connections, including:
    - Removing illicit connections
    - Educating the discharger to prevent future illicit discharges
    - Tracking the actions taken to eliminate the illicit discharges

8.3 Action Plan

Action Items: Illicit Discharge Prevention Procedures	
1. Maintain Public Response System	The Town of Mendon plans to maintain the public response system to receive and respond to reports of potential illicit discharges from residents.
2. Conduct Annual IDDE Employee Training	The Town of Mendon must conduct annual employee training on illicit discharge identification, reporting and elimination. Training topics are discussed in Section 8.2. Logs of employee training should be included in **Appendix G**. The IDDE training can be periodically combined with other required training topics, such as good housekeeping, pollution prevention and health and safety. The Town may rely on EPA or MassDEP sponsored training events as well as regional training.

Section 9 Evaluation of IDDE Program Progress and Reporting

The Town shall evaluate and report the overall effectiveness of the program based on the tracking indicators in the annual report.

Section 2.3.4.9 of the 2016 permit includes the following minimum indicators for tracking of program success:

- The number of illicit discharges identified and removed,
- The number and percent of total outfall catchments served by the MS4 evaluated using the catchment investigation procedure,
- All dry weather and wet weather screening and sampling results and
- The volume of sewage removed.

Records must be kept for at least five years per Section 4.2.a of the Permit. Records under the IDDE Program include information used in the development of the written (hardcopy or electronic) IDDE Program, any monitoring results, copies of reports, records of screening, follow-up and elimination of illicit discharges; maintenance records; and inspection records.

9.1 Reporting

All outfall results shall be documented and reported on annually in the Annual reports. Outfall monitoring results shall include the date, outfall or interconnection identifier, location, weather conditions at time of sampling, precipitation in previous 48 hours, field screening parameter results and results of all analyses. Results of any other stormwater or receiving water quality monitoring or studies conducted during the reporting period where that data is being used by the Town to inform permit compliance or program effectiveness shall also be reported on in the annual report according to Section 4.3 of the permit.

In addition, the Town must report on the activities related to implementation of the IDDE Program in their annual reports according to section 4.4.b.iv of the permit. These activities include: status of the map, status and results of the illicit discharge potential ranking and assessment, identification of **Problem Catchments**, status of all protocols described in part 2.3.4 of the permit (program responsibilities and systematic procedure), number and identifier of catchments evaluated, number and identifier of outfalls screened, number of illicit discharges located, number of illicit discharges removed, gallons of flow removed, identification of tracking indicators and measures of progress based on those indicators and employee training.

9.2 Action Plan

Action Items: Evaluation of IDDE Program	
1. Track Indicators of Program Success	The Town will track the indicators of Program Success, as listed above and report on them annually. The Town may include additional tracking indicators to aid in the annual evaluation.
2. Record Keeping	The Town will keep records of all IDDE activities in the Highway Department office. The majority of IDDE records will be maintained electronically and in **Appendix H** to this Plan, though large reports may be filed separately. Record keeping requirements are described in this Plan, and will include: • Outfall Inventory updates: dates, outfall location/ID, field observations. • Outfall Monitoring: dates, outfall location/ID, field observations, in situ and laboratory results, precipitation previous 48 hours. • Location, structure ID, pollutant of concern for suspected illicit discharges. • Log of follow-up activities to confirm and then locate illicit discharge – dates, locations, personnel, actions. • A log of phone calls and complaints received regarding suspected illicit connections and other storm drain issues. Note actions taken and dates. • Employee Training Log • Information used in the development of the IDDE Program. • Inspection and maintenance records.
3. Annual Evaluation of Program Effectiveness	The Town will annually summarize and evaluate IDDE Program progress based on the EPA's requirements and tracking indicators in the Annual Report to the EPA and MassDEP.

Section 10 Implementation and Schedule

10.1 Implementation of the IDDE Program

Implementation of the IDDE program will follow the schedule below. This schedule will be updated annually as requirements are completed.

Program Requirement	IDDE Plan Section	Deadline
Complete Phase I Mapping	Section 2	June 30, 2020
Complete Dry Weather Outfall Screening	Section 6.1	June 30, 2021
Annual Employee IDDE Training	Section 8.2	Annually by June 30 Include record of training in Appendix F
Complete Catchment Investigation Procedure, including identification of Key Junction Manholes and include as Appendix to IDDE Plan	Section 6.2	December 30, 2019
Begin Catchment Investigations of Problem Outfalls	Section 6.2	June 30, 2020
Continue Confirmatory and Follow-up Outfall Screening as Needed During Catchment Investigations	Section 6	As needed
Complete Final Outfall Ranking	Section 5.1	June 30, 2021
Follow protocol for confirmation and removal of illicit discharges	Section 7	Ongoing

Appendix A

Non-Storm Water Discharges Bylaw

CHAPTER XXIII - Non-Storm Water Discharge

Section 1. Purpose

The purpose of this Bylaw is to regulate illicit connections and discharges to the storm water system, which is necessary for the protection of the Town's water bodies and groundwater, and to safeguard the environment and public health, safety, and welfare.

The objectives of this Bylaw are:

To prevent pollutants from entering the Town's municipal separate storm water system (MS4);
To prohibit illicit connections and unauthorized discharges to the MS4;
To require the removal of all such illicit connections;
To comply with state and federal statutes and regulations relating to stormwater discharges;
To establish the legal authority to ensure compliance with the provisions of this Bylaw through inspection, monitoring, and enforcement; and
To prevent contamination of drinking water supplies.

Section 2. Authority

In accordance with the Home Rule Amendment and in partial fulfillment of the obligations of the Town under the Clean Water Act (33 U.S.C. 1251 & Sec.) and under the Town's National Pollutant Discharge Elimination System Storm Water Permit, the Town hereby establishes a comprehensive and fair system of regulation of Discharge to the Town's Municipal Separate Storm Water System (MS4).

Section 3. Responsibility for Administration

The Highway Department shall administer, implement and enforce this bylaw. Any powers granted to or duties imposed upon the Highway Department may be delegated in writing by the Highway Surveyor to employees or agents of the Highway Department.

Section 4. Definitions

For the purposes of this Bylaw, the following shall mean:

Section 4.1 *Authorized Enforcement Agency*: The Highway Department, its employees or agents designated to enforce this Bylaw.

Section 4.2 *Best Management Practice (BMP)*: An activity, procedure, restraint, or structural improvement that helps to reduce the quantity or improve the quality of stormwater runoff.

Section 4.3 *Clean Water Act*: The Federal Water Pollution Control Act (33 U.S.C. § 1251 et seq.) as hereafter amended.

Section 4.4 *Discharge of Pollutants*: The addition from any source of any pollutant or combination of pollutants into storm drain systems or into the waters of the United States or Commonwealth from any source.

Section 4.5 *Groundwater*: All water beneath the surface of the ground.

Section 4.6 *Illegal Discharge*: Any direct or indirect non-stormwater discharge to storm drain systems, except as specifically exempted in Section 6.

Section 4.7 *Illicit Connection*: Any surface or subsurface drain or conveyance, which allows an illegal discharge into storm drain systems. Illicit connections include conveyances which allow a non-stormwater discharge to storm drain systems including sewage, process wastewater or wash water and any connections from indoor drains, sinks, or toilets, regardless of whether said connection was previously allowed, permitted or approved before the effective date of this bylaw.

Section 4.8 *Impervious Surface*: Any material or structure on or above the ground that prevents water from infiltrating the underlying soil.

Section 4.9 *Municipal separate storm water system* (MS4) or *Municipal Storm Drain System*: The system of conveyances designed or used for collecting or conveying stormwater, including any road with a drainage system, street, gutter, curb, inlet, piped storm drain, pumping facility, retention or detention basin, natural or man-made or altered drainage channel, reservoir, and other drainage structure that together comprise the storm drainage system owned or operated by the Town.

Section 4.10 *National Pollutant Discharge Elimination System* (NPDES) *Storm Water Discharge Permit*: A permit issued by the United States Environmental Protection Agency or jointly with the State that authorizes the discharge of pollutants to waters of the United States (Massachusetts Department of Environmental Protection).

Section 4.11 *Non-Stormwater Discharge*: Any discharge to the storm drain systems not composed entirely of stormwater.

Section 4.12 *Person*: Any individual, partnership, association, firm, company, trust, corporation, and, any agency, authority, department or political subdivision of the Commonwealth or the federal government, to the extent permitted by law, and any officer, employee, or agent of such person.

Section 4.13 *Pollutant*: Any element or property of sewage, industrial or commercial waste, runoff, leachate, heated effluent, or other matter whether originating at a point or nonpoint source, that is or may be introduced into any sewage treatment works or waters of the Commonwealth. Pollutants shall include:

1) Paints, varnishes, and solvents;
2) Oil and other automotive fluids;
3) Non-hazardous liquid and solid wastes and yard wastes;
4) Refuse, rubbish, garbage, litter, or other discarded or abandoned objects, accumulations and floatables;
5) Hazardous materials and wastes; sewage, fecal coliform and pathogens;
6) Dissolved and particulate metals;
7) Rock, sand and soils;
8) Construction wastes and residues;
9) And noxious or offensive matter of any kind.

Section 4.14 *Process wastewater*: any water which, during manufacturing or processing, comes into direct contact with or results from the production or use of any material, intermediate product, finished product, or waste product.

Section 4.15 *Recharge*: The process by which groundwater is replenished by precipitation through the percolation of runoff and surface water through the soil.

Section 4.16 *Stormwater*: Runoff from precipitation or snow melt.

Section 4.17 *Storm Drain System*: The system of conveyances designed or used for collecting or conveying stormwater, including any road with a drainage system, street, gutter, curb, inlet, piped storm drain, pumping facility, retention or detention basin, natural or manmade or altered drainage channel, reservoir, and other drainage structure that together comprise the storm drainage system on public or private ways within the Town.

Section 4.18 *Toxic* or *Hazardous Material* or *Waste*: Any material which, because of its quantity, concentration, chemical, corrosive, flammable, reactive, toxic, infectious or radioactive characteristics, either separately or in combination with any substance or substances, constitutes a present or potential threat to human health, safety, welfare, or to the environment. Toxic or hazardous materials include any synthetic organic chemical, petroleum product, heavy metal, radioactive or infectious waste, acid and alkali, and any substance defined as Toxic or Hazardous under G.L. Ch. 21C and Ch. 21E, and the regulations at 310 CMR 30.000 and 310 CMR 40.000.

Section 4.19 *Uncontaminated*: Water containing no pollutants.

Section 4.20 *Watercourses*: A natural or man-made channel through which water flows or a stream of water, including a river, brook or underground stream.

Section 4.21 *Waters of the Commonwealth*: All waters within the jurisdiction of the Commonwealth, including, without limitation, rivers, streams, lakes, ponds, springs, impoundments, estuaries, wetlands, coastal waters, and groundwater.

Section 4.22 *Wastewater*: any sanitary waste, sludge, or septic tank or cesspool overflow, and water that during manufacturing, cleaning or processing, comes into direct contact with or results from the production or use of any raw material, intermediate product, finished product, byproduct or waste product.

Section 5. Applicability

This Bylaw shall apply to flows entering the municipally owned storm water and drainage system on public or private ways within the Town.

Section 6. Regulations

The Highway Department may promulgate rules, regulations and a permitting process to effectuate the purposes of this Bylaw. Failure by the Highway Dept. to promulgate such rules and regulations shall not have the effect of suspending or invalidating this Bylaw.

Section 7. Prohibited Activities

Section 7.1 Illegal Discharges

No person shall dump, discharge, cause or allow to be discharged any pollutant or non-stormwater discharge into storm drain systems, watercourse, or into the waters of the Commonwealth.

Section 7.2 Illicit Connections

No person shall construct, use, allow, maintain or continue any illicit connection to storm drain systems, regardless of whether the connection was permissible under applicable law, regulation or custom at the time of connection.

Section 7.3 Obstruction of the Storm Drain Systems

No person shall obstruct or interfere with the normal flow of stormwater into or out of storm drain systems without prior approval from the Highway Department or its designated agent.

Section 7.4 Exemptions

This Bylaw shall not apply to any of the following non-stormwater discharges or flows provided that the source is not a significant contributor of a pollutant to storm drain systems:

Municipal waterline flushing;
Discharges from landscape irrigation or lawn watering;
Water from individual residential vehicle washing and temporary fund-raising car wash events;
Discharges from dechlorinated swimming pool water provided it is allowed to stand for one week prior to draining, or tested for chlorine levels with a pool test kit prior to draining (less than one parts per million chlorine), and the pool is drained in such a way as not to cause a nuisance;
Discharges from street sweepers of minor amounts of water during operations;
Discharges or flows resulting from fire fighting activities;
Non-stormwater discharges permitted under an NPDES permit, waiver, or waste discharge order administered under the authority of the United States Environmental Protection Agency, provided that the discharge is in full compliance with the requirements of the permit, waiver, or order and applicable laws and regulations.

Section 8. Exemptions With Verbal Notification To Highway Department

This section shall apply to any of the following non-stormwater discharges or flows provided that the source is not a significant contributor of a pollutant to storm drain systems, provided that verbal notification is received by the Highway Surveyor or his designee:

a. Uncontaminated groundwater discharge from a sump pump, with a permit from the Highway Department;
b. Water from exterior foundation drains, footing drains (not including active groundwater dewatering systems, such as dewatering excavations for foundation or pipelines), crawl space pumps, or air conditioning condensation;
c. Dye testing, provided verbal notification is given to the Highway Department prior to the time of the test.

Section 9. Suspension Of Storm Drainage System Access

Section 9.1 Emergency Suspension of Storm Drainage System

The Highway Department may suspend storm drain access to any person or property without prior written notice when such suspension is necessary to stop an actual or threatened illegal discharge that presents or may present imminent risk of harm to the public health, safety, welfare or the environment. In the event any person fails to comply with an emergency suspension order, the Authorized Enforcement Agency may take all reasonable steps to prevent or minimize harm to the public health, safety, welfare or the environment.

Section 9.2 Removal of Illicit Connections

Any person discharging to a municipal storm drain system in violation of this bylaw may have their storm drain system access terminated if such termination would abate or reduce an illicit discharge. The Highway Department will notify a violator of the proposed termination of storm drain system access. The violator may petition the Highway Department for reconsideration and hearing. A person commits an offense if the person reinstates storm drain system access to premises terminated pursuant to this section, without prior approval from the Highway Department.

Section 10. Notification Of Spills

Notwithstanding any other requirements of local, state or federal law, as soon as any person responsible for a facility or operation, or responsible for emergency response for a facility or operation has information of any known or suspected release of materials at that facility or operation which is resulting or may result in illegal discharge of pollutants, that person shall take all necessary steps to ensure containment, and cleanup of the release. In the event of a release of oil or hazardous materials, the person shall immediately notify the municipal fire and police departments, Highway Department and Board of Health. In the event of a release of non-hazardous material, said person shall notify the Authorized Enforcement Agency no later than the next business day. Written confirmation of all telephone, facsimile or in person notifications shall be provided to the Authorized Enforcement Agency within three business days thereafter. If the discharge of prohibited materials is from a commercial or industrial facility, the facility owner or operator of the facility shall retain on-site written record of the discharge and the actions taken to prevent its recurrence. Such records shall be retained for at least three years.

Section 11. Enforcement

Section 11.1 The Highway Department or its authorized agent shall enforce this Bylaw, and the regulations promulgated hereunder, as well as the terms and conditions of all permits, notices, and orders, and may pursue all civil and criminal remedies for such violations.

Section 11.2 Civil Relief

If anyone violates the provisions of this Bylaw, regulations, permit, notice, or order issued hereunder, the Highway Department may seek injunctive relief in a court of competent jurisdiction to restrain the person from activities, which would create further violations or compelling the person to abate or remedy the violation.

Section 11.3 Orders

The Highway Department may issue a written order to enforce the provisions of this Bylaw or the regulations hereunder, which may include: (a) elimination of illicit connections or discharges to the storm drainage system; (b) termination of access to the storm drainage system; (c) performance of monitoring, analyses, and reporting; (d) cessation of unlawful discharges, practices, or operations; and (e) remediation of contamination in connection herewith. If the Highway Department determines that abatement or remediation of contamination is required, the order shall set forth a deadline for completion of the abatement or remediation. Said order shall further advise that, should the violator or property owner fail to abate or perform remediation within the specified deadline, the Town may, at its option, undertake such work, and expenses thereof shall be charged to the violator or property owner.

Within thirty (30) days after completing all measures necessary to abate the violation or to perform remediation, the violator and the property owner will be notified of the costs incurred by the Town, including administrative costs. The violator or property owner may file a written protest objecting to the amount or basis of costs with the Highway Department within thirty (30) days of receipt of the notification of the costs incurred. If the amount due is not received by the expiration of the time in which to file a protest or within thirty (30) days following a decision of the Highway Department affirming or reducing the costs, or from a final decision of a court of competent jurisdiction, the costs shall become a special assessment against the property owner and shall constitute a lien on the owner's property for the amount of said costs. Interest shall begin to accrue on any unpaid costs at the statutory rate provided in G.L. Chapter 59, § 57 after the thirty-first day at which the costs first become due.

Section 11.4 Non-Criminal Disposition

The Town may elect to utilize the non-criminal disposition procedure set forth in G.L. Chapter 40, § 21D. The Highway Department shall be the enforcing entity. The penalty for the 1st violation is $100.00. The penalty for the 2nd violation is $200.00. The penalty for the 3rd and subsequent violations shall be $300.00. Each day or part thereof that such violation occurs or continues shall constitute a separate offense.

Section 11.5 Criminal and Civil Penalties

Any person who violates any provision of this Bylaw, valid regulation, or the terms or conditions in any permit or order prescribed or issued hereunder, shall be subject to a fine not to exceed $300.00 for each day such violation occurs or continues or subject to a civil penalty, which may be assessed in an action brought on behalf of the Town in any court of competent jurisdiction.

Section 11.6 Entry to Perform Duties under this Ordinance

To the extent permitted by state law, or if authorized by the owner or other party in control of the property, the Highway Department, its agents, officers, and employees may enter upon privately owned property for the purpose of performing their duties under this Bylaw and regulations and may make or cause to be made such examinations, surveys or sampling as the Highway Department deems reasonably necessary.

Section 11.7 Appeals

The decisions or orders of the Highway Department shall be final. Further relief shall be to a court of competent jurisdiction.

Section 11.8 Remedies Not Exclusive

The remedies listed in this Bylaw are not exclusive of any other remedies available under any applicable federal, state or local law.

Section 12. Severability

If any provision, paragraph, sentence, or clause, of this Bylaw shall be held invalid for any reason, all other provisions shall continue in full force and effect.

Section 13. Transitional Provisions

Residential property owners shall comply with this Bylaw on a schedule set forth in the Highway Department compliance order, but such property owners shall have no more than eighteen months from the effective date of the Bylaw to comply with its provisions, unless good cause is shown for the failure to comply with the Bylaw during that period.

Appendix B

2016 MS4 General Permit Relevant Sections

c. The permittee shall report on the activities undertaken to provide public participation opportunities including compliance with part 2.3.3.a. Public participation opportunities pursuant to part 2.3.3.b may include, but are not limited to, websites; hotlines; clean-up teams; monitoring teams; or an advisory committee.

2.3.4. Illicit Discharge Detection and Elimination (IDDE) Program

Objective: The permittee shall implement an IDDE program to systematically find and eliminate sources of non-stormwater discharges to its municipal separate storm sewer system and implement procedures to prevent such discharges.

a. Legal Authority - The IDDE program shall include adequate legal authority to:: prohibit illicit discharges; investigate suspected illicit discharges; eliminate illicit discharges, including discharges from properties not owned by or controlled by the MS4 that discharge into the MS4 system; and implement appropriate enforcement procedures and actions. Adequate legal authority consists of a currently effective ordinance, by-law, or other regulatory mechanism. For permittees authorized by the MS4-2003 permit, the ordinance, by-law, or other regulatory mechanism was a requirement of the MS4-2003 permit and was required to be effective by May 1, 2008. For new permittees the ordinance, by-law, or other regulatory mechanism shall be in place within 3 years of the permit effective date.
b. During the development of the new components of the IDDE program required by this permit, permittees authorized by the MS4-2003 permit must continue to implement their existing IDDE program required by the MS4-2003 permit to detect and eliminate illicit discharges to their MS4.

2.3.4.1. Definitions and Prohibitions

The permittee shall prohibit illicit discharges and sanitary sewer overflows (SSOs) to its MS4 and require removal of such discharges consistent with parts 2.3.4.2 and 2.3.4.4 of this permit.

An SSO is a discharge of untreated sanitary wastewater from a municipal sanitary sewer.

An illicit discharge is 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.

2.3.4.2. Elimination of Illicit Discharges

a. Upon detection of an illicit discharge, the permittee shall locate, identify and eliminate the illicit discharge as expeditiously as possible. Upon identification of the illicit source the MS4 notify all responsible parties for any such discharge and require immediate cessation of improper disposal practices in accordance with its legal authorities. Where elimination of an illicit discharge within 60 days of its identification as an illicit discharge is not possible, the permittee shall establish an expeditious schedule for its elimination and report the dates of identification and schedules for removal in the permittee's annual reports. The permittee shall immediately commence actions necessary for elimination. The permittee shall diligently pursue elimination of all illicit discharges. In the interim, the permittee shall take all reasonable and prudent measures to minimize the discharge of pollutants to and from its MS4.

b. The period between identification and elimination of an illicit discharge is not a grace period. Discharges from an MS4 that are mixed with an illicit discharge are not authorized by this Permit (part 1.3.a) and remain unlawful until eliminated.

2.3.4.3. Non-Stormwater Discharges

The permittee may presume that the sources of non-stormwater listed in part 1.4 of this permit need not be addressed. However, if the permittee identifies any of these sources as significant contributors of pollutants to the MS4, then the permittee shall implement measures to control these sources so they are no longer significant contributors of pollutants, and/or eliminate them entirely, consistent with part 2.3.4.

2.3.4.4. Sanitary Sewer Overflows

a. Upon detection of an SSO the permittee shall eliminate it as expeditiously as possible and take interim mitigation measures to minimize the discharge of pollutants to and from its MS4 until elimination is completed.

b. The permittee shall identify all known locations where SSOs have discharged to the MS4 within the previous five (5) years. This shall include SSOs resulting, during dry or wet weather, from inadequate conveyance capacities, or where interconnectivity of the storm and sanitary sewer infrastructure allows for communication of flow between the systems. Within one (1) year of the effective date of the permit, the permittee shall develop an inventory of all identified SSOs indicating the following information, if available:

1. Location (approximate street crossing/address and receiving water, if any);
2. A clear statement of whether the discharge entered a surface water directly or entered the MS4;
3. Date(s) and time(s) of each known SSO occurrence (i.e., beginning and end of any known discharge);
4. Estimated volume(s) of the occurrence;
5. Description of the occurrence indicating known or suspected cause(s);
6. Mitigation and corrective measures completed with dates implemented; and
7. Mitigation and corrective measures planned with implementation schedules.

The permittee shall maintain the inventory as a part of the SWMP and update the inventory annually, all updates shall include the information in part 2.3.4.4.b.1-7.

c. In accordance with Paragraph B.12 of Appendix B of this permit, upon becoming aware of an SSO to the MS4, the permittee shall provide oral notice to EPA within 24 hours. Additionally, the permittee shall provide written notice to EPA and MassDEP within five (5) days of becoming aware of the SSO occurrence and shall include the information in the updated inventory. The notice shall contain all of the information listed in part 2.3.4.4.b. Where common notification requirements for SSOs are included in multiple NPDES permits issued to a permittee, a single notification may be made to EPA as directed in the permittee's wastewater or CSO NPDES permit and constitutes compliance with this part.

d. The permittee shall include and update the SSO inventory in its annual report, including the status of mitigation and corrective measures implemented by the permittee to address each SSO identified pursuant to this part.

e. The period between detection and elimination of a discharge from the SSO to the MS4 is not a grace period. Discharges from an MS4 that are mixed with an SSO are not authorized by this Permit (part 1.3.a) and remain unlawful until eliminated.

2.3.4.5. System mapping

The permittee shall develop a revised and more detailed map than was required by the MS4-2003 permit. This revised map of the MS4 shall be completed in two phases as outlined below. The mapping shall include a depiction of the permittee's separate storm sewer system in the permit area. The mapping is intended to facilitate the identification of key infrastructure and factors influencing proper system operation, and the potential for illicit sanitary sewer discharges.

a. Phase I: The system map shall be updated within two (2) years of the permit effective date to include the following information:

- Outfalls and receiving waters (required by MS4-2003 permit)
- Open channel conveyances (swales, ditches, etc.)
- Interconnections with other MS4s and other storm sewer systems
- Municipally-owned stormwater treatment structures (e.g., detention and retention basins, infiltration systems , bioretention areas, water quality swales, gross particle separators, oil/water separators, or other proprietary systems)
- Waterbodies identified by name and indication of all use impairments as identified on the most recent EPA approved Massachusetts Integrated List of waters report pursuant to Clean Water Act section 303(d) and 305(b)
- Initial catchment delineations. Any available system data and topographic information may be used to produce initial catchment delineations. For the purpose of this permit, a catchment is the area that drains to an individual outfall or interconnection.

b. Phase II: The system map shall be updated annually as the following information becomes available during implementation of catchment investigation procedures in part 2.3.4.8. This information must be included in the map for all outfalls within ten (10) years of the permit effective date:
- 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 (if available)
- Municipal combined sewer system (if applicable).

c. Recommended elements to be included in the system map as information becomes available:
- Storm sewer material, size (pipe diameter) and age
- Sanitary sewer system material, size (pipe diameter) and age
- Privately-owned stormwater treatment structures
- Where a municipal sanitary sewer system exists, properties known or suspected to be served by a septic system, especially in high-density urban areas
- Area where the permittee's MS4 has received or could receive flow from septic system discharges (e.g., areas with poor soils, or high ground water elevations unsuitable for conventional subsurface disposal systems)
- 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 corrected illicit discharges (with dates and flow estimates).

d. The mapping may be produced by hand or through computer-aided methods (e.g. GIS). The required scale and detail of the map shall be appropriate to facilitate a rapid understanding of the system by the permittee, EPA and the state. In addition, the mapping shall serve as a planning tool for the implementation and phasing of the IDDE program and demonstration of the extent of complete and planned investigations and corrections. The permittee shall update the mapping as necessary to reflect newly discovered information and required corrections or modifications.

e. The permittee shall report on the progress towards the completion of the system map in each annual report.

2.3.4.6. Written Illicit Discharge Detection and Elimination Program

The IDDE program shall be recorded in a written (hardcopy or electronic) document. The IDDE program shall include each of the elements described in parts 2.3.4.7 and part 2.3.4.8, unless the permittee provides a written explanation within the IDDE program as to why a particular element is not applicable to the permittee.

Notwithstanding the permittee's explanation, EPA may at any time determine that a particular element is in fact applicable to the permittee and require the permittee to add it to the IDDE program. The written (hardcopy or electronic) IDDE program shall be completed within one (1) year of the effective date of the permit and updated in accordance with the milestones of this part. The permittee shall implement the IDDE program in accordance with the goals and milestones contained in this part.

a. The written (hardcopy or electronic) IDDE program shall include a reference or citation of the authority the permittee will use to implement all aspects of the IDDE program.
b. Statement of IDDE Program Responsibilities - The permittee shall establish a written (hardcopy or electronic) statement that clearly identifies responsibilities with regard to eliminating illicit discharges. The statement shall identify the lead municipal agency(ies) or department(s) responsible for implementing the IDDE Program as well as any other agencies or departments that may have responsibilities for aspects of the program (e.g., board of health responsibilities for overseeing septic system construction; sanitary sewer system staff; inspectional services for enforcing plumbing codes; town counsel responsibilities in enforcement actions, etc.). Where multiple departments and agencies have responsibilities with respect to the IDDE program specific areas of responsibility shall be defined and processes for coordination and data sharing shall be established and documented.

c. Program Procedures – The permittee shall include in the written IDDE program all written procedures developed in accordance with the requirements and timelines in parts 2.3.4.7 and 2.3.4.8 below. At a minimum this shall include the written procedures for dry weather outfall screening and sampling and for catchment investigations.

2.3.4.7. Assessment and Priority Ranking of Outfalls/Interconnections

The permittee shall assess and priority rank the outfalls in terms of their potential to have illicit discharges and SSOs and the related public health significance. This ranking will determine the priority order for

screening of outfalls and interconnections pursuant to part 2.3.4.7.b, catchment investigations for evidence of illicit discharges and SSOs pursuant to part 2.3.4.8, and provides the basis for determining permit milestones of this part.

a. Outfall/Interconnection Inventory and Initial Ranking:
An initial outfall and interconnection inventory and priority ranking to assess illicit discharge potential based on existing information shall be completed within one (1) year from the effective date of the permit; an updated inventory and ranking will be provided in each annual report thereafter. The inventory shall be updated annually to include data collected in connection with the dry weather screening and other relevant inspections conducted by the permittee.

i. The outfall and interconnection inventory will identify each outfall and interconnection discharging from the MS4, record its location and condition, and provide a framework for tracking inspections, screenings and other activities under the permittee's IDDE program.

- An outfall means a point source as defined by 40 CFR § 122.2 as the point where the municipal separate storm sewer discharges to waters of the United States. An outfall does not include open conveyances connecting two municipal separate storm sewers or pipes, tunnels or other conveyances that connect segments of the same stream or other waters of the United States and that are used to convey waters of the United States. (40 CFR § 122.26(b)(9)). However, it is strongly recommended that a permittee inspect all accessible portions of the system as part of this process. Culverts longer than a simple road crossing shall be included in the inventory unless the permittee can confirm that they are free of any connections and simply convey waters of the United States.
- An interconnection means the point (excluding sheet flow over impervious surfaces) where the permittee's MS4 discharges to another MS4 or other storm sewer system, through which the discharge is conveyed to waters of the United States or to another storm sewer system and eventually to a water of the United States.

ii. The permittee shall classify each of the permittee's outfalls and interconnections into one of the following categories:
- Problem Outfalls: 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.[4] Problem Outfalls need not be screened pursuant to part 2.3.4.7.b.
- High Priority Outfalls: 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: Outfalls/interconnections determined by the permittee as low priority based on the characteristics listed below or other available information.

[4] 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
- Ammoni a ≥ 0.5 mg/L, surfactants ≥ 0.25 mg/L, and detectable levels of chlorine.

- Excluded outfalls: outfalls/interconnections with no potential for illicit discharges may be excluded from the IDDE program. This category is limited to roadway drainage in undeveloped areas with no dwellings and no sanitary sewers; drainage for athletic fields, parks or undeveloped green space and associated parking without services; cross-country drainage alignments (that neither cross nor are in proximity to sanitary sewer alignments) through undeveloped land.

iii. The permittee shall priority rank outfalls into the categories above (except for excluded outfalls), based on the following characteristics of the defined initial catchment area where information is available:

- 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.
- 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 younger will probably have a low illicit discharge potential.
- Sewer conversion – contributing catchment areas that were once serviced by septic systems, but have been converted to sewer connections may have a high illicit discharge potential.
- Historic combined sewer systems – contributing areas that were once serviced by a combined sewer system, but have been separated may have a high illicit discharge potential.
- Surrounding density of aging septic systems – Septic systems thirty years or older in residential land use areas are prone to have failures and may have a high illicit discharge potential.
- Culverted streams – any river or stream that is culverted for distances greater than a simple roadway crossing may have a high illicit discharge potential.
- Water quality limited waterbodies that 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.
- The permittee may also consider additional relevant characteristics, including location-specific characteristics; if so, the permittee shall include the additional characteristics in its written (hardcopy or electronic) IDDE program.

b. Dry Weather Outfall and Interconnection Screening and Sampling

All outfalls/interconnections (excluding Problem and excluded Outfalls) shall be inspected for the presence of dry weather flow within three (3) years of the permit effective date. The permittee shall screen all High and Low Priority Outfalls in accordance with their initial ranking developed at part 2.3.4.7.a.

i. Written procedure: The permittee shall develop an outfall and interconnection screening and sampling procedure to be included in the IDDE program within one (1) year of the permit effective date. This procedure shall include the following procedures for:

- sample collection,
- use of field kits,

- storage and conveyance of samples (including relevant hold times), and
- field data collection and storage.

An example screening and sampling protocol (*EPA New England Bacterial Source Tracking Protocol*) can be found on EPA's website.

ii. Weather conditions: Dry weather screening and sampling shall proceed only when no more than 0.1 inches of rainfall has occurred in the previous 24-hour period and no significant snow melt is occurring.

iii. Screening requirements: For each outfall/interconnection:

1. The permittee shall record all of the following information and include it in the outfall/interconnection inventory and priority ranking:
    - unique identifier,
    - receiving water,
    - date of most recent inspection,
    - dimensions,
    - shape,
    - material (concrete, PVC),
    - spatial location (latitude and longitude with a minimum accuracy of +/-30 feet,
    - physical condition,
    - indicators of potential non-stormwater discharges (including presence or evidence of suspect flow and sensory observations such as odor, color, turbidity, floatables, or oil sheen).
2. If an outfall/interconnection is inaccessible or submerged, the permittee shall proceed to the first accessible upstream manhole or structure for the observation and sampling and report the location with the screening results.
3. If no flow is observed, but evidence of illicit flow exists, the permittee shall 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 (proceed as in iv. below).
4. Where dry weather flow is found at an outfall/interconnection, at least one (1) sample shall be collected, and:
    a) Samples shall be analyzed at a minimum for:
        - ammonia,
        - chlorine,
        - conductivity,
        - salinity,
        - *E. coli* (freshwater receiving water) or enterococcus (saline or brackish receiving water),
        - surfactants (such as MBAS),
        - temperature, and
        - pollutants of concern[5]
    b) All analyses with the exception of indicator bacteria and pollutants of concern can be performed with field test kits or field instrumentation and are not subject to 40

[5] Where the discharge is directly into a water quality limited water or a water subject to an approved TMDL as indicated in Appendix F; the sample shall be analyzed for the pollutant(s) of concern identified as the cause of the impairment as specified in Appendix G

CFR part 136 requirements. Sampling for bacteria and pollutants of concern shall be conducted using the analytical methods found in 40 CFR §136, or alternative methods approved by EPA in accordance with the procedures in 40 CFR §136. Sampling for ammonia and surfactants must use sufficiently sensitive methods to detect those parameters at or below the threshold indicator concentrations of 0.5 mg/L for ammonia and 0.25 mg/L for surfactants. Sampling for residual chlorine must use a method with a detection limit of 0.02 mg/L or 20 ug/L.

iv. The permittee may rely on screening conducted under the MS4-2003 permit, pursuant to an EPA enforcement action, or by the state or EPA to the extent that it meets the requirements of part 2.3.4.7.b.iii.4. All data shall be reported in each annual report. Permittees that have conducted substantially equivalent monitoring to that required by part 2.3.4.7.b as part of an EPA enforcement action can request an exemption from the requirements of part 2.3.4.7.b by submitting a written request to EPA and retaining exemption approval from EPA as part of the SWMP. Until the permittee receives formal written approval of the exemption from part 2.3.4.7.b from EPA the permittee remains subject to all requirements of part 2.3.4.7.b.

v. The permittee shall submit all screening data used in compliance with this part in its Annual Report.

c. Follow-up ranking of outfalls and interconnections:

i. The permittee's outfall and interconnection ranking (2.3.4.7.a) shall be updated to reprioritize outfalls and interconnections based on information gathered during dry weather screening (part 2.3.4.7.b).

ii. Outfalls/interconnections where relevant information was found indicating sewer input to the MS4 or sampling results indicating sewer input[6] shall be considered highly likely to contain illicit discharges from sanitary sources, and such outfalls/interconnections shall be ranked at the top of the High Priority Outfalls category for investigation. At this time, permittees may choose to rank other outfalls and interconnections based on any new information from the dry weather screening.

iii. The ranking can be updated continuously as dry weather screening information becomes available, but shall be completed within three (3) years of the effective date of the permit.

2.3.4.8. Catchment Investigations

The permittee shall develop a systematic procedure to investigate each catchment associated with an outfall or interconnection within their MS4 system.

a. Timelines:

- A written catchment investigation procedure shall be developed within 18 months of the permit effective date in accordance with the requirements of part 2.3.4.8.b below.
- Investigations of catchments associated with Problem Outfalls shall begin no later than two (2)

[6] 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.

years from the permit effective date.

- Investigations of catchments associated with High and Low Priority Outfalls shall follow the ranking of outfalls updated in part 2.3.4.7.c.
- Investigations of catchments associated with Problem Outfalls shall be completed with seven (7) years of the permit effective date
- Investigations of catchments where any information gathered on the outfall/interconnection identifies sewer input[7] shall be completed within seven (7) years of the permit effective date.
- Investigations of catchments associated with all Problem, High- and Low-Priority Outfalls shall be completed within ten (10) years of the permit effective date.

*For the purposes of these milestones, an individual catchment investigation will be considered complete if all relevant procedures in part 2.3.4.8.c. and 2.3.4.8.d. below have been completed.

b. A written catchment investigation procedure shall be developed that:

i. **Identifies maps, historic plans and records, and other sources of data**, including but not limited to plans related to the construction of the storm drain and of sanitary sewers, prior work performed on the storm drains or sanitary sewers, board of health or other municipal data on septic system failures or required upgrades, and complaint records related to SSOs, sanitary sewer surcharges, and septic system breakouts. These data sources will be used in identifying system vulnerability factors within each catchment.

ii. **Includes a manhole inspection methodology** that shall describe a storm drain network investigation that involves systematically and progressively observing, sampling (as required below) and evaluating key junction manholes (see definition in Appendix A) in the MS4 to determine the approximate location of suspected illicit discharges or SSOs. The manhole inspection methodology may either start from the outfall and work up the system or start from the upper parts of the catchment and work down the system or be a combination of both practices. Either method must, at a minimum, include an investigation of each key junction manhole within the MS4, even where no evidence of an illicit discharge is observed at the outfall. The manhole inspection methodology must describe the method the permittee will use. The manhole inspection methodology shall include procedures for dry and wet weather investigations.

iii. **Establishes procedures to isolate and confirm sources of illicit discharges** where manhole investigations or other physical evidence or screening has identified that MS4 alignments are influenced by illicit discharges or SSOs. These shall include isolation of the drainage area for implementation of more detailed investigations, inspection of additional manholes along the alignment to refine the location of potential contaminant sources, and methods such as sandbagging key junction manhole inlets, targeted internal plumbing inspections, dye testing, video inspections, or smoke testing to isolate and confirm the sources.

c. Requirements for each catchment investigation associated with an outfall/interconnection:

i. For each catchment being investigated, the permittee shall review relevant mapping and historic plans and records gathered in accordance with Part 2.3.4.8.b.i. This review shall be used to identify

[7] 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.

areas within the catchment with higher potential for illicit connections. The permittee shall identify and record the presence of any of the following specific **System Vulnerability Factors (SVFs)**:

- 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.

EPA recommends the permittee include the following in their consideration of System Vulnerability Factors:

- Sewer pump/lift stations, siphons, or known sanitary sewer restrictions where power/equipment failures or blockages could readily result in SSOs;
- Any sanitary sewer and storm drain infrastructure greater than 40 years old;
- Widespread code-required septic system upgrades required at property transfers (indicative of inadequate soils, water table separation, or other physical constraints of the area rather that poor owner maintenance);
- History of multiple Board of Health actions addressing widespread septic system failures (indicative of inadequate soils, water table separation, or other physical constraints of the area rather that poor owner maintenance);

The permittee shall document the presence or absence of System Vulnerability Factors for each catchment, retain this documentation as part of its IDDE program, and report this information in Annual Reports. Catchments with a minimum of one (1) System Vulnerability Factor are subject to wet weather sampling requirements of part 2.3.4.8.c.ii.2.

ii. For each catchment, the permittee must inspect key junction manholes and gather catchment information on the locations of MS4 pipes, manholes, and the extent of the contributing catchment.

1. <u>For all catchments</u>
   a) Infrastructure information shall be incorporated into the permittee's mapping required at part 2.3.4.5; the permittee will refine their catchment delineation based on the field investigation where appropriate.
   b) The SVF inventory for the catchment will be updated based on information obtained during the inspection, including common (twin invert) manholes, directly piped connections between storm drains and sanitary sewer infrastructure, common weir walls, sanitary sewer underdrain connections and other structural vulnerabilities where sanitary discharges could enter the storm drain system during wet weather.
      1) **Where a minimum of one (1) SVF is identified based on previous information**

or the investigation, a wet weather investigation must be conducted at the associated outfall (see below).

c) During dry weather, key junction manholes[8] shall be opened and inspected systematically for visual and olfactory evidence of illicit connections (e.g., excrement, toilet paper, gray filamentous bacterial growth, or sanitary products present).
   1) If flow is observed, the permittee shall sample the flow at a minimum for ammonia, chlorine and surfactants and can use field kits for these analyses.
   2) Where sampling results or visual or olfactory evidence indicate potential illicit discharges or SSOs, the area draining to the junction manhole shall be flagged for further upstream investigation.

d) 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 investigations will be considered complete upon completion of key junction manhole sampling.

2. <u>For all catchments with a minimum of one (1) SVF identified</u>
   a) The permittee shall meet the requirements above for dry weather screening
   b) The permittee shall inspect and sample under wet weather conditions to the extent necessary to determine whether wet weather-induced high flows in sanitary sewers or high groundwater in areas served by septic systems result in discharges of sanitary flow to the MS4.
      1) The permittee shall conduct at least one wet weather screening and sampling at the outfall that includes the same parameters required during dry weather screening, part 2.3.4.7.b.iii.4.
      2) Wet weather sampling and screening shall proceed during or after a storm event of sufficient depth or intensity to produce a stormwater discharge. EPA strongly recommends sampling during the spring (March through June) when groundwater levels are relatively high.
      3) The permit does not require a minimum rainfall event prior to wet weather screening. However, permittees may incorporate provisions that assist in targeting such discharges, including avoiding sampling during the initial period of discharge ("first flush") and/or identifying minimum storm event intensities likely to trigger sanitary sewer interconnections.
   c) This sampling can be done upon completion of any dry weather investigation but must be completed before the catchment investigation is marked as complete.

iii. All data collected as part of the dry and wet weather catchment investigations shall be recorded and reported in each annual report.

d. <u>Identification/Confirmation of illicit source</u>
Where the source of an illicit discharge has been approximated between two manholes in the permittee's MS4, the permittee shall isolate and identify/confirm the source of the illicit discharge using more detailed methods identified in their written procedure (2.3.4.8.b.iii). For outfalls that contained evidence of an illicit discharge, catchment investigations will be considered complete upon

[8] Where catchments do not contain junction manholes, the dry weather screening and sampling shall be considered as meeting the manhole inspection requirement. In these catchments, dry weather screenings that indicate potential presence of illicit discharges shall be further investigated pursuant to part 2.3.4.8.d. Investigations in these catchments may be considered complete where dry weather screening reveals no 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.

confirmation of all illicit sources.

e. Illicit discharge removal
When the specific source of an illicit discharge is identified, the permittee shall exercise its authority as necessary to require its removal pursuant to part 2.3.4.2 or 2.3.4.3.

i. For each confirmed source the permittee shall include in the annual report the following information:
- 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; and
- estimate of the volume of flow removed.

ii. Within one year of removal of all identified illicit discharges within a catchment area, confirmatory outfall or interconnection screening shall be conducted. The confirmatory screening shall be conducted in dry weather unless System Vulnerability Factors have been identified, in which case both dry weather and wet weather confirmatory screening shall be conducted. If confirmatory screening indicates evidence of additional illicit discharges, the catchment shall be scheduled for additional investigation.

2.3.4.9. Indicators of IDDE Program Progress

The permittee shall define or describe indicators for tracking program success and evaluate and report on the overall effectiveness of the IDDE program in each annual report. At a minimum the permittee shall document in each annual report:
- the number of SSOs and illicit discharges identified and removed,
- the number and percent of total outfall catchments served by the MS4 evaluated using the catchment investigation procedure,
- all dry weather and wet weather screening and sampling results and
- the volume of sewage removed

2.3.4.10 Ongoing Screening

Upon completion of all catchment investigations pursuant to part 2.3.4.8.c and illicit discharge removal and confirmation (if necessary) pursuant to paragraph 2.3.4.8.e, each outfall or interconnection shall be reprioritized for screening in accordance with part 2.3.4.8.a and scheduled for ongoing screening once every five years. Ongoing screening shall consist of dry weather screening and sampling consistent with part 2.3.4.7.b; wet weather screening and sampling shall also be required at outfalls where wet weather screening was required due to SVFs and shall be conducted in accordance with part 2.3.4.8.c.ii. All sampling results shall be reported in the permittee's annual report.

2.3.4.11 Training

The permittee shall, at a minimum, annually provide training to employees involved in IDDE program about the program, including how to recognize illicit discharges and SSOs. The permittee shall report on the frequency and type of employee training in the annual report.

Appendix G
Massachusetts Small MS4 Permit Monitoring Requirements
For Discharges into Impaired Waters – Parameters and Methods

Pollutant Causing Impairment	Monitoring Parameter	EPA or Approved Method No.
Aluminum	Aluminum, Total	200.7; 200.8; 200.9
Ammonia (Un-ionized)	Ammonia – Nitrogen	350.1
Arsenic	Arsenic, Total	200.7; 200.8; 200.9
Cadmium	Cadmium, Total	200.7; 200.8; 200.9
Chlordane	NMR	608; 625
Chloride	Chloride	300
Chromium (total)	Chromium, Total	200.7; 200.8; 200.9
Copper	Copper, Total	200.7; 200.8; 200.9
DDT	NMR	608; 625
DEHP (Di-sec-octyl phthalate)	NMR	---
Dioxin (including 2,3,7,8-TCDD)	NMR	613; 1613
Dioxin (2,3,7,8-Tetrachlorodibenzo-p-dioxin only)	NMR	613
Lead	Lead, Total	200.7; 200.8; 200.9
Mercury in Water Column	NMR unless potentially present such (e.g., salvage yards crushing vehicles with Hg switches)	200.7; 200.8; 200.9
Nitrogen (Total)	Nitrogen, Total	351.1/351.2 + 353.2
Pentachlorophenol (PCP)	NMR	---
Petroleum Hydrocarbons	Oil and Grease	1664
Phosphorus (Total)	Phosphorus, Total	365.1; 365.2; 365.3; SM 4500-P-E
Polychlorinated biphenyls	NMR	---
Polycyclic Aromatic Hydrocarbons (PAHs) (Aquatic Ecosystems)	PAHs	610; 1625
Sulfide-Hydrogen Sulfide	NMR	---
Mercury in Fish Tissue	NMR	---
PCB in Fish Tissue	NMR	---
Total Dissolved Solids	Total Dissolved Solids	160.1
Total Suspended Solids (TSS)	Total Suspended Solids	160.2, 180.1
Turbidity	Total Suspended Solids and Turbidity	160.2, 180.1
Secchi disk transparency	Total Suspended Solids	160.2
Sediment Screening Value (Exceedence)	Total Suspended Solids	160.2

Sedimentation/Siltation	Total Suspended Solids	160.2
Bottom Deposits	Total Suspended Solids	160.2
Color	NMR	---
pH, High	pH	150.2
pH, Low	pH	150.2
Taste and Odor	NMR	---
Temperature, water	NMR	---
Salinity	Specific Conductance	120.1
Enterococcus	Enterococcus	1106.1; 1600; Enterolert® 12 22.
Escherichia coli	E. coli	1103.1; 1603; Colilert® 12 16, Colilert-18® 12 15 16.; mColiBlue-24®17.
Fecal Coliform	Fecal Coliform	1680; 1681
Organic Enrichment (Sewage) Biological Indicators	Enterococcus (marine waters) or E. coli (freshwater)	1106.1; 1600
Debris/Floatables/Trash	NMR	or
Foam/Flocs/Scum/Oil Slicks	Contact MassDEP	1103.1; 1603
Oil and Grease	Oil and Grease	---
Chlorophyll-a	Total Phosphorus (freshwater)	---
	Total Nitrogen (marine waters)	1664
Nutrient/Eutrophication Biological Indicators	Total Phosphorus (freshwater)	365.1; 365.2; 365.3
	Total Nitrogen (marine waters)	351.1/351.2 + 353.2
Dissolved oxygen saturation / Oxygen, Dissolved	Dissolved Oxygen	365.1; 365.2; 365.3
	Temperature	351.1/351.2 + 353.2
	BOD_5	360.1; 360.2
	Total Phosphorus (freshwater)	SM-2550
	Total Nitrogen (marine waters)	SM-5210
Excess Algal Growth	Total Phosphorus (freshwater)	365.1; 365.2; 365.3
	Total Nitrogen (marine waters)	351.1/351.2 + 353.2
Aquatic Plants (Macrophytes)	NMR	---

Abnormal Fish deformities, erosions, lesions, tumors (DELTS)	NMR	---
Abnormal Fish Histology (Lesions)	NMR	---
Estuarine Bioassessments	Contact MassDEP	---
Fishes Bioassessments	Contact MassDEP	---
Aquatic Macroinvertebrate Bioassessments	Contact MassDEP	---
Combined Biota/Habitat Bioassessments	Contact MassDEP	---
Habitat Assessment (Streams)	Contact MassDEP	---
Lack of a coldwater assemblage	Contact MassDEP	---
Fish Kills	Contact MassDEP	---
Whole Effluent Toxicity (WET)	Contact MassDEP	---
Ambient Bioassays -- Chronic Aquatic Toxicity	Contact MassDEP	---
Sediment Bioassays -- Acute Toxicity Freshwater	Contact MassDEP	---
Sediment Bioassays -- Chronic Toxicity Freshwater	Contact MassDEP	---
Fish-Passage Barrier	NMR	---
Alteration in stream-side or littoral vegetative covers	NMR	---
Low flow alterations	NMR	---
Other flow regime alterations	NMR	---
Physical substrate habitat alterations	NMR	---
Other anthropogenic substrate alterations	NMR	---
Non-Native Aquatic Plants	NMR	---
Eurasian Water Milfoil, Myriophyllum spicatum	NMR	---
Zebra mussel, Dreissena polymorph	NMR	---
Other	Contact MassDEP	---

Notes:

NMR" indicates no monitoring required

"Total Phosphorus (freshwater)" indicates monitoring required for total phosphorus where stormwater discharges to a water body that is freshwater

"Total Nitrogen (marine water)" indicates monitoring required for total nitrogen where stormwater discharges to a water body that is a marine or estuarine water

Appendix C

Storm Drain System Map and

Initial Outfall/Interconnection Inventory and Ranking

OUTFALL CATCHMENTS
MENDON, MASSACHUSETTS

July 2016

- Manhole
- Outfall
- Catch Basin
- Drain Line
- Major Basin
- Subbasin
- Catchment Delineations
- Outfall Delineations Checked
- MS4 Regulated Area (2010 and 2000 Census)

N
W E
S

0 1,000 2,000
Feet

UPTON

HOPEDALE

CHARLES

BLACKSTONE

MILLVILLE

BLACKSTONE

Muddy Brook

Rock Meadow Brook

NIPMUCK POND

LONG MEADOW

Meadow Brook

Wigwam Brook

Ohio Brook

Spring Brook

Mill River

Round Meadow Brook

MISCOE ROAD

NORTH AVENUE

NORTHBRIDGE ROAD

WEST HILL ROAD

OLD SAWMILL ROAD

ADARE ROAD

MOWRY STREET

UXBRIDGE ROAD

KINSLEY LANE

PARK STREET

PLEASANT STREET

MILLVILLE STREET

TOWER ROAD

DUDLEY ROAD

MILFORD STREET

ELM STREET

MAIN STREET

WHITE ROAD

BLUEBERRY DRIVE

PUFFER DRIVE

AMMIDON ROAD

DUMP ROAD

CAPE ROAD

THAYER ROAD

BATES STREET

BLACKSTONE STREET

Town of Mendon Initial Outfall/Interconnection Inventory and Ranking

Outfall ID	Pipe Condition	Longitude	Latitude	Receiving Waterbody	Applicable Impairments	Sampling Results above Threshold	Discharging to Area of Concern	Priority
CR-01	GOOD	-71.49974849	42.10341381	Charles River	Dissolved Oxygen, Phosphorus, Bacteria			High
CR-02	GOOD	-71.49974779	42.10354174	Charles River	Dissolved Oxygen, Phosphorus, Bacteria			High
CR-03	GOOD	-71.49917982	42.09416329	Charles River	Dissolved Oxygen, Phosphorus, Bacteria			High
CR-04	GOOD	-71.50030172	42.08046636	Charles River	Dissolved Oxygen, Phosphorus, Bacteria			High
MB	GOOD	-71.57250584	42.13244611	Muddy Brook			Discharges to Wellhead Protection Area	High
MB-12	GOOD	-71.55327139	42.08665716	Muddy Brook			Discharges near recreation area	High
MB-13	GOOD	-71.55362946	42.09143531	Muddy Brook			Discharges near recreation area	High
MB-43	GOOD	-71.55485281	42.10489378	Muddy Brook			Discharges to Wellhead Protection Area	High
MB-44	GOOD	-71.55489235	42.10506473	Muddy Brook			Discharges to Wellhead Protection Area	High
MB-45	GOOD	-71.55504006	42.10532516	Muddy Brook			Discharges to Wellhead Protection Area	High
MB-61	GOOD	-71.55504394	42.09734979	Muddy Brook			Discharges to Wellhead Protection Area/near recreation area	High
MB-67	GOOD	-71.53907883	42.0958923	Muddy Brook			Discharges to Wellhead Protection Area	High
MB-68	GOOD	-71.5400832	42.09582722	Muddy Brook			Discharges to Wellhead Protection Area	High
MR	GOOD	-71.51046639	42.09459173	Mill River	Bacteria			High
MR	GOOD	-71.5288009	42.08347119	Mill River	Bacteria			High
MR-01	GOOD	-71.52853257	42.08086088	Mill River	Bacteria			High
MR-02	GOOD	-71.52497362	42.07977366	Mill River	Bacteria			High
MR-03	GOOD	-71.52102825	42.07841976	Mill River	Bacteria			High
MR-05	GOOD	-71.52450118	42.07850068	Mill River	Bacteria			High
MR-06	GOOD	-71.52261201	42.07699873	Mill River	Bacteria			High
MR-07	GOOD	-71.52479768	42.07700725	Mill River	Bacteria			High
MR-08	GOOD	-71.52562028	42.07903165	Mill River	Bacteria			High
MR-09	GOOD	-71.5284589	42.0792062	Mill River	Bacteria			High
MR-10	GOOD	-71.52540902	42.07423109	Mill River	Bacteria			High
MR-11	GOOD	-71.52280024	42.07198725	Mill River	Bacteria			High
MR-12	GOOD	-71.51993612	42.06565508	Mill River	Bacteria			High
MR-13	GOOD	-71.51981914	42.06571586	Mill River	Bacteria			High
MR-14	GOOD	-71.51890784	42.06515639	Mill River	Bacteria			High
MR-15	GOOD	-71.5135476	42.06544315	Mill River	Bacteria			High
MR-16	GOOD	-71.51276808	42.06717019	Mill River	Bacteria			High
MR-17	GOOD	-71.50986005	42.10159563	Mill River	Bacteria			High
MR-18	GOOD	-71.50672456	42.10252776	Mill River	Bacteria			High
MR-19	GOOD	-71.50636764	42.10256617	Mill River	Bacteria	0.5 - Surfactants and >Ammonia threshhold		High
MR-20	GOOD	-71.5092512	42.09502731	Mill River	Bacteria			High
MR-21	GOOD	-71.50061617	42.08558488	Mill River	Bacteria			High
MR-22	GOOD	-71.50515595	42.07630895	Mill River	Bacteria			High
MR-23	GOOD	-71.50727277	42.08933922	Mill River	Bacteria			High
MR-24	GOOD	-71.51033469	42.09310511	Mill River	Bacteria	>0.25 - Surfactants and >Ammonia threshhold		High
MR-25	GOOD	-71.51050531	42.09222512	Mill River	Bacteria			High
MR-26	GOOD	-71.5119857	42.09147592	Mill River	Bacteria			High
MR-27	GOOD	-71.51233396	42.09179956	Mill River	Bacteria			High
MR-28	GOOD	-71.51493317	42.09439113	Mill River	Bacteria			High
MR-30	GOOD	-71.51046429	42.09460735	Mill River	Bacteria	>0.25 - Surfactants and >Ammonia threshhold		High
MR-31	GOOD	-71.50938259	42.09700531	Mill River	Bacteria			High
MR-32	GOOD	-71.50935279	42.09706645	Mill River	Bacteria			High
NP-01	GOOD	-71.56832265	42.10143773	Nipmuck Pond	Bacteria		Discharges to Wellhead Protection Area	High
NP-02	GOOD	-71.5681009	42.10034518	Nipmuck Pond	Bacteria		Discharges to Wellhead Protection Area	High
NP-03	GOOD	-71.56636941	42.09827124	Nipmuck Pond	Bacteria		Discharges to public beach	High
NP-04	GOOD	-71.56478397	42.09652168	Nipmuck Pond	Bacteria			High
NP-05	GOOD	-71.56427936	42.09560912	Nipmuck Pond	Bacteria			High
NP-06	GOOD	-71.56397602	42.09444893	Nipmuck Pond	Bacteria			High
NP-07	DAMAGED	-71.56325143	42.09196925	Nipmuck Pond	Bacteria			High
NP-08	GOOD	-71.56909801	42.10057304	Nipmuck Pond	Bacteria		Discharges to Wellhead Protection Area	High
NP-09	DAMAGED	-71.57491785	42.09703709	Nipmuck Pond	Bacteria		Discharges to Wellhead Protection Area	High
NP-10	GOOD	-71.57821446	42.0876395	Nipmuck Pond	Bacteria			High
NP-11	GOOD	-71.57809424	42.08754735	Nipmuck Pond	Bacteria			High
NP-12	GOOD	-71.57940133	42.0862572	Nipmuck Pond	Bacteria			High
NP-13	GOOD	-71.58006618	42.08572741	Nipmuck Pond	Bacteria			High
NP-14	GOOD	-71.58069991	42.08275059	Nipmuck Pond	Bacteria			High
NP-15	GOOD	-71.5835901	42.07701886	Nipmuck Pond	Bacteria			High
NP-16	GOOD	-71.58564122	42.07211135	Nipmuck Pond	Bacteria			High
NP-17	GOOD	-71.58674956	42.06756739	Nipmuck Pond	Bacteria			High
OB-05	GOOD	-71.56670674	42.08220055	Ohio Brook	Bacteria			High
OB-06	GOOD	-71.5682442	42.08226147	Ohio Brook	Bacteria			High
OB-07	GOOD	-71.56808131	42.07505347	Ohio Brook	Bacteria			High
OB-08	GOOD	-71.55625889	42.07687792	Ohio Brook	Bacteria			High
OB-09	GOOD	-71.55627499	42.07689136	Ohio Brook	Bacteria			High
OB-1	GOOD	-71.55266896	42.08459518	Ohio Brook	Bacteria			High
OB-10	GOOD	-71.55509891	42.07545623	Ohio Brook	Bacteria			High
OB-3	GOOD	-71.55427454	42.08206873	Ohio Brook	Bacteria			High
OB-3	GOOD	-71.55355115	42.08183998	Ohio Brook	Bacteria			High
OB-4	DAMAGED	-71.55242129	42.08254112	Ohio Brook	Bacteria			High
RB		-71.56613725	42.11063384	Rock Meadow Brook	Dissolved Oxygen, Phosphorus			High
RB-01	GOOD	-71.56613725	42.11063384	Rock Meadow Brook	Dissolved Oxygen, Phosphorus			High
RB-02	GOOD	-71.56164858	42.10733413	Rock Meadow Brook	Dissolved Oxygen, Phosphorus			High
RB-03	GOOD	-71.56954828	42.11357698	Rock Meadow Brook	Dissolved Oxygen, Phosphorus			High
RB-04	GOOD	-71.57201161	42.11538835	Rock Meadow Brook	Dissolved Oxygen, Phosphorus			High
RB-05	GOOD	-71.57367551	42.11766614	Rock Meadow Brook	Dissolved Oxygen, Phosphorus			High
RB-06	GOOD	-71.57367594	42.11768318	Rock Meadow Brook	Dissolved Oxygen, Phosphorus			High
RB-07	GOOD	-71.57384603	42.1227455	Rock Meadow Brook	Dissolved Oxygen, Phosphorus			High
RB-08	GOOD	-71.57842465	42.12185768	Rock Meadow Brook	Dissolved Oxygen, Phosphorus			High
RB-09	GOOD	-71.57542947	42.11765163	Rock Meadow Brook	Dissolved Oxygen, Phosphorus			High
RB-10	GOOD	-71.57515069	42.11650865	Rock Meadow Brook	Dissolved Oxygen, Phosphorus			High
RB-11	GOOD	-71.57566537	42.1155212	Rock Meadow Brook	Dissolved Oxygen, Phosphorus			High
RB-12	GOOD	-71.57887235	42.11561503	Rock Meadow Brook	Dissolved Oxygen, Phosphorus			High
RB-13	GOOD	-71.57879954	42.11560207	Rock Meadow Brook	Dissolved Oxygen, Phosphorus			High
RB-14	GOOD	-71.57876775	42.11558255	Rock Meadow Brook	Dissolved Oxygen, Phosphorus			High

Town of Mendon Initial Outfall/Interconnection Inventory and Ranking

Outfall ID	Pipe Condition	Longitude	Latitude	Receiving Waterbody	Applicable Impairments	Sampling Results above Threshold	Discharging to Area of Concern	Priority
RB-15	GOOD	-71.58037171	42.1163458	Rock Meadow Brook	Dissolved Oxygen, Phosphorus			High
RB-17	GOOD	-71.58181305	42.11630851	Rock Meadow Brook	Dissolved Oxygen, Phosphorus		Discharges to Wellhead Protection Area	High
RB-18	GOOD	-71.58768755	42.11936952	Rock Meadow Brook	Dissolved Oxygen, Phosphorus		Discharges to Wellhead Protection Area	High
RB-19	GOOD	-71.58912955	42.12012437	Rock Meadow Brook	Dissolved Oxygen, Phosphorus		Discharges to Wellhead Protection Area	High
RB-20	GOOD	-71.59074397	42.12048273	Rock Meadow Brook	Dissolved Oxygen, Phosphorus		Discharges to Wellhead Protection Area	High
RB-21	GOOD	-71.59214958	42.12062601	Rock Meadow Brook	Dissolved Oxygen, Phosphorus			High
RB-22	GOOD	-71.59271714	42.120643	Rock Meadow Brook	Dissolved Oxygen, Phosphorus			High
RB-23	GOOD	-71.58796886	42.11540265	Rock Meadow Brook	Dissolved Oxygen, Phosphorus		Discharges to Wellhead Protection Area	High
RB-24	GOOD	-71.59186839	42.11312447	Rock Meadow Brook	Dissolved Oxygen, Phosphorus			High
RB-25	GOOD	-71.56886851	42.10423603	Rock Meadow Brook	Dissolved Oxygen, Phosphorus			High
RB-26	GOOD	-71.57261866	42.10453821	Rock Meadow Brook	Dissolved Oxygen, Phosphorus			High
RB-27	GOOD	-71.57355868	42.10462556	Rock Meadow Brook	Dissolved Oxygen, Phosphorus			High
RB-28	GOOD	-71.57500089	42.1047637	Rock Meadow Brook	Dissolved Oxygen, Phosphorus			High
RB-29	GOOD	-71.58118158	42.10386384	Rock Meadow Brook	Dissolved Oxygen, Phosphorus			High
RB-30	GOOD	-71.58334661	42.10254058	Rock Meadow Brook	Dissolved Oxygen, Phosphorus			High
RB-31	GOOD	-71.5833785	42.1024941	Rock Meadow Brook	Dissolved Oxygen, Phosphorus			High
RB-32	GOOD	-71.58344165	42.10254699	Rock Meadow Brook	Dissolved Oxygen, Phosphorus			High
RB-33	GOOD	-71.58844573	42.10266087	Rock Meadow Brook	Dissolved Oxygen, Phosphorus			High
RB-34	GOOD	-71.59168378	42.10214289	Rock Meadow Brook	Dissolved Oxygen, Phosphorus			High
RB-35	GOOD	-71.57686552	42.09536596	Rock Meadow Brook	Dissolved Oxygen, Phosphorus	>0.25 - Surfactants, >Ammonia threshhold and E.coli detected		High
RB-36	GOOD	-71.5773998	42.09320486	Rock Meadow Brook	Dissolved Oxygen, Phosphorus			High
RB-37	GOOD	-71.58031993	42.09149577	Rock Meadow Brook	Dissolved Oxygen, Phosphorus			High
RB-38	GOOD	-71.57748663	42.08944847	Rock Meadow Brook	Dissolved Oxygen, Phosphorus			High
RB-39	GOOD	-71.57736391	42.08945338	Rock Meadow Brook	Dissolved Oxygen, Phosphorus			High
RB-40	GOOD	-71.58756061	42.08951432	Rock Meadow Brook	Dissolved Oxygen, Phosphorus			High
RB-41	FAIR	-71.58983066	42.08830725	Rock Meadow Brook	Dissolved Oxygen, Phosphorus			High
RB-42	GOOD	-71.58948773	42.09047461	Rock Meadow Brook	Dissolved Oxygen, Phosphorus			High
RB-43	GOOD	-71.58710355	42.09341081	Rock Meadow Brook	Dissolved Oxygen, Phosphorus			High
RB-44	GOOD	-71.57611137	42.12596867	Rock Meadow Brook	Dissolved Oxygen, Phosphorus			High
RB-45	GOOD	-71.57173984	42.12525112	Rock Meadow Brook	Dissolved Oxygen, Phosphorus			High
RBI-16	GOOD	-71.58082926	42.11614554	Rock Meadow Brook	Dissolved Oxygen, Phosphorus			High
HB-01	FAIR	-71.5668894	42.06622409	Hop Brook				Low
HB-02	GOOD	-71.56621114	42.067043	Hop Brook				Low
HB-03	GOOD	-71.56435485	42.06555898	Hop Brook				Low
HB-04	GOOD	-71.56277316	42.06519235	Hop Brook				Low
HB-05	GOOD	-71.56262256	42.06521423	Hop Brook				Low
HB-06	GOOD	-71.55997716	42.06543792	Hop Brook				Low
HB-07	GOOD	-71.55988887	42.06726141	Hop Brook				Low
HB-08	GOOD	-71.56153529	42.0673085	Hop Brook				Low
MB	GOOD	-71.55797844	42.11329534	Muddy Brook				Low
MB		-71.53816048	42.08588837	Muddy Brook				Low
MB		-71.53894195	42.11129729	Muddy Brook				Low
MB		-71.55797844	42.11329534	Muddy Brook				Low
MB		-71.54636872	42.0858478	Muddy Brook				Low
MB		-71.52878289	42.10089054	Muddy Brook				Low
MB-03		-71.53817709	42.08588482	Muddy Brook				Low
MB-09	GOOD	-71.54679716	42.08314103	Muddy Brook				Low
MB-1	GOOD	-71.53350326	42.08710026	Muddy Brook				Low
MB-10	GOOD	-71.54768517	42.08287755	Muddy Brook				Low
MB-10	GOOD	-71.55137073	42.08730933	Muddy Brook				Low
MB-14	DAMAGED	-71.55331205	42.09323312	Muddy Brook				Low
MB-15	GOOD	-71.54156394	42.10610923	Muddy Brook				Low
MB-16	GOOD	-71.54112529	42.10616444	Muddy Brook				Low
MB-18	GOOD	-71.53893042	42.11129306	Muddy Brook				Low
MB-18	GOOD	-71.5409743	42.11095257	Muddy Brook				Low
MB-19	GOOD	-71.54275124	42.1135205	Muddy Brook				Low
MB-2	GOOD	-71.53440063	42.08656636	Muddy Brook				Low
MB-20	GOOD	-71.54243112	42.11557538	Muddy Brook				Low
MB-21	GOOD	-71.54042253	42.11409471	Muddy Brook				Low
MB-22	GOOD	-71.53991513	42.11304338	Muddy Brook				Low
MB-23	GOOD	-71.53605529	42.10891628	Muddy Brook				Low
MB-24	GOOD	-71.53524532	42.10698315	Muddy Brook				Low
MB-25	GOOD	-71.53437518	42.10680482	Muddy Brook				Low
MB-26	GOOD	-71.53673478	42.10386356	Muddy Brook				Low
MB29	GOOD	-71.53217169	42.08781932	Muddy Brook				Low
MB-29	GOOD	-71.53218711	42.08808204	Muddy Brook				Low
MB-30	GOOD	-71.53289242	42.08647583	Muddy Brook				Low
MB-31	GOOD	-71.53448937	42.08532044	Muddy Brook				Low
MB-32	GOOD	-71.53480472	42.08533643	Muddy Brook				Low
MB-33	GOOD	-71.53755607	42.0849326	Muddy Brook				Low
MB-34	GOOD	-71.53766738	42.08489316	Muddy Brook				Low
MB-35	GOOD	-71.53752386	42.08315794	Muddy Brook				Low
MB-36	GOOD	-71.53731873	42.08307942	Muddy Brook				Low
MB-37	GOOD	-71.53013664	42.08606806	Muddy Brook				Low
MB-38	GOOD	-71.55033895	42.10322846	Muddy Brook				Low
MB-39	GOOD	-71.55040655	42.10311869	Muddy Brook				Low
MB-4	GOOD	-71.5416962	42.09123556	Muddy Brook				Low
MB-40	GOOD	-71.55046645	42.10299946	Muddy Brook				Low
MB-41	GOOD	-71.55043507	42.10297892	Muddy Brook				Low
MB-46	GOOD	-71.56453309	42.08639994	Muddy Brook				Low
MB-47	GOOD	-71.56426783	42.08548608	Muddy Brook				Low
MB-48	GOOD	-71.56572651	42.08364552	Muddy Brook				Low
MB-49	FAIR	-71.56294119	42.0828791	Muddy Brook				Low
MB-5	GOOD	-71.54719084	42.0865463	Muddy Brook				Low
MB-50	GOOD	-71.55059852	42.11044217	Muddy Brook				Low
MB-51	GOOD	-71.55027174	42.11916524	Muddy Brook				Low
MB-52	GOOD	-71.5536501	42.11317418	Muddy Brook				Low
MB-53	GOOD	-71.566575	42.11843888	Muddy Brook				Low
MB-54	GOOD	-71.56914219	42.12626529	Muddy Brook				Low
MB-55	GOOD	-71.56628066	42.13017932	Muddy Brook				Low
MB-56	GOOD	-71.56361771	42.13087505	Muddy Brook				Low
MB-57	GOOD	-71.57384034	42.13361139	Muddy Brook				Low
MB-59	GOOD	-71.54644783	42.0859271	Muddy Brook				Low
MB-6	GOOD	-71.55998968	42.0983699	Muddy Brook				Low
MB-60	GOOD	-71.56246036	42.09874555	Muddy Brook				Low
MB-62	GOOD	-71.52450673	42.09308885	Muddy Brook				Low
MB-63	GOOD	-71.54353375	42.10183144	Muddy Brook				Low
MB-64	GOOD	-71.54354588	42.10184351	Muddy Brook				Low

Town of Mendon Initial Outfall/Interconnection Inventory and Ranking

Outfall ID	Pipe Condition	Longitude	Latitude	Receiving Waterbody	Applicable Impairments	Sampling Results above Threshold	Discharging to Area of Concern	Priority
MB-65	GOOD	-71.54055826	42.09965546	Muddy Brook				**Low**
MB-66	GOOD	-71.53997556	42.09762511	Muddy Brook				**Low**
MB-69	GOOD	-71.5400832	42.09582722	Muddy Brook				**Low**
MB-7	FAIR	-71.54496006	42.08505649	Muddy Brook				**Low**
MB-70	GOOD	-71.53802794	42.09563242	Muddy Brook				**Low**
MB-71	GOOD	-71.53639598	42.09422606	Muddy Brook				**Low**
MB-72	GOOD	-71.52860048	42.08818842	Muddy Brook				**Low**
MB-73	GOOD	-71.52755312	42.08749553	Muddy Brook				**Low**
MB-8	GOOD	-71.54515467	42.08452254	Muddy Brook				**Low**
RMB-01	GOOD	-71.53849855	42.08082174	Round Meadow Brook				**Low**
RMB-02	GOOD	-71.5305947	42.07663566	Round Meadow Brook				**Low**
RMB-03	GOOD	-71.52464778	42.071658	Round Meadow Brook				**Low**
RMB-04	FAIR	-71.52477567	42.07139741	Round Meadow Brook				**Low**
RMB-05	GOOD	-71.52123455	42.06777932	Round Meadow Brook				**Low**
SP-04	GOOD	-71.53048277	42.10583838	Spindleville Pond				**Low**
SP-06	GOOD	-71.54439025	42.12300172	Spindleville Pond				**Low**
SP-07	GOOD	-71.51676065	42.09943993	Spindleville Pond				**Low**
SP-08	GOOD	-71.51745247	42.09731561	Spindleville Pond				**Low**
SP-09	GOOD	-71.51750473	42.09735383	Spindleville Pond				**Low**
SP-1	GOOD	-71.53662061	42.11197669	Spindleville Pond				**Low**
SP-2	GOOD	-71.53666973	42.11253333	Spindleville Pond				**Low**
SP-3	GOOD	-71.53516533	42.11292883	Spindleville Pond				**Low**
SP-5	GOOD	-71.53096745	42.1042593	Spindleville Pond				**Low**

Appendix D

Sampling Protocol and Procedures

Mendon, MA Dry Weather Sampling Procedure

1) Review supplies of sampling bottles and test kits on a weekly basis and order as necessary for field sampling activities.
2) Notify the Town of Mendon of the sampling schedule prior to going into the field:
    a. Public Works: 508-473-0737
    b. Police Department: 508-478-2737
3) Observe the physical attributes of each outfall or sampling location.
4) If dry weather flow is present, note flow volume, odor, and all other characteristics listed on the data collection form. If using an iPad, fill in form fields or drop down menus as needed.
    a. In the event that the flow is too slow to sample, place a sandbag upstream of the outfall to capture flow and return to the site in 24 hours to obtain a sample.
    b. In the event that the outfall is submerged in the receiving water, record this information on the data sheet for the outfall and do not take a sample. An alternate sampling location at an upstream manhole should be located.
5) Take a photograph of the outfall with an iPad or camera. If possible, hold a piece of paper or a white board with the unique identifier written on it in the photograph.
6) Sample storm drain outfalls as close to the outfall opening as possible, wearing a fresh pair of disposable gloves.
7) **Test Kits**. Using a sterile and pre-cleaned sampling bottle, collect the surface water with care to not disturb sediment materials or collect surface debris/scum as best possible. Use sampling pole if needed to safely reach the outfall. The collected water will be poured into **surfactant** test tube, **chlorine** sample cell, and the remainder will be tested for **ammonia** with test strips. Follow the manufacturer instructions for all test kit procedures. All waste from the field test kits should be retained and disposed of according to manufacturer instructions.
8) **Meters**. A properly calibrated meter should be used to record the following parameters directly from the stream or outfall:
    a. Conductivity
    b. Salinity
    c. Temperature
    d. pH (for applicable watersheds only)
    e. Dissolved oxygen (for applicable watersheds only)

    When flow volume or depth is insufficient to immerse the meter probe, a clean sample bottle may be used to collect a sufficient volume of water to immerse the probe. In such instances, meter readings should be taken immediately.

9) **Threshold Levels**. In situ readings will be compared to field thresholds as follows:

Parameter	Threshold Level	Source
Surfactants	≥ 0.25 mg/L	EPA New England Bacterial Source Tracking Protocol
Ammonia	≥ 0.5 mg/L	EPA New England Bacterial Source Tracking Protocol
Chlorine	≥ 0.02 mg/L	EPA 2016 General Permit
pH	< 5	Center for Watershed Protection
Conductivity	> 2,000 uS/cm	Center for Watershed Protection
Dissolved Oxygen (DO)	< 5.0 mg/L	314 CMR 4.00 for Class B Warm Water
Temperature (°F)	> 83 °F	314 CMR 4.00 for Class B Warm Water
Salinity	> 0.5 ppt Rivers	EPA Voluntary Estuary Monitoring Manual

10) **Water quality samples** will be taken for laboratory analysis according to the following table. Each bottle will be marked with time, date, and outfall identifier, and parameter to be analyzed.

	All Flowing Outfalls	Impaired Watersheds	EPA Approved Method for Analysis
Required	**E. coli** for freshwater receiving water Samples should be collected first, in a separate sterile sample bottle.	**<u>Mill River (MA51-36):</u>** E. coli **<u>Rock Meadow Brook (MA72-21):</u>** Aquatic Macroinvertebrate Bioassessment Total Phosphorus BOD_5 *Dissolved Oxygen (meter)* *Temperature (meter)* **<u>Charles River (MA72-03):</u>** E. coli Total Phosphorus BOD_5 *Dissolved Oxygen (meter)* *Temperature (meter)* **<u>Blackstone River Watershed:</u>** Total Phosphorus	E. coli: 1103.1; 1603; Collilert 12 16, Collilert-18 12 15 16; mColiBlue-25 17 Total Phosphorus: 365.1; 365.2; 365.3 Dissolved Oxygen: 360.1; 360.2 Temperature: SM-2550 BOD_5: SM-5210

Results should be recorded, custody forms completed, and samples placed in a cooler on ice. If using an iPad, fill in all form fields for sampling data, check parameter analysis box if a threshold was exceeded, and check outfall completed box when done. **<u>Make note of the first bacteria sample time for determining the hold limit until lab analysis.</u>**

Be sure to upload all data entry before leaving the site. If there is any doubt whether data was captured, duplicate information on paper forms.

Upon completion of sampling and return to the laboratory, all samples will be turned over to the appropriate sample custodian(s) and accompanied by an appropriate Chain-of-Custody ("COC") form.

Field Equipment Needed

- **PAPERWORK**
  - Signed Site Safety Plan
  - Chain of Custody form filled out
  - Bottle Labels in Ziploc Bag
  - Field sheets
  - Center for Watershed Protection Chapter 11
  - Field maps
  - Sampling Plan & Locations
- Sample bottles (from lab with hold-time and storage requirements)
- Extra sample bottles in case of contamination, cracking, or loss
- Sampling Pole
- Cooler with ice
- Carry Caddy
- Digital Camera or iPad
- Cell Phone or hand-held radio
- First aid kit
- Flashlight or head lamp
- Nitrile gloves
- Tape measure
- YSI Meter(s) (YSI-Pro30: Salinity, Conductivity, Temperature; YSI-Pro20 or YSI-550A: Dissolved Oxygen)
- Surfactants, Ammonia, and Chlorine Test Kits – use kits listed in EPA Bacteria Source Protocol 2012 Draft)
- 1 liter bottle
- Watch with a second hand
- Duct tape
- Sharpies
- Paper Towels
- Glass Containers (3) for (1) surfactant kit liquid waste, (2) chloride kit liquid waste, and (3) surfactant kit glass ampules. All disposed of as hazardous waste.
- Trash bag for solo cups, gloves, etc.
- White board/paper for unique outfall ID for photograph
- **PERSONAL GEAR**
  - Waders (or other appropriate footwear)
  - Insect repellant
  - Sunscreen
  - Steel-toed boots (if opening manholes)
  - Safety goggles
  - Light colored long sleeve shirts and pants on-site
  - Reflective safety vest
  - Business cards

Chapter 11: The Outfall Reconnaissance Inventory

This chapter describes a simple field assessment known as the Outfall Reconnaissance Inventory (ORI). The ORI is designed to fix the geospatial location and record basic characteristics of individual storm drain outfalls, evaluate suspect outfalls, and assess the severity of illicit discharge problems in a community. Field crews should walk all natural and man-made streams channels with perennial and intermittent flow, even if they do not appear on available maps (Figure 19). The goal is to complete the ORI on every stream mile in the MS4 within the first permit cycle, starting with priority subwatersheds identified during the desktop analysis. The results of the ORI are then used to help guide future outfall monitoring and discharge prevention efforts.

11.1 Getting Started

The ORI requires modest mapping, field equipment, staffing and training resources. A complete list of the required and optional resources needed to perform an ORI is presented in Table 30. The ORI can be combined with other stream assessment tools, and may be supplemented by simple indicator monitoring. Ideally, a Phase II community should plan on surveying its entire drainage network at least once over the course of each five-year permit cycle. Experience suggests that it may take up to three stream walks to identify all outfalls.

Figure 19: Walk all streams and constructed open channels

Best Times to Start

Timing is important when scheduling ORI field work. In most regions of the country, spring and fall are the best seasons to perform the ORI. Other seasons typically have challenges such as over-grown vegetation or high groundwater that mask illicit discharges, or make ORI data hard to interpret[9].

Prolonged dry periods during the non-growing season with low groundwater levels are optimal conditions for performing an ORI. Table 31 summarizes some of the regional factors to consider when scheduling ORI surveys in your community. Daily weather patterns also determine whether ORI field work should proceed. In general, ORI field work should be conducted at least 48 hours after the last runoff-producing rain event.

Field Maps

The field maps needed for the ORI are normally generated during the desktop assessment phase of the IDDE program described in Chapter 5. This section

[9] Upon initial program start-up, the ORI should be conducted during periods of low groundwater to more easily identify likely illicit discharges. However, it should be noted that high water tables can increase sewage contamination in storm drain networks due to infiltration and inflow interactions. Therefore, in certain situations, seasonal ORI surveys may be useful at identifying these types of discharges. Diagnosis of this source of contamination, however, can be challenging.

Table 30: Resources Needed to Conduct the ORI		
Need Area	**Minimum Needed**	**Optional but Helpful**
Mapping	• Roads • Streams	• Known problem areas • Major land uses • Outfalls • Specific industries • Storm drain network • SIC-coded buildings • Septics
Field Equipment	• 5 one-liter sample bottles • Backpack • Camera (preferably digital) • Cell phones or hand-held radios • Clip boards and pencils • Field sheets • First aid kit • Flash light or head lamp • GPS unit • Spray paint (or other marker) • Surgical gloves • Tape measure • Temperature probe • Waders (snake proof where necessary) • Watch with a second hand	• Portable Spectrophotometer and reagents (can be shared among crews) • Insect repellant • Machete/clippers • Sanitary wipes or biodegradable soap • Wide-mouth container to measure flow • Test strips or probes (e.g., pH and ammonia)
Staff	• Basic training on field methodology • Minimum two staff per crew	• Ability to track discharges up the drainage system • Knowledge of drainage area, to identify probable sources. • Knowledge of basic chemistry and biology

Table 31: Preferred Climate/Weather Considerations for Conducting the ORI		
Preferred Condition	**Reason**	**Notes/Regional Factors**
Low groundwater (e.g., very few flowing outfalls)	High groundwater can confound results	In cold regions, do not conduct the ORI in the early spring, when the ground is saturated from snowmelt.
No runoff-producing rainfall within 48 hours	Reduces the confounding influence of storm water	The specific time frame may vary depending on the drainage system.
Dry Season	Allows for more days of field work	Applies in regions of the country with a “wet/dry seasonal pattern.” This pattern is most pronounced in states bordering or slightly interior to the Gulf of Mexico or the Pacific Ocean.
Leaf Off	Dense vegetation makes finding outfalls difficult	Dense vegetation is most problematic in the southeastern United States. This criterion is helpful but not required.

provides guidance on the basic requirements for good field maps. First, ORI field maps do not need to be fancy. The scale and level of mapping detail will vary based on preferences and navigational skills of field crews. At a minimum, maps should have labeled streets and hydrologic features (USGS blue line streams, wetlands, and lakes), so field crews can orient themselves and record their findings spatially.

Field maps should delineate the contributing drainage area to major outfalls, but only if they are readily available. Urban landmarks such as land use, property boundaries, and storm drain infrastructure are also quite useful in the field. ORI field maps should be used to check the accuracy and quality of pre-existing mapping information, such as the location of outfalls and stream origins.

Basic street maps offer the advantage of simplicity, availability, and well-labeled road networks and urban landmarks. Supplemental maps such as a 1": 2000' scale USGS Quad sheet or finer scale aerial photograph are also recommended for the field. USGS Quad sheets are readily available and display major transportation networks and landmarks, "blue line" streams, wetlands, and topography. Quad maps may be adequate for less developed subwatersheds, but are not always accurate in more urban subwatersheds.

Recent aerial photographs may provide the best opportunity to navigate the subwatershed and assess existing land cover. Aerial photos, however, may lack topography and road names, can be costly, and are hard to record field notes on due to their darkness. GIS-ready aerial photos and USGS Quad sheets can be downloaded from the internet or obtained from local planning, parks, or public works agencies.

Field Sheets

ORI field sheets are used to record descriptive and quantitative information about each outfall inventoried in the field. Data from the field sheets represent the building blocks of an outfall tracking system allowing program managers to improve IDDE monitoring and management. A copy of the ORI field sheet is provided in Appendix D, and is also available as a Microsoft Word™ document. Program managers should modify the field sheet to meet the specific needs and unique conditions in their community.

Field crews should also carry an authorization letter and a list of emergency phone numbers to report any emergency leaks, spills, obvious illicit discharges or other water quality problems to the appropriate local authorities directly from the field. Local law enforcement agencies may also need to be made aware of the field work. Figure 20 shows an example of a water pollution emergency contact list developed by Montgomery County, MD.

Equipment

Basic field equipment needed for the ORI includes waders, a measuring tape, watch, camera, GPS unit, and surgical gloves (see Table 30). GPS units and digital cameras are usually the most expensive equipment items; however, some local agencies may already have them for other applications. Adequate ranging, water-resistant, downloadable GPS units can be purchased for less than $150. Digital cameras are preferred and can cost between $200 and $400, however, conventional or disposable cameras can also work, as long as they have flashes. Hand-held data recorders and customized software can be used to record text, photos, and GPS coordinates electronically in the field. While

these technologies can eliminate field sheets and data entry procedures, they can be quite expensive. Field crews should always carry basic safety items, such as cell phones, surgical gloves, and first aid kits.

Staffing

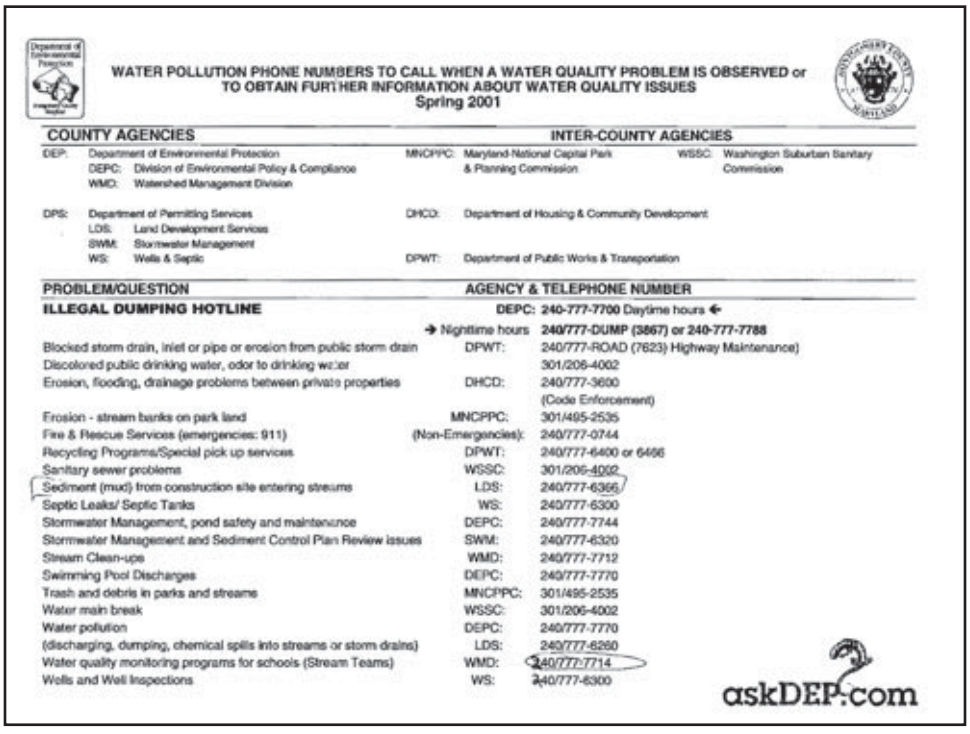
The ORI requires at least a two-person crew, for safety and logistics. Three person crews provide greater safety and flexibility, which helps divide tasks, allows one person to assess adjacent land uses, and facilitates tracing outfalls to their source. All crew members should be trained on how to complete the ORI and should have a basic understanding of illicit discharges and their water quality impact. ORI crews can be staffed by trained volunteers, watershed groups and college interns. Experienced crews can normally expect to cover two to three stream miles per day, depending on stream access and outfall density.

11.2 Desktop Analysis to Support the ORI

Two tasks need to be done in the office before heading out to the field. The major ORI preparation tasks include estimating the total stream and channel mileage in the subwatershed and generating field maps. The total mileage helps program managers scope out how long the ORI will take and how much it will cost. As discussed before, field maps are an indispensable navigational aid for field crews working in the subwatershed.

Delineating Survey Reaches

ORI field maps should contain a preliminary delineation of **survey reaches**. The stream network within your subwatershed should be delineated into discrete segments of relatively uniform character. Delineating survey reaches provides good stopping and starting points for field crews, which



WATER POLLUTION PHONE NUMBERS TO CALL WHEN A WATER QUALITY PROBLEM IS OBSERVED or TO OBTAIN FURTHER INFORMATION ABOUT WATER QUALITY ISSUES
Spring 2001

COUNTY AGENCIES

DEP: Department of Environmental Protection
DEPC: Division of Environmental Policy & Compliance
WMD: Watershed Management Division

DPS: Department of Permitting Services
LDS: Land Development Services
SWM: Stormwater Management
WS: Wells & Septic

INTER-COUNTY AGENCIES

MNCPPC: Maryland-National Capital Park & Planning Commission
WSSC: Washington Suburban Sanitary Commission
DHCD: Department of Housing & Community Development
DPWT: Department of Public Works & Transportation

PROBLEM/QUESTION	AGENCY & TELEPHONE NUMBER	
ILLEGAL DUMPING HOTLINE	DEPC:	**240-777-7700** Daytime hours ←
	→ Nighttime hours	**240/777-DUMP (3867) or 240-777-7788**
Blocked storm drain, inlet or pipe or erosion from public storm drain	DPWT:	240/777-ROAD (7623) Highway Maintenance)
Discolored public drinking water, odor to drinking water		301/206-4002
Erosion, flooding, drainage problems between private properties	DHCD:	240/777-3600 (Code Enforcement)
Erosion - stream banks on park land	MNCPPC:	301/495-2535
Fire & Rescue Services (emergencies: 911)	(Non-Emergencies):	240/777-0744
Recycling Programs/Special pick up services	DPWT:	240/777-6400 or 6456
Sanitary sewer problems	WSSC:	301/206-4002
Sediment (mud) from construction site entering streams	LDS:	240/777-6366
Septic Leaks/ Septic Tanks	WS:	240/777-6300
Stormwater Management, pond safety and maintenance	DEPC:	240/777-7744
Stormwater Management and Sediment Control Plan Review issues	SWM:	240/777-6320
Stream Clean-ups	WMD:	240/777-7712
Swimming Pool Discharges	DEPC:	240/777-7770
Trash and debris in parks and streams	MNCPPC:	301/495-2535
Water main break	WSSC:	301/206-4002
Water pollution	DEPC:	240/777-7770
(discharging, dumping, chemical spills into streams or storm drains)	LDS:	240/777-6260
Water quality monitoring programs for schools (Stream Teams)	WMD:	240/777-7714
Wells and Well Inspections	WS:	240/777-6300

askDEP.com

Figure 20: Example of a comprehensive emergency contact list for Montgomery County, MD

is useful from a data management and logistics standpoint. Each survey reach should have its own unique identifying number to facilitate ORI data analysis and interpretation. Figure 21 illustrates some tips for delineating survey reaches, and additional guidance is offered below:

- Survey reaches should be established above the confluence of streams and between road crossings that serve as a convenient access point.
- Survey reaches should be defined at the transition between major changes in land use in the stream corridor (e.g. forested land to commercial area).
- Survey reaches should generally be limited to a quarter mile or less in length. Survey reaches in lightly developed subwatersheds can be longer than those in more developed subwatersheds, particularly if uniform stream corridor conditions are expected throughout the survey reach.
- Access through private or public property should be considered when delineating survey reaches as permission may be required.

It should be noted that initial field maps are not always accurate, and changes may need to be made in the field to adjust survey reaches to account for conditions such as underground streams, missing streams or long culverts. Nevertheless, upfront time invested in delineating survey reaches makes it easier for field crews to perform the ORI.

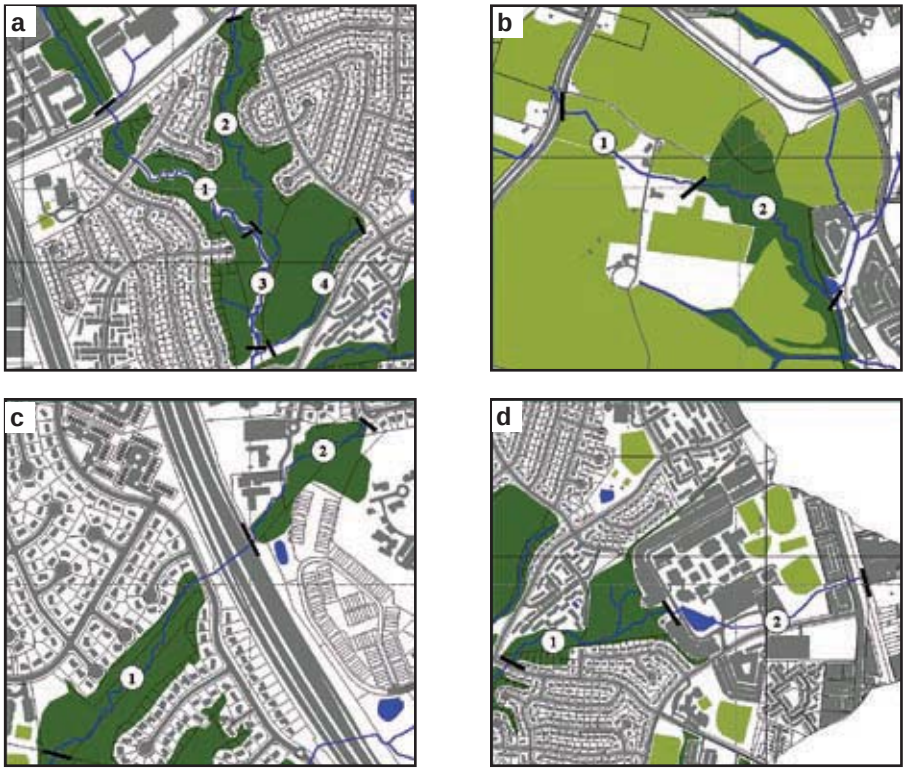


Figure 21: Various physical factors control how survey reaches are delineated. (a) Survey reaches based on the confluence of stream tributaries. (b) A long tributary split into ¼ mile survey reaches. (c) Based on a major road crossing (include the culvert in the downstream reach). (d) Based on significant changes in land use (significant changes in stream features often occur at road crossings, and these crossings often define the breakpoints between survey reaches).

11.3 Completing the ORI

Field crews conduct an ORI by walking all streams and channels to find outfalls, record their location spatially with a GPS unit and physically mark them with spray paint or other permanent marker. Crews also photograph each outfall and characterize its dimensions, shape, and component material, and record observations on basic sensory and physical indicators. If dry weather flow occurs at the outfall, additional flow and water quality data are collected. Field crews may also use field probes or test strips to measure indicators such as temperature, pH, and ammonia at flowing outfalls.

The ORI field sheet is divided into eight sections that address both flowing and non-flowing outfalls (Appendix D). Guidance on completing each section of the ORI field sheet is presented below.

Outfalls to Survey

The ORI applies to **all** outfalls encountered during the stream walk, regardless of diameter, with a few exceptions noted in Table 32. Common outfall conditions seen in communities are illustrated in Figure 22 As a rule, crews should only omit an outfall if they can definitively conclude it has no potential to contribute to a transitory illicit discharge. While EPA's Phase I guidance only targeted major outfalls (diameter of 36 inches or greater), documenting all outfalls is recommended, since smaller pipes make up the majority of all outfalls and frequently have illicit discharges (Pitt *et al.*, 1993 and Lalor, 1994). A separate ORI field sheet should be completed for each outfall.

Table 32: Outfalls to Include in the Screening

Outfalls to Record	Outfalls to Skip
• Both large and small diameter pipes that appear to be part of the storm drain infrastructure • Outfalls that appear to be piped headwater streams • Field connections to culverts • Submerged or partially submerged outfalls • Outfalls that are blocked with debris or sediment deposits • Pipes that appear to be outfalls from storm water treatment practices • Small diameter ductile iron pipes • Pipes that appear to only drain roof downspouts but that are subsurface, preventing definitive confirmation	• Drop inlets from roads in culverts (unless evidence of illegal dumping, dumpster leaks, etc.) • Cross-drainage culverts in transportation right-of-way (i.e., can see daylight at other end) • Weep holes • Flexible HDPE pipes that are known to serve as slope drains • Pipes that are clearly connected to roof downspouts via above-ground connections

 Ductile iron round pipe	 4-6” HDPE; Check if roof leader connection (legal)	 Field connection to inside of culvert; Always mark and record.
 Small diameter (<2”) HDPE; Often a sump pump (legal), or may be used to discharge laundry water (illicit).	 Elliptical RCP; Measure both horizontal and vertical diameters.	 Double RCP round pipes; Mark as separate outfalls unless known to connect immediately up-pipe
 Culvert (can see to other side); Don’t mark as an outfall	 Open channel “chute” from commercial parking lot; Very unlikely illicit discharge. Mark, but do not return to sample (unless there is an obvious problem).	 Small diameter PVC pipe; Mark, and look up-pipe to find the origin.
 CMP outfall; Crews should also note upstream sewer crossing.	 Box shaped outfall	 CMP round pipe with two weep holes at bridge crossing. (Don’t mark weep holes)

Figure 22: Typical Outfall Types Found in the Field

Obvious Discharges

Field crews may occasionally encounter an obvious illicit discharge of sewage or other pollutants, typified by high turbidity, odors, floatables and unusual colors. When obvious discharges are encountered, field crews should STOP the ORI survey, track down the source of the discharge and immediately contact the appropriate water pollution agency for enforcement. Crews should photo-document the discharge, estimate its flow volume and collect a sample for water quality analysis (if this can be done safely). All three kinds of evidence are extremely helpful to support subsequent enforcement. Chapter 13 provides details on techniques to track down individual discharges.

11.4 ORI Section 1 - Background Data

The first section of the ORI field sheet is used to record basic data about the survey, including time of day, GPS coordinates for the outfall, field crew members, and current and past weather conditions (Figure 23). Much of the information in this section is self-explanatory, and is used to create an accurate record of when, where, and under what conditions ORI data were collected.

Every outfall should be photographed and marked by directly writing a unique identifying number on each outfall that serves as its subwatershed "address" (Figure 24). Crews can use spray paint or another temporary marker to mark outfalls, but may decide to replace temporary markings with permanent ones if the ORI is repeated later. Markings help crews confirm outfall locations during future investigations, and gives citizens a better way to report the location of spills or discharges when calling a water pollution hotline. Crews should mark the spatial location of all outfalls they encounter directly on field maps, and record the coordinates with a GPS unit that is accurate to within 10 feet. Crews should take a digital photo of each outfall, and record photo numbers in Section 1 of the field sheet.

Section 1: Background Data

Subwatershed:		Outfall ID:	
Today's date:		Time (Military):	
Investigators:		Form completed by:	
Temperature (°F):	Rainfall (in.): Last 24 hours: Last 48 hours:		
Latitude:	Longitude:	GPS Unit:	GPS LMK #:
Camera:		Photo #s:	
Land Use in Drainage Area (Check all that apply):			
☐ Industrial		☐ Open Space	
☐ Ultra-Urban Residential		☐ Institutional	
☐ Suburban Residential		Other: _____	
☐ Commercial		Known Industries: _____	
Notes (e.g., origin of outfall, if known):			

Figure 23: Section 1 of the ORI Field Sheet

Figure 24: Labeling an outfall (a variety of outfall naming conventions can be used)

The land use of the drainage area contributing to the outfall should also be recorded. This may not always be easy to characterize at large diameter outfalls that drain dozens or even hundreds of acres (unless you have aerial photographs). On the other hand, land use can be easily observed at smaller diameter outfalls, and in some cases, the specific origin can be found (e.g., a roof leader or a parking lot; Figure 25). The specific origin should be recorded in the "notes" portion of Section 1 on the field sheet.

11.5 ORI Section 2 - Outfall Description

This part of the ORI field sheet is where basic outfall characteristics are noted (Figure 26). These include material, and presence of flow at the outfall, as well as the pipe's dimensions (Figure 27). These measurements are used to confirm and supplement existing storm drain maps (if they are available). Many communities only map storm drain outfalls that exceed a given pipe diameter, and may not contain data on the material and condition of the pipe.

Figure 25: The origin of this corrugated plastic pipe was determined to be a roof leader from the house up the hill.

Section 2 of the field sheet also asks if the outfall is submerged in water or obstructed by sediment and the amount of flow, if present. Figure 28 provides some photos that illustrate how to characterize relative submergence, deposition and flow at outfalls. If no flow is observed at the outfall, you can skip the next two sections of the ORI field sheet and continue with Section 5.

Section 2: Outfall Description

LOCATION	MATERIAL	SHAPE		DIMENSIONS (IN.)	SUBMERGED
☐ **Closed Pipe**	☐ RCP ☐ CMP ☐ PVC ☐ HDPE ☐ Steel ☐ Other: _____	☐ Circular ☐ Eliptical ☐ Box ☐ Other: _____	☐ Single ☐ Double ☐ Triple ☐ Other: _____	Diameter/Dimensions: _____	In Water: ☐ No ☐ Partially ☐ Fully With Sediment: ☐ No ☐ Partially ☐ Fully
☐ **Open drainage**	☐ Concrete ☐ Earthen ☐ rip-rap ☐ Other: _____	☐ Trapezoid ☐ Parabolic ☐ Other: _____		Depth: _____ Top Width: _____ Bottom Width: _____	
☐ **In-Stream**	**(applicable when collecting samples)**				
Flow Present?	☐ Yes ☐ No *If No, Skip to Section 5*				
Flow Description (If present)	☐ Trickle ☐ Moderate ☐ Substantial				

Figure 26: Section 2 of the ORI Field Sheet

Figure 27: Measuring Outfall Diameter

Submerged: More than ½ below water

Partially submerged: Bottom is below water

Fully submerged: Can't see outfall

Outfall fully submerged by debris

Fully submerged from downstream trees trapping debris

Partially submerged by leaf debris "back water"

Trickle Flow: Very narrow stream of water

Moderate Flow: Steady stream, but very shallow depth

Significant flow (Source is a fire hydrant discharge)

Figure 28: Characterizing Submersion and Flow

11.6 ORI Section 3 - Quantitative Characterization for Flowing Outfalls

This section of the ORI records direct measurements of **flowing outfalls**, such as flow, temperature, pH and ammonia (Figure 29). If desired, additional water quality parameters can be added to this section. Chapter 12 discusses the range of water quality parameters that can be used.

Field crews measure the rate of flow using one of two techniques. The first technique simply records the time it takes to fill a container of a known volume, such as a one liter sample bottle. In the second technique,

Section 3: Quantitative Characterization

FIELD DATA FOR FLOWING OUTFALLS				
PARAMETER		**RESULT**	**UNIT**	**EQUIPMENT**
☐Flow #1	Volume		Liter	Bottle
	Time to fill		Sec	
☐Flow #2	Flow depth		In	Tape measure
	Flow width	____' ____"	Ft, In	Tape measure
	Measured length	____' ____"	Ft, In	Tape measure
	Time of travel		S	Stop watch
Temperature			°F	Thermometer
pH			pH Units	Test strip/Probe
Ammonia			mg/L	Test strip

Figure 29: Section 3 of the ORI Field Sheet

the crew measures the velocity of flow, and multiplies it by the estimated cross sectional area of the flow.

To use the flow volume technique, it may be necessary to use a "homemade" container to capture flow, such as a cut out plastic milk container that is marked to show a one liter volume. The shape and flexibility of plastic containers allows crews to capture relatively flat and shallow flow (Figure 30). The flow volume is determined as the volume of flow captured in the container per unit time.

The second technique measures flow rate based on velocity and cross sectional area, and is preferred for larger discharges where containers are too small to effectively capture the flow (Figure 31). The crew measures and marks off a fixed flow length (usually about five feet), crumbles leaves or other light material, and drops them into the discharge (crews can also carry peanuts or ping pong balls to use). The crew then measures the time it takes the marker to travel across the length. The velocity of flow is computed as the length of the flow path (in feet) divided by the travel time (in seconds). Next, the cross-sectional flow area is measured by taking multiple readings of the depth and width of flow. Lastly, cross-sectional area (in square feet) is multiplied by flow velocity (feet/second) to calculate the flow rate (in cubic feet/second).

Crews may also want to measure the quality of the discharge using relatively inexpensive probes and test strips (e.g., water temperature, pH, and ammonia). The choice of which indicator parameters to measure is usually governed by the overall IDDE monitoring framework developed by the community. Some communities have used probes or test strips to measure additional indicators such as conductivity, chlorine, and hardness. Research by Pitt (for this project) suggests that probes by Horiba for pH and conductivity are the most reliable and

Figure 30: Measuring flow (as volume per time)

accurate, and that test strips have limited value.

When probes or test strips are used, measurements should be made from a sample bottle that contains flow captured from the outfall. The exact measurement recorded by the field probe should be recorded in Section 3 of the field sheet. Some interpolation may be required for test strips, but do not interpolate further than the mid-range between two color points.

11.7 ORI Section 4 – Physical Indicators for Flowing Outfalls Only

This section of the ORI field sheet records data about four sensory indicators associated with **flowing outfalls**—odor, color, turbidity and floatables (Figure 32). Sensory indicators can be detected by smell or sight, and require no measurement equipment. Sensory indicators do not always reliably predict illicit discharge, since the senses can be fooled, and may result in a "false negative" (i.e., sensory indicators fail to detect an illicit discharge when one is actually present). Sensory indicators are important, however, in detecting the most severe or obvious discharges. Section 4 of the field sheet asks whether the sensory indicator is present, and if so, what is its severity, on a scale of one to three.

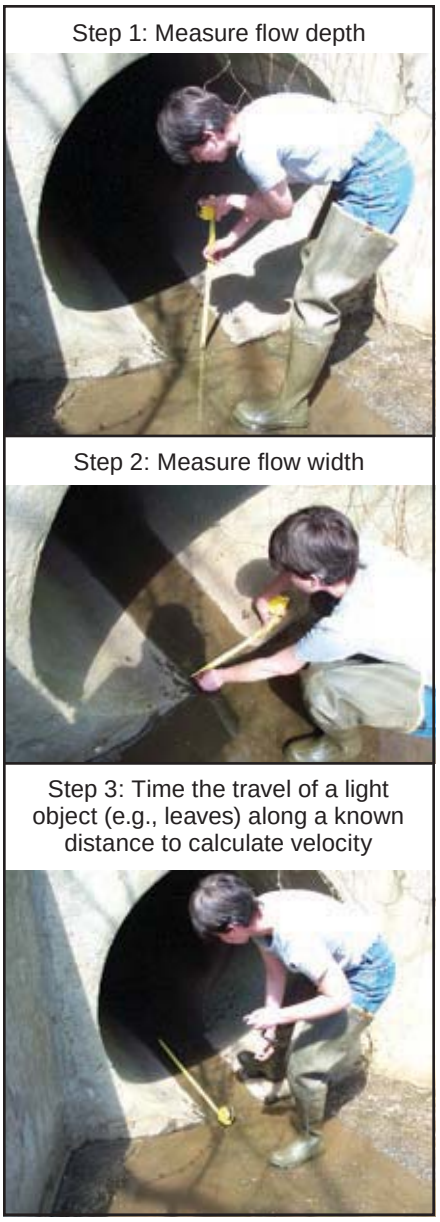


Figure 31: Measuring flow (as velocity times cross-sectional area)

Section 4: Physical Indicators for Flowing Outfalls Only

Are Any Physical Indicators Present in the flow? ☐ Yes ☐ No *(If No, Skip to Section 5)*

INDICATOR	CHECK if Present	DESCRIPTION	RELATIVE SEVERITY INDEX M(1-3)		
Odor	☐	☐ Sewage ☐ Rancid/sour ☐ Petroleum/gas ☐ Sulfide ☐ Other:	☐ 1 – Faint	☐ 2 – Easily detected	☐ 3 – Noticeable from a distance
Color	☐	☐ Clear ☐ Brown ☐ Gray ☐ Yellow ☐ Green ☐ Orange ☐ Red ☐ Other:	☐ 1 – Faint colors in sample bottle	☐ 2 – Clearly visible in sample bottle	☐ 3 – Clearly visible in outfall flow
Turbidity	☐	See severity	☐ 1 – Slight cloudiness	☐ 2 – Cloudy	☐ 3 – Opaque
Floatables -Does Not Include Trash!!	☐	☐ Sewage (Toilet Paper, etc.) ☐ Suds ☐ Petroleum (oil sheen) ☐ Other:	☐ 1 – Few/slight; origin not obvious	☐ 2 – Some; indications of origin (e.g., possible suds or oil sheen)	☐ 3 - Some; origin clear (e.g., obvious oil sheen, suds, or floating sanitary materials)

Figure 32: Section 4 of the ORI Field Sheet

Odor

Section 4 asks for a description of any odors that emanate from the outfall and an associated severity score. Since noses have different sensitivities, the entire field crew should reach consensus about whether an odor is present and how severe it is. A severity score of one means that the odor is faint or the crew cannot agree on its presence or origin. A score of two indicates a moderate odor within the pipe. A score of three is assigned if the odor is so strong that the crew smells it a considerable distance away from the outfall.

TIP

Make sure the origin of the odor is the outfall. Sometimes shrubs, trash or carrion, or even the spray paint used to mark the outfall can confuse the noses of field crews.

Color

The color of the discharge, which can be clear, slightly tinted, or intense is recorded next. Color can be quantitatively analyzed in the lab, but the ORI only asks for a visual assessment of the discharge color and its intensity. The best way to measure color is to collect the discharge in a clear sample bottle and hold it up to the light (Figure 33). Field crews should also look for downstream plumes of color that appear to be associated with the outfall. Figure 34 illustrates the spectrum of colors that may be encountered during an ORI survey, and offers insight on how to rank the relative intensity or strength of discharge color. Color often helps identify industrial discharges; Appendix K provides guidance on colors often associated with specific industrial operations.

Turbidity

The ORI asks for a visual estimate of the turbidity of the discharge, which is a measure of the cloudiness of the water. Like color, turbidity is best observed in a clear sample bottle, and can be quantitatively measured using field probes. Crews should also look for turbidity in the plunge pool below the outfall, and note any downstream turbidity plumes that appear to be related to the outfall. Field crews can sometimes confuse turbidity with color, which are related but are not the same. Remember, turbidity is a measure of how easily light can penetrate through the sample bottle, whereas color is defined by the tint or intensity of the color observed. Figure 34 provides some examples of how to distinguish turbidity from color, and how to rank its relative severity.

Figure 33: Using a sample bottle to estimate color and turbidity

Color: Brown; Severity: 2
Turbidity Severity: 2

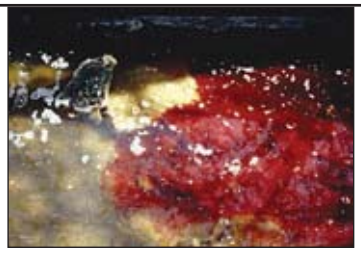
Color: Blue-green; Severity: 3
Turbidity Severity: 2

Highly Turbid Discharge
Color: Brown; Severity: 3
Turbidity Severity: 3

Sewage Discharge
Color: 3
Turbidity: 3

Paint
Color: White; Severity: 3
Turbidity: 3

Industrial Discharge
Color: Green; Severity: 3
Turbidity Severity: 3



Blood
Color: Red; Severity: 3
Turbidity Severity: None

Failing Septic System:
Turbidity Severity: 3

Turbidity in Downstream Plume
Turbidity Severity: 2
(also confirm with sample bottle)

High Turbidity in Pool
Turbidity Severity: 2
(Confirm with sample bottle)

Iron Floc
Color: Reddish Orange; Severity: 3
(Often associated with a natural source)

Slight Turbidity
Turbidity: 1
(Difficult to interpret this observation; May be natural or an illicit discharge)

Construction Site Discharge
Turbidity Severity: 3

Discharge of Rinse from Floor Sanding
(Found during wet weather)
Turbidity Severity: 3

Figure 34: Interpreting Color and Turbidity

Floatables

The last sensory indicator is the presence of any floatable materials in the discharge or the plunge pool below. Sewage, oil sheen, and suds are all examples of floatable indicators; trash and debris are generally not in the context of the ORI. The presence of floatable materials is determined visually, and some guidelines for ranking their severity are provided in Figure 35, and described below.

If you think the floatable is sewage, you should automatically assign it a severity score of three since no other source looks quite like it. Surface oil sheens are ranked based on their thickness and coverage. In some cases, surface sheens may not be related to oil discharges, but instead are created by in-stream processes, such as shown in Figure 36. A thick or swirling sheen associated with a petroleum-like odor may be diagnostic of an oil discharge.

Suds are rated based on their foaminess and staying power. A severity score of three is designated for thick foam that travels many feet before breaking up. Suds that break up quickly may simply reflect water turbulence, and do not necessarily have an illicit origin. Indeed, some streams have naturally occurring foams due to the decay of organic matter. On the other hand, suds that are accompanied by a strong organic or sewage-like odor may indicate a sanitary sewer leak or connection. If the suds have a fragrant odor, they may indicate the presence of laundry water or similar wash waters.

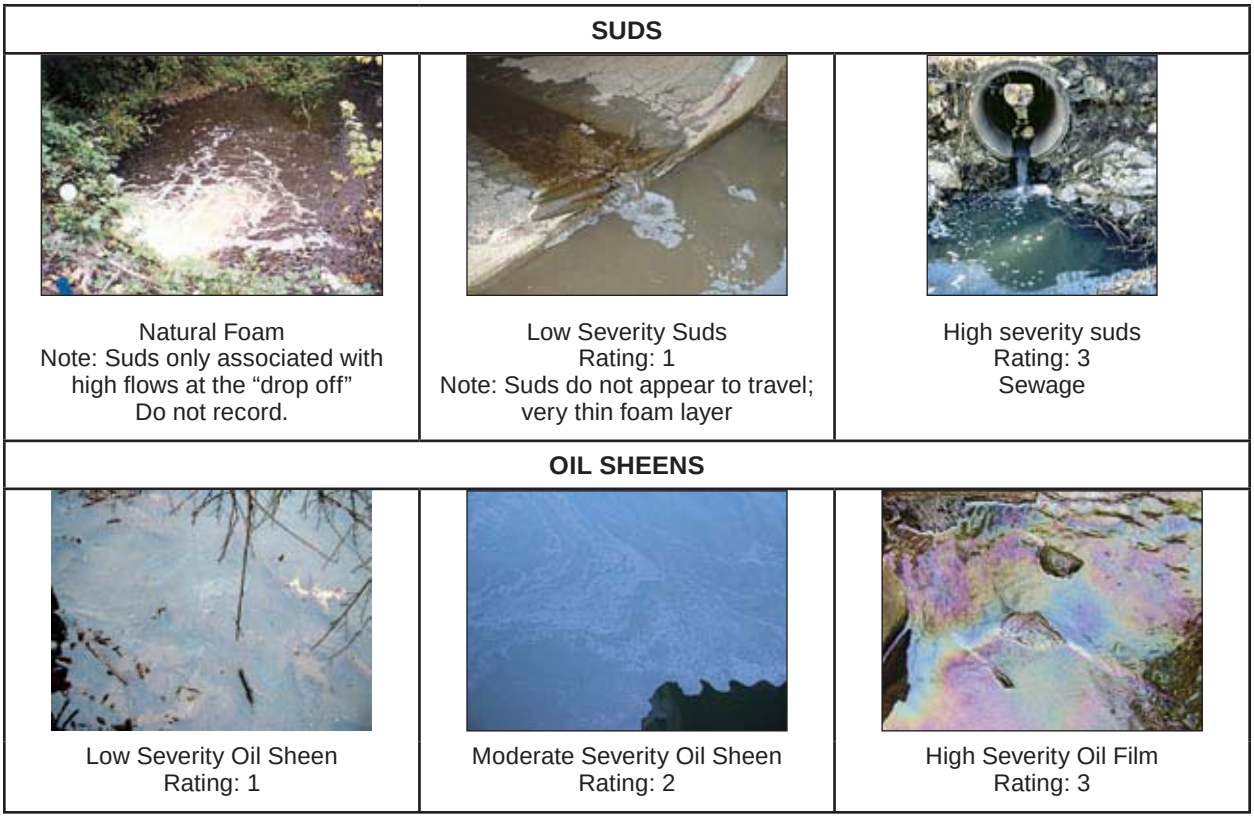


Figure 35: Determining the Severity of Floatables

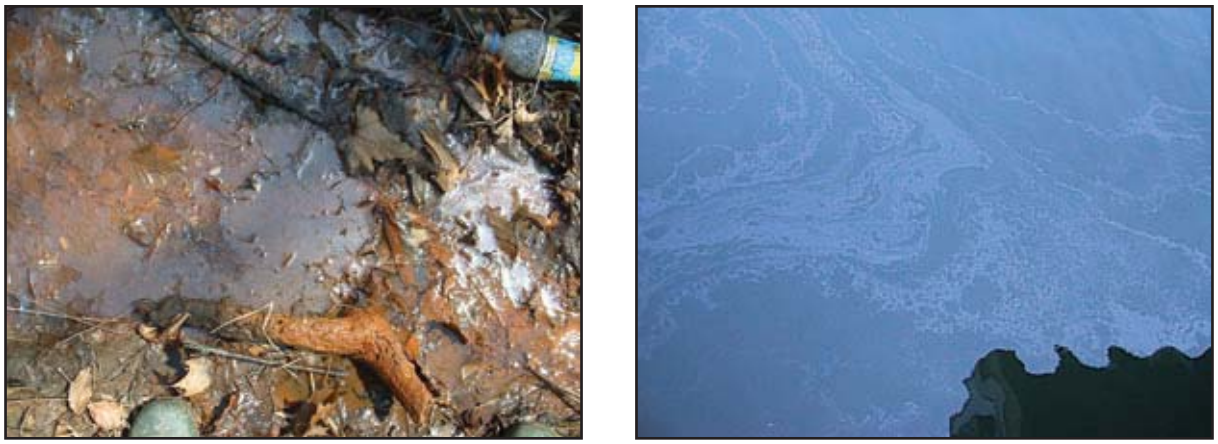


Figure 36: Synthetic versus Natural Sheen (a) Sheen from bacteria such as iron floc forms a sheet-like film that cracks if disturbed (b) Synthetic oil forms a swirling pattern

11.8 ORI Section 5 - Physical Indicators for Both Flowing and Non-Flowing Outfalls

Section 5 of the ORI field sheet examines physical indicators found at both **flowing and non-flowing** outfalls that can reveal the impact of past discharges (Figure 37). Physical indicators include outfall damage, outfall deposits or stains, abnormal vegetation growth, poor pool quality, and benthic growth on pipe surfaces. Common examples of physical indicators are portrayed in Figures 38 and 39. Many of these physical conditions can indicate that an intermittent or transitory discharge has occurred in the past, even if the pipe is not currently flowing. Physical indicators are not ranked according to their severity, because they are often subtle, difficult to interpret and could be caused by other sources. Still, physical indicators can provide strong clues about the discharge history of a storm water outfall, particularly if other discharge indicators accompany them.

Section 5: Physical Indicators for Both Flowing and Non-Flowing Outfalls
Are physical indicators that are not related to flow present? ☐ Yes ☐ No *(If No, Skip to Section 6)*

INDICATOR	CHECK if Present	DESCRIPTION	COMMENTS
Outfall Damage	☐	☐ Spalling, Cracking or Chipping ☐ Peeling Paint ☐ Corrosion	
Deposits/Stains	☐	☐ Oily ☐ Flow Line ☐ Paint ☐ Other:	
Abnormal Vegetation	☐	☐ Excessive ☐ Inhibited	
Poor pool quality	☐	☐ Odors ☐ Colors ☐ Floatables ☐ Oil Sheen ☐ Suds ☐ Excessive Algae ☐ Other:	
Pipe benthic growth	☐	☐ Brown ☐ Orange ☐ Green ☐ Other:	

Figure 37: Section 5 of the ORI Field Sheet

Bacterial growth at this outfall indicates nutrient enrichment and a likely sewage source.

This bright red bacterial growth often indicates high manganese and iron concentrations. Surprisingly, it is not typically associated with illicit discharges.

Sporalitis filamentous bacteria, also known as “sewage fungus” can be used to track down sanitary sewer leaks.

Algal mats on lakes indicate eutrophication. Several sources can cause this problem. Investigate potential illicit sources.

Illicit discharges or excessive nutrient application can lead to extreme algal growth on stream beds.

The drainage to this outfall most likely has a high nutrient concentration. The cause may be an illicit discharge, but may be excessive use of lawn chemicals.

This brownish algae indicates an elevated nutrient level.

Figure 38: Interpreting Benthic and Other Biotic Indicators

Reddish staining on the rocks below this outfall indicate high iron concentrations.

Toilet paper directly below the storm drain outlet.

Watershed Protection??

Trash is not an indicator of illicit discharges, but should be noted.

Staining at the base of the outfall may indicate a persistent, intermittent discharge.

Excessive vegetation may indicate enriched flows associated with sewage.

Brownish stain of unclear origin. May be from degradation of the brick infrastructure.

Cracked rock below the outfall may indicate an intermittent discharge.

Poor pool quality. Consider sampling from the pool to determine origin.

Figure 39: Typical Findings at Both Flowing and Non-Flowing Outfalls

11.9 ORI Sections 6-8 - Initial Outfall Designation and Actions

The last three sections of the ORI field sheet are where the crew designates the illicit discharge severity of the outfall and recommends appropriate management and monitoring actions (Figure 40). A discharge rating is designated as obvious, suspect, potential or unlikely, depending on the number and severity of discharge indicators checked in preceding sections.

It is important to understand that the ORI designation is only an initial determination of discharge potential. A more certain determination as to whether it actually is an illicit discharge is made using a more sophisticated indicator monitoring method. Nevertheless, the ORI outfall

designation gives program managers a better understanding of the distribution and severity of illicit discharge problems within a subwatershed.

Section 7 of the ORI field sheet records whether indicator samples were collected for laboratory analysis, or whether an intermittent flow trap was installed (e.g., an optical brightener trap or caulk dam described in Chapter 13). Field crews should record whether the sample was taken from a pool or directly from the outfall, and the type of intermittent flow trap used, if any. This section can also be used to recommend follow-up sampling, if the crew does not carry sample bottles or traps during the survey.

The last section of the ORI field sheet is used to note any unusual conditions near the outfall such as dumping, pipe failure, bank erosion or maintenance needs. While these maintenance conditions are not directly related to illicit discharge detection, they often are of interest to other agencies and utilities that maintain infrastructure.

11.10 Customizing the ORI for a Community

The ORI method is meant to be adaptable, and should be modified to reflect local conditions and field experience. Some indicators can be dropped, added or modified in the ORI form. This section looks at four of the most common adaptations to the ORI:

- Open Channels
- Submerged/Tidally Influenced Outfalls
- Cold Climates
- Use of Biological Indicators

In each case, it may be desirable to revise the ORI field sheet to collect data reflecting these conditions.

Open Channels

Field crews face special challenges in more rural communities that have extensive open channel drainage. The ditches and channels serve as the primary storm water conveyance system, and may lack storm drain and sewer pipes. The open channel network is often very long with only a few obvious outfalls that are located far apart. While the network can have illicit discharges from septic systems, they can typically only be detected in the ORI if a straight pipe is found. Some adaptations for open channel systems are suggested in Table 33.

Section 6: Overall Outfall Characterization

☐ Unlikely ☐ Potential (presence of two or more indicators) ☐ Suspect (one or more indicators with a severity of 3) ☐ Obvious

Section 7: Data Collection

1.	Sample for the lab?	☐ Yes	☐ No	
2.	If yes, collected from:	☐ Flow	☐ Pool	
3.	Intermittent flow trap set?	☐ Yes	☐ No	If Yes, type: ☐ OBM ☐ Caulk dam

Section 8: Any Non-Illicit Discharge Concerns (e.g., trash or needed infrastructure repairs)?

Figure 40: Sections 6-8 of the ORI Field Sheet

Submerged/Tidally Influenced Outfalls

The ORI can be problematic in coastal communities where outfalls are located along the waterfront and may be submerged at high tide. The ORI methods need to be significantly changed to address these constraints. Often, outfalls are initially located from offshore using canoes or boats, and then traced landward to the first manhole that is not tidally influenced. Field crews then access the storm drain pipe at the manhole and measure whatever indicators they can observe in the confined and dimly lit space. Table 33 recommends strategies to sample outfalls in the challenging environment of coastal communities.

Winter and Ice

Ice can be used as a discharge indicator in northern regions when ice forms in streams and pipes during the winter months (Figure 41). Because ice lasts for many weeks, and most illicit discharges are warm, astute field crews can interpret outfall history from ice melting patterns along pipes and streams. For example, exaggerated melting at a frozen or flowing outfall may indicate warm water from sewage or industrial discharge. Be careful, because groundwater is warm enough to cause some melting at below freezing temperatures. Also, ice acts like an intermittent flow trap, and literally freezes these discharges. Crews should also look for these traps to find any discolored ice within the pipe or below the outfall.

A final winter indicator is "rime ice," which forms when steam freezes. This beautiful ice formation is actually a good indicator of sewage or other relatively hot discharge that causes steam to form (Figure 41).

Biological Indicators

The diversity and pollution tolerance of various species of aquatic life are widely used as an indicator of overall stream health, and has sometimes been used to detect illicit discharges. One notable example is the presence of the red-eared slider turtle, which is used in Galveston, Texas to find sewage discharges, as they have a propensity for the nutrient rich waters associated with sewage (Figure 42).

Table 33: Special Considerations for Open Channels/Submerged Outfalls

OPEN CHANNELS	
Challenge	**Suggested Modification**
Too many miles of channel to walk	Stop walking at a given channel size or drainage area
Difficulty marking them	Mark on concrete or adjacent to earth channel
Interpreting physical indicators	For open channels with mild physical indicators, progress up the system to investigate further.
SUBMERGED/TIDALLY INFLUENCED OUTFALLS	
Challenge	**Suggested Modification**
Access for ORI – Tidal Influence	Access during low tide
Access for ORI – Always submerged	Access by boat or by shore walking
Interpreting physical indicators	For outfalls with mild physical indicators, also inspect from the nearest manhole that is not influenced by tides
Sampling (if necessary)	Sample "up pipe"

Figure 41: Cold climate indicators of illicit discharges

Figure 42: One biological indicator is this red-eared slider turtle

11.11 Interpreting ORI Data

The ORI generates a wealth of information that can provide managers with valuable insights about their illicit discharge problems, if the data are managed and analyzed effectively. The ORI can quickly define whether problems are clustered in a particular area or spread across the community. This section presents a series of methods to compile, organize and interpret ORI data, including:

1. Basic Data Management and Quality Control
2. Outfall Classification
3. Simple Suspect Outfall Counts
4. Mapping ORI Data
5. Subwatershed and Reach Screening
6. Characterizing IDDE Problems at the Community Level

The level of detail for each analysis method should be calibrated to local resources, program goals, and the actual discharge problems discovered in the stream corridor. In general, the most common conditions and problems will shape your initial monitoring strategy, which prioritizes the subwatersheds or reaches that will be targeted for more intensive investigations.

Program managers should analyze ORI data well before every stream mile is walked in the community, and use initial results to modify field methods. For example, if initial results reveal widespread potential problems, program managers may want to add more indicator monitoring to the ORI to track down individual discharge sources (see Chapter 12). Alternatively, if the same kind of discharge problem is repeatedly found, it may be wise to investigate whether there is a common source or activity generating it (e.g., high turbidity observed at many flowing outfalls as a result of equipment washing at active construction sites).

Basic Data Management and Quality Control

The ORI produces an enormous amount of raw data to characterize outfall conditions. It is not uncommon to compile dozens of individual ORI forms in a single subwatershed. The challenge is to devise a system to organize, process, and translate this data into simpler outputs and formats that can guide illicit discharge elimination efforts. The system starts with effective quality control procedures in the field.

Field sheets should be managed using either a three-ring binder or a clipboard. A small field binder offers the ability to quickly flip back and forth among the outfall forms. Authorization letters, emergency contact lists, and extra forms can also be tucked inside.

At the end of each day, field crews should regroup at a predetermined location to compare notes. The crew leader should confirm that all survey reaches and outfalls of interest have been surveyed, discuss initial findings, and deal with any logistical problems. This is also a good time to check whether field crews are measuring and recording outfall data in the same way, and are consistent in what they are (or are not) recording. Crew leaders should also use this time to review field forms for accuracy and thoroughness. Illegible handwriting should be neatened and details added to notes and any sketches. The crew leader should also organize the forms together into a single master binder or folder for future analysis.

Once crews return from the field, data should be entered into a spreadsheet or database. A Microsoft Access database is provided with this Manual as part of Appendix D (Figure 43), and is supplied on a compact disc with each hard copy. It can also be downloaded with Appendix D from http://www.stormwatercenter.net. Information stored in this database can easily be imported into a GIS for mapping purposes. The GIS can generate its own database table that allows the user to create subwatershed maps showing outfall characteristics and problem areas.

Once data entry is complete, be sure to check the quality of the data. This can be done quickly by randomly spot-checking 10% of the entered data. For example, if 50 field sheets were completed, check five of the spreadsheet or database entries. When transferring data into GIS, quality control maps that display labeled problem outfalls should be created. Each survey crew is responsible for reviewing the accuracy of these maps.

Outfall Classification

A simple outfall designation system has been developed to summarize the discharge potential for individual ORI field sheets. Table 34 presents the four outfall designations that can be made.

Table 34: Outfall Designation System Using ORI Data

Designation	Description
1. Obvious Discharge	Outfalls where there is an illicit discharge that doesn't even require sample collection for confirmation
2. Suspect Discharge	Flowing outfalls with high severity on one or more physical indicators
3. Potential Discharge	Flowing or non-flowing outfalls with presence of two or more physical indicators
4. Unlikely Discharge	Non-flowing outfalls with no physical indicators of an illicit discharge

Simple Suspect Outfall Counts

The first priority is to count the frequency of each outfall designation in the subwatershed or the community as a whole. This simple screening analysis counts the number of problem outfalls per stream mile (i.e., the sum of outfalls designated as having potential, suspected or obvious illicit discharge potential). The density of problem outfalls per stream mile is an important metric to target and screen subwatersheds.

Based on problem outfall counts, program managers may discover that a particular monitoring strategy may not apply to the community. For example, if few problem outfalls are found, an extensive follow-up monitoring program may not be needed, so that program resources can be shifted to pollution hotlines to report and control transitory discharges such as illegal dumping. The key point of this method is to avoid getting lost in the raw data, but look instead to find patterns that can shape a cost-effective IDDE program.

Mapping ORI Data

Maps are an excellent way to portray outfall data. If a GIS system is linked to the ORI database, maps that show the spatial distribution of problem outfalls, locations of dumping, and overall reach conditions can be easily generated. Moreover, GIS provides flexibility that allows for rapid updates to maps as new data are collected and compiled. The sophistication and detail of maps will depend on the initial findings, program goals, available software, and GIS capability.

Subwatershed maps are also an effective and important communication and education tool to engage stakeholders (e.g., public officials, businesses and community residents), as they can visually depict reach quality and the location of problem outfalls. The key point to remember is that maps are tools for understanding data. Try to map with a purpose in mind. A large number of cluttered maps may only confuse, while a smaller number with select data may stimulate ideas for the follow-up monitoring strategy.

Subwatershed and Survey Reach Screening

Problem outfall metrics are particularly valuable to screen or rank priority subwatersheds or survey reaches. The basic approach is simple: select the outfall metrics that are most important to IDDE program goals, and then see how individual subwatersheds or reaches rank in the process. This screening process can help determine which subwatersheds will be priorities for initial follow-up monitoring efforts. When feasible, the screening process should incorporate non-ORI data, such as existing dry weather water quality data, citizen complaints, permitted facilities, and habitat or biological stream indicators.

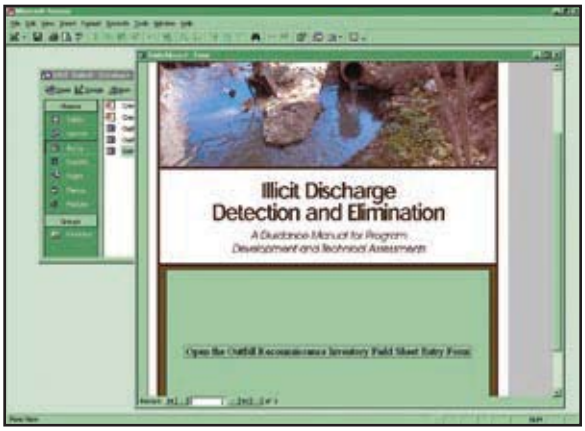


Figure 43: Sample screen from ORI Microsoft Access database

An example of how outfall metrics can screen subwatersheds is provided in Table 35. In this hypothetical example, four metrics were used to screen three subwatersheds within a community: number of suspect discharges, subwatershed population as a percent of the total community, number of industrial discharge permits, and number of outfalls per stream mile. Given these screening criteria, subwatershed C was selected for the next phase of detailed investigation.

Characterizing the IDDE Problem at the Community Level

ORI data should be used to continuously revisit and revise the IDDE program as more is learned about the nature and distribution of illicit discharge problems in the community. For example, ORI discharge designation should be compared against illicit discharge potential (IDP) predictions made during the original desktop analysis (Chapter 5) to refine discharge screening factors, and formulate new monitoring strategies.

In general, community illicit discharge problem can be characterized as minimal, clustered, or severe (Table 36). In the minimal scenario, very few and scattered problems exist; in the clustered scenario, problems are located in isolated subwatersheds; and in the severe scenario, problems are widespread.

Table 35: An Example of ORI Data Being Used to Compare Across Subwatersheds

	# of suspect discharges	Population as % of total community	# of industrial discharge permits	# of outfalls per stream/ conveyance mile
Subwatershed A	2	30	4	6
Subwatershed B	1	10	0	3
Subwatershed C	8	60	2	12

Table 36: Using Stream and ORI Data to Categorize IDDE Problems

Extent	ORI Support Data
Minimal	• Less than 10% of total outfalls are flowing • Less than 20% of total outfalls with obvious, suspect or potential designation
Clustered	• Two thirds of the flowing outfalls are located within one third of the subwatersheds • More than 20% of the communities subwatersheds have greater than 20% of outfalls with obvious, suspect or potential designation
Severe	• More than 10% of total outfalls are flowing • More than 50% of total outfalls with obvious, suspect or potential designation • More than 20% of total outfalls with obvious or suspect designation

11.12 Budgeting and Scoping the ORI

Many different factors come into play when budgeting and scoping an ORI survey: equipment needs, crew size and the stream miles that must be covered. This section presents some simple rules of thumb for ORI budgeting.

Equipment costs for the ORI are relatively minor, with basic equipment to outfit one team of three people totaling about $800 (Table 37). This cost includes one-time expenses to acquire waders, a digital camera and a GPS unit, as well as disposable supplies.

The majority of the budget for an ORI is for staffing the desktop analysis, field crews and data analysis. Field crews can consist of two or three members, and cover about two to three miles of stream (or open channel) per day. Three staff-days should be allocated for pre- and post-field work for each day spent in the field.

Table 38 presents example costs for two hypothetical communities that conduct the ORI. Community A has 10 miles of open channel to investigate, while Community B has 20 miles. In addition, Community A has fewer staff resources available and therefore uses two-person field crews, while Community B uses three-person field crews. Total costs are presented as annual costs, assuming that each community is able to conduct the ORI for all miles in one year.

Table 37: Typical Field Equipment Costs for the ORI

Item	Cost
100 Latex Disposable Gloves	$25
5 Wide Mouth Sample Bottles (1 Liter)	$20
Large Cooler	$25
3 Pairs of Waders	$150
Digital Camera	$200
20 Cans of Spray Paint	$50
Test Kits or Probes	$100-$500
1 GPS Unit	$150
1 Measuring Tape	$10
1 First Aid Kit	$30
Flashlights, Batteries, Labeling tape, Clipboards	$25
Total	**$785-$1185**

Table 38: Example ORI Costs		
Item	**Community A**	**Community B**
Field Equipment[1]	$700	$785
Staff Field Time[2]	$2,000	$6,000
Staff Office Time[3]	$3,000	$6,000
Total	**$5,700**	**$12,785**

[1] From Table 44
[2] Assumes $25/hour salary (2 person teams in Community A and three- person teams in Community B) and two miles of stream per day.
[3] Assumes three staff days for each day in field.

Chapter 13: Tracking Discharges To A Source

Once an illicit discharge is found, a combination of methods is used to isolate its specific source. This chapter describes the four investigation options that are introduced below.

Storm Drain Network Investigation

Field crews strategically inspect manholes within the storm drain network system to measure chemical or physical indicators that can isolate discharges to a specific segment of the network. Once the pipe segment has been identified, on-site investigations are used to find the specific discharge or improper connection.

Drainage Area Investigation

This method relies on an analysis of land use or other characteristics of the drainage area that is producing the illicit discharge. The investigation can be as simple as a "windshield" survey of the drainage area or a more complex mapping analysis of the storm drain network and potential generating sites. Drainage area investigations work best when prior indicator monitoring reveals strong clues as to the likely generating site producing the discharge.

On-site Investigation

On-site methods are used to trace the source of an illicit discharge in a pipe segment, and may involve dye, video or smoke testing within isolated segments of the storm drain network.

Septic System Investigation

Low-density residential watersheds may require special investigation methods if they are not served by sanitary sewers and/or storm water is conveyed in ditches or swales. The major illicit discharges found in low-density development are failing septic systems and illegal dumping. Homeowner surveys, surface inspections and infrared photography have all been effectively used to find failing septic systems in low-density watersheds.

13.1 Storm Drain Network Investigations

This method involves progressive sampling at manholes in the storm drain network to narrow the discharge to an isolated pipe segment between two manholes. Field crews need to make two key decisions when conducting a storm drain network investigation—where to start sampling in the network and what indicators will be used to determine whether a manhole is considered clean or dirty.

Where to Sample in the Storm Drain Network

The field crew should decide how to attack the pipe network that contributes to a problem outfall. Three options can be used:

- Crews can work progressively up the trunk from the outfall and test manholes along the way.
- Crews can split the trunk into equal segments and test manholes at strategic junctions in the storm drain system.
- Crews can work progressively down from the upper parts of the storm drain network toward the problem outfall.

The decision to move up, split, or move down the trunk depends on the nature and land use of the contributing drainage area. Some guidance for making this decision is provided in Table 53. Each option requires different levels of advance preparation. Moving up the trunk can begin immediately when an illicit discharge is detected at the outfall, and only requires a map of the storm drain system. Splitting the trunk and moving down the system require a little more preparation to analyze the storm drain map to find the critical branches to strategically sample manholes. Accurate storm drain maps are needed for all three options. If good mapping is not available, dye tracing can help identify manholes, pipes and junctions, and establish a new map of the storm drain network.

Option 1: Move up the Trunk

Moving up the trunk of the storm drain network is effective for illicit discharge problems in relatively small drainage areas. Field crews start with the manhole closest to the outfall, and progressively move up the network, inspecting manholes until indicators reveal that the discharge is no longer present (Figure 50). The goal is to isolate the discharge between two storm drain manholes.

Table 53: Methods to Attack the Storm Drain Network

Method	Nature of Investigation	Drainage System	Advance Prep Required
Follow the discharge up	Narrow source of an individual discharge	Small diameter outfall (< 36”) Simple drainage network	No
Split into segments	Narrow source of a discharge identified at outfall	Large diameter outfall (> 36”), Complex drainage Logistical or traffic issues may make sampling difficult.	Yes
Move down the storm drain	Multiple types of pollution, many suspected problems—possibly due to old plumbing practices or number of NPDES permits	Very large drainage area (> one square mile).	Yes

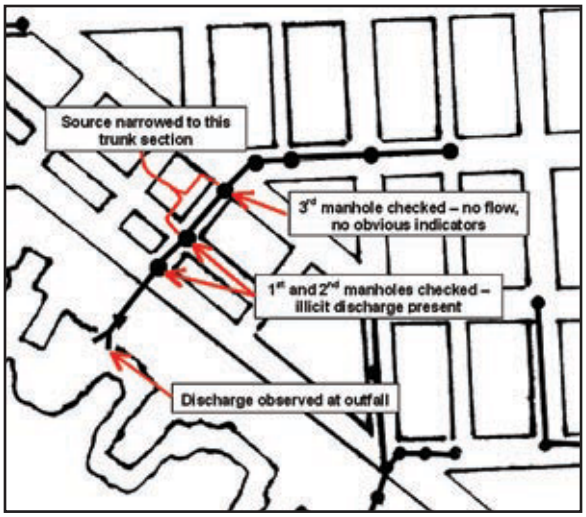


Figure 50: Example investigation following the source up the storm drain system

Option 2: Split the storm drain network

When splitting the storm drain network, field crews select strategic manholes at junctions in the storm drain network to isolate discharges. This option is particularly suited in larger and more complex drainage areas since it can limit the total number of manholes to inspect, and it can avoid locations where access and traffic are problematic.

The method for splitting the trunk is as follows:

1. Review a map of the storm drain network leading to the suspect outfall.
2. Identify major contributing branches to the trunk. The trunk is defined as the largest diameter pipe in the storm drain network that leads directly to the outfall. The "branches" are networks of smaller pipes that contribute to the trunk.
3. Identify manholes to inspect at the farthest downstream node of each contributing branch and one immediately upstream (Figure 51).
4. Working up the network, investigate manholes on each contributing branch and trunk, until the source is narrowed to a specific section of the trunk or contributing branch.
5. Once the discharge is narrowed to a specific section of trunk, select the appropriate on-site investigation method to trace the exact source.
6. If narrowed to a contributing branch, move up or split the branch until a specific pipe segment is isolated, and commence the appropriate on-site investigation to determine the source.

Option 3: Move down the storm drain network

In this option, crews start by inspecting manholes at the "headwaters" of the storm drain network, and progressively move down pipe. This approach works best in very large drainage areas that have many potential continuous and/or intermittent discharges. The Boston Water and Sewer Commission has employed the headwater option to investigate intermittent discharges in complex drainage areas up to three square miles (Jewell, 2001). Field crews certify that each upstream branch of the storm drain network has no contributing discharges before moving down pipe to a "junction manhole" (Figure 52). If discharges are found, the crew performs dye testing to pinpoint the discharge. The crew then confirms that the discharge is removed before moving farther down the pipe network. Figure 53 presents a detailed flow chart that describes this option for analyzing the storm drain network.

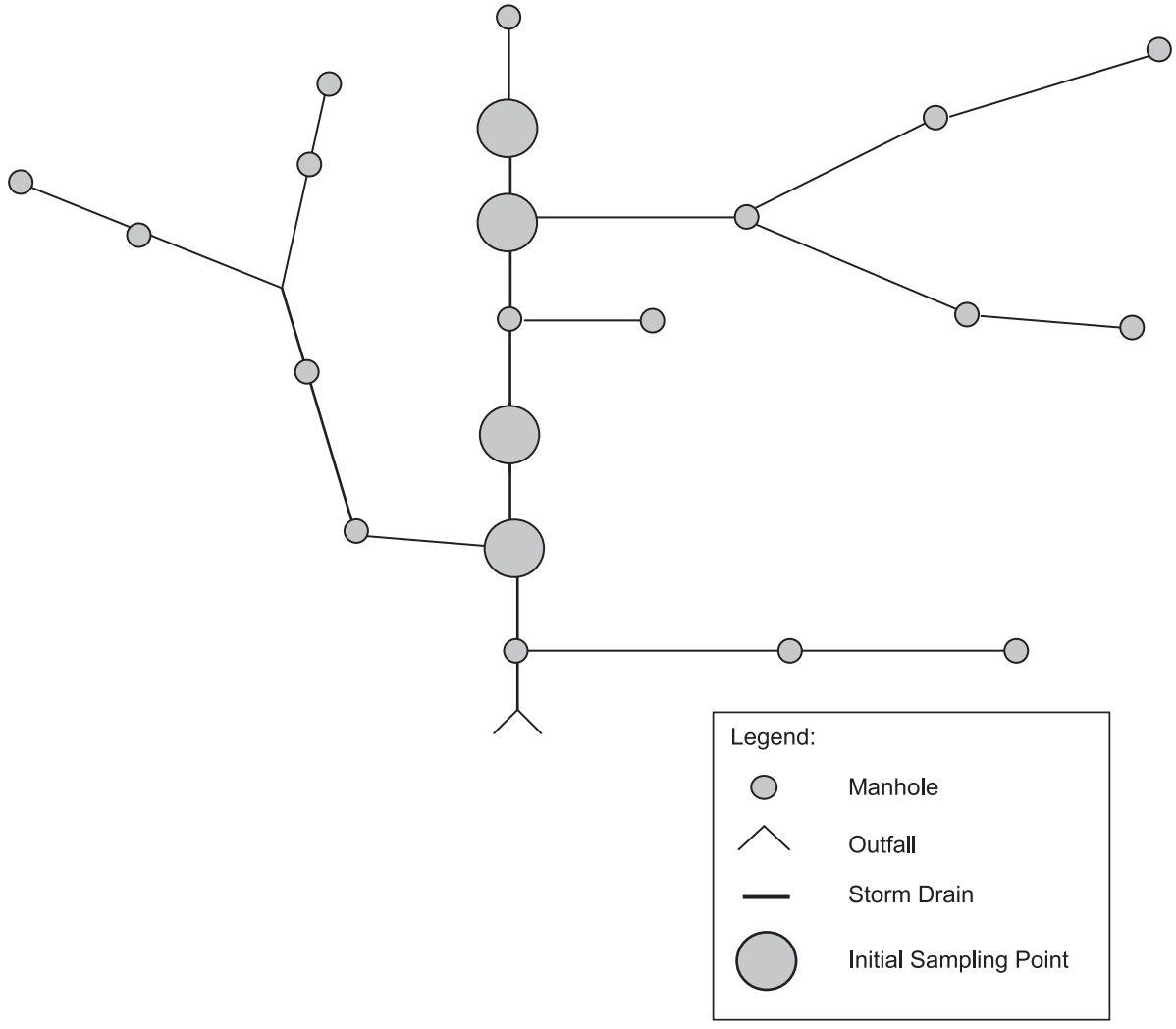


Figure 51: Key initial sampling points along the trunk of the storm drain

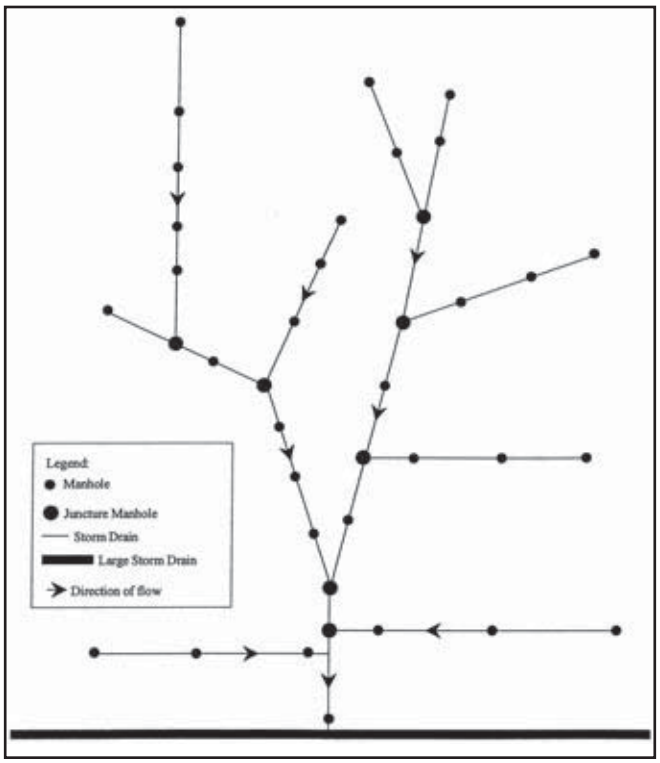


Figure 52: Storm Drain Schematic Identifying "Juncture Manholes" (Source: Jewell, 2001)

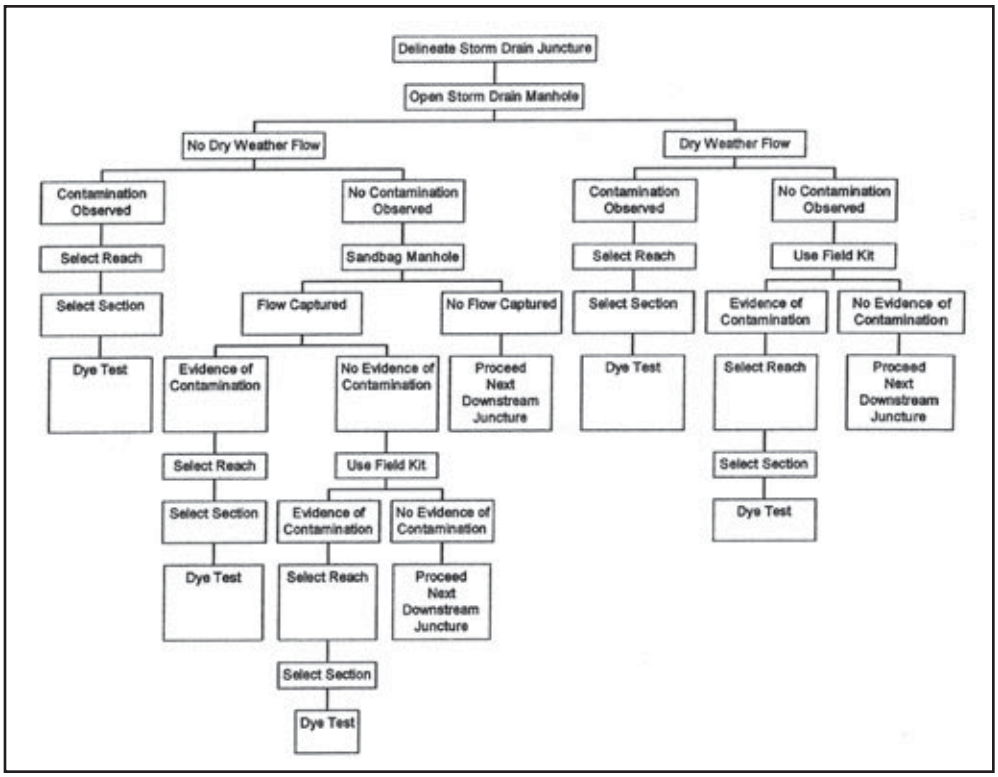


Figure 53: A Process for Following Discharges Down the Pipe (Source: Jewell, 2001)

Dye Testing to Create a Storm Drain Map

As noted earlier, storm drain network investigations are extremely difficult to perform if accurate storm drain maps are not available. In these situations, field crews may need to resort to dye testing to determine the flowpath within the storm drain network. Fluorescent dye is introduced into the storm drain network and suspected manholes are then inspected to trace the path of flow through the network (U.S. EPA, 1990). Two or three member crews are needed for dye testing. One person drops the dye into the trunk while the other(s) looks for evidence of the dye down pipe.

To conduct the investigation, a point of interest or down pipe "stopping point" is identified. Dye is then introduced into manholes upstream of the stopping point to determine if they are connected. The process continues in a systematic manner until an upstream manhole can no longer be determined, whereby a branch or trunk of the system can be defined, updated or corrected. More information on dye testing methods is provided in Section 13.3.

Manhole Inspection: Visual Observations and Indicator Sampling

Two primary methods are used to characterize discharges observed during manhole inspections—visual observations and indicator sampling. In both methods, field crews must first open the manhole to determine whether an illicit discharge is present. Manhole inspections require a crew of two and should be conducted during dry weather conditions.

Basic field equipment and safety procedures required for manhole inspections are outlined in Table 54. In particular, field crews need to be careful about how they will safely divert traffic (Figure 54). Other safety considerations include proper lifting of manhole covers to reduce the potential for back injuries, and testing whether any toxic or flammable fumes exist within the manhole before the cover is removed. Wayne County, MI has developed some useful operational procedures for inspecting manholes, which are summarized in Table 55.

Table 54: Basic Field Equipment Checklist

- Camera and film or digital camera
- Clipboards
- Field sheets
- Field vehicle
- First aid kit
- Flashlight or spotlight
- Gas monitor and probe
- Manhole hook/crow bar
- Mirror
- Storm drain, stream, and street maps
- Reflective safety vests
- Rubber / latex gloves
- Sledgehammer
- Spray paint
- Tape measures
- Traffic cones
- Two-way radios
- Waterproof marker/ pen
- Hand held global positioning satellite (GPS) system receiver (best resolution available within budget, at least 6' accuracy)

Figure 54: Traffic cones divert traffic from manhole inspection area

Table 55: Field Procedure for Removal of Manhole Covers
(Adapted from: Pomeroy et al., 1996)

Field Procedures:

1. Locate the manhole cover to be removed.
2. Divert road and foot traffic away from the manhole using traffic cones.
3. Use the tip of a crowbar to lift the manhole cover up high enough to insert the gas monitor probe. Take care to avoid creating a spark that could ignite explosive gases that may have accumulated under the lid. Follow procedures outlined for the gas monitor to test for accumulated gases.
4. If the gas monitor alarm sounds, close the manhole immediately. Do not attempt to open the manhole until some time is allowed for gases to dissipate.
5. If the gas monitor indicates the area is clear of hazards, remove the monitor probe and position the manhole hook under the flange. Remove the crowbar. Pull the lid off with the hook.
6. When testing is completed and the manhole is no longer needed, use the manhole hook to pull the cover back in place. Make sure the lid is settled in the flange securely.
7. Check the area to ensure that all equipment is removed from the area prior to leaving.

Safety Considerations:

1. Do not lift the manhole cover with your back muscles.
2. Wear steel-toed boots or safety shoes to protect feet from possible crushing injuries that could occur while handling manhole covers.
3. Do not move manhole covers with hands or fingers.
4. Wear safety vests or reflective clothing so that the field crew will be visible to traffic.
5. Manholes may only be entered by properly trained and equipped personnel and when all OSHA and local rules a.

Visual Observations During Manhole Inspection

Visual observations are used to observe conditions in the manhole and look for any signs of sewage or dry weather flow. Visual observations work best for obvious illicit discharges that are not masked by groundwater or other "clean" discharges, as shown in Figure 55. Typically, crews progressively inspect manholes in the storm drain network to look for contaminated flows. Key visual observations that are made during manhole inspections include:

- Presence of flow
- Colors
- Odors
- Floatable materials
- Deposits or stains (intermittent flows)

Figure 55: Manhole observation (left) indicates a sewage discharge. Source is identified at an adjacent sewer manhole that overflowed into the storm drain system (right).

Indicator Sampling

If dry weather flow is observed in the manhole, the field crew can collect a sample by attaching a bucket or bottle to a tape measure/rope and lowering it into the manhole (Figure 56). The sample is then immediately analyzed in the field using probes or other tests to get fast results as to whether the flow is clean or dirty. The most common indicator parameter is ammonia, although other potential indicators are described in Chapter 12.

Manhole indicator data is analyzed by looking for "hits," which are individual samples that exceed a benchmark concentration. In addition, trends in indicator concentrations are also examined throughout the storm drain network.

Figure 56: Techniques to sample from the storm drain

Figure 57 profiles a storm drain network investigation that used ammonia as the indicator parameter and a benchmark concentration of 1.0 mg/L. At both the outfall and the first manhole up the trunk, field crews recorded finding "hits" for ammonia of 2.2 mg/L and 2.3 mg/L, respectively. Subsequent manhole inspections further up the network revealed one manhole with no flow, and a second with a hit for ammonia (2.4 mg/L). The crew then tracked the discharge upstream of the second manhole, and found a third manhole with a low ammonia reading (0.05 mg/L) and a fourth with a much higher reading (4.3 mg/L). The crew then redirected its effort to sample above the fourth manhole with the 4.3 mg/L concentration, only to find another low reading. Based on this pattern, the crew concluded the discharge source was located between these two manholes, as nothing else could explain this sudden increase in concentration over this length of pipe.

The results of storm drain network investigations should be systematically documented to guide future discharge investigations, and describe any infrastructure maintenance problems encountered. An example of a sample manhole inspection field log is displayed in Figure 58.

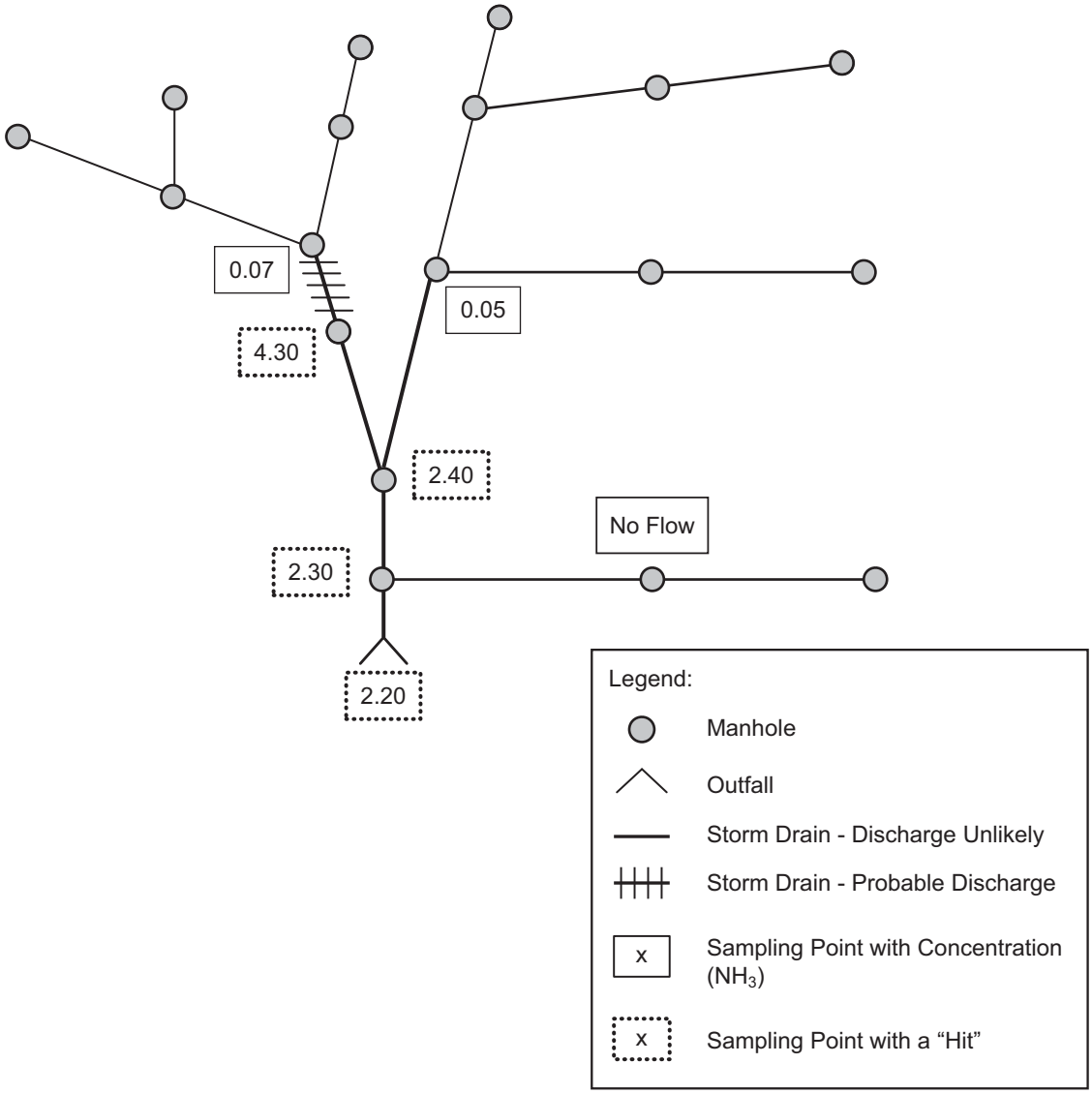
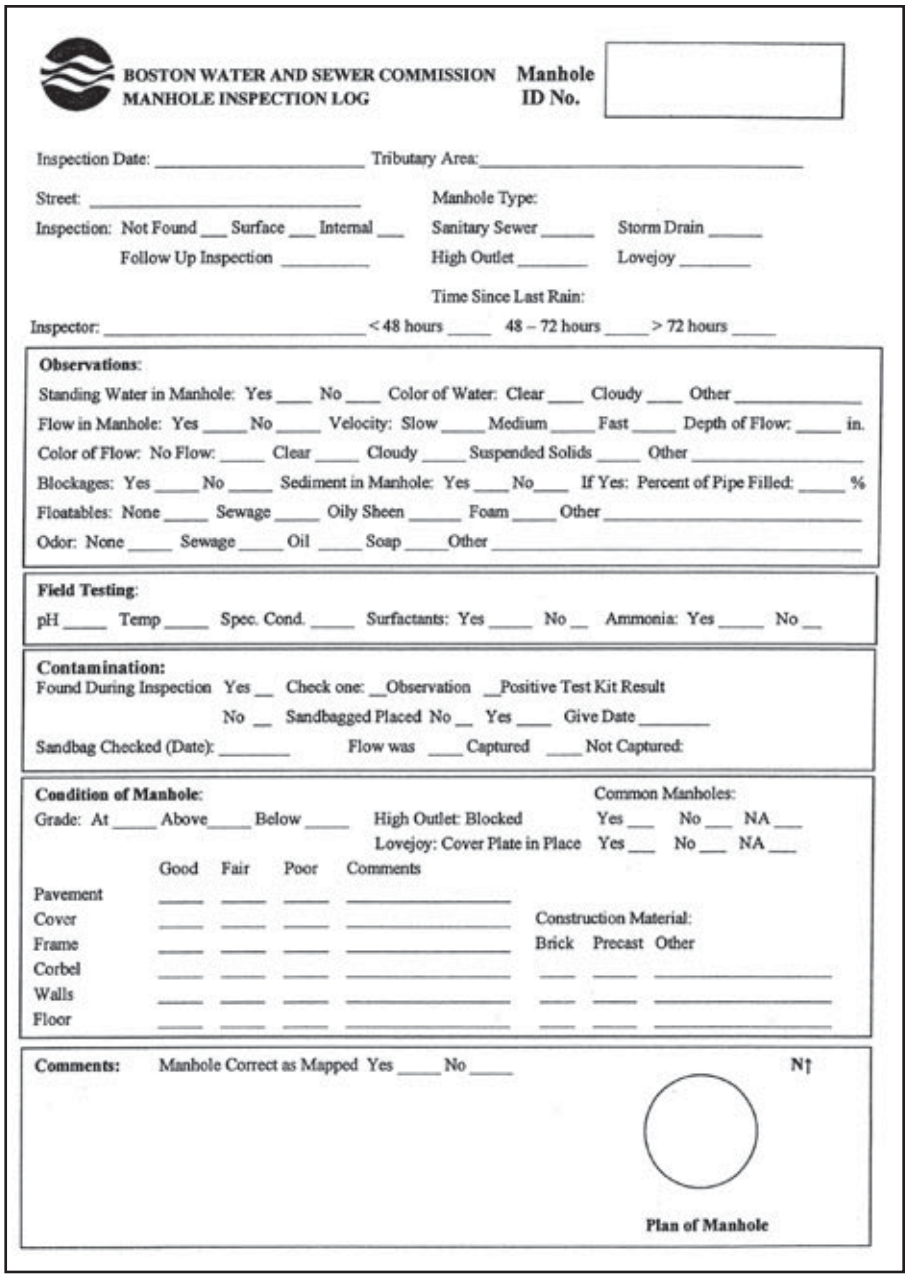


Figure 57: Use of ammonia as a trace parameter to identify illicit discharges



BOSTON WATER AND SEWER COMMISSION
MANHOLE INSPECTION LOG

Manhole ID No.

Inspection Date: _____ Tributary Area: _____

Street: _____

Manhole Type:

Inspection: Not Found ___ Surface ___ Internal ___

Sanitary Sewer _____ Storm Drain _____

Follow Up Inspection _____

High Outlet _____ Lovejoy _____

Time Since Last Rain:

Inspector: _____ < 48 hours _____ 48 – 72 hours _____ > 72 hours _____

Observations:

Standing Water in Manhole: Yes ____ No ____ Color of Water: Clear ____ Cloudy ____ Other _____

Flow in Manhole: Yes _____ No _____ Velocity: Slow _____ Medium _____ Fast _____ Depth of Flow: _____ in.

Color of Flow: No Flow: _____ Clear _____ Cloudy _____ Suspended Solids _____ Other _____

Blockages: Yes _____ No _____ Sediment in Manhole: Yes ____ No____ If Yes: Percent of Pipe Filled: _____ %

Floatables: None _____ Sewage _____ Oily Sheen _____ Foam _____ Other _____

Odor: None _____ Sewage _____ Oil _____ Soap _____ Other _____

Field Testing:

pH _____ Temp _____ Spec. Cond. _____ Surfactants: Yes _____ No __ Ammonia: Yes _____ No __

Contamination:

Found During Inspection Yes __ Check one: __Observation __Positive Test Kit Result

No __ Sandbagged Placed No __ Yes ____ Give Date _____

Sandbag Checked (Date): _____ Flow was ____ Captured ____ Not Captured:

Condition of Manhole:

Grade: At _____ Above _____ Below _____ High Outlet: Blocked Yes ___ No ___ NA ___

Lovejoy: Cover Plate in Place Yes ___ No ___ NA ___

Common Manholes:

	Good	Fair	Poor	Comments
Pavement	____	____	____	_____
Cover	____	____	____	_____
Frame	____	____	____	_____
Corbel	____	____	____	_____
Walls	____	____	____	_____
Floor	____	____	____	_____

Construction Material:

Brick	Precast	Other
____	____	_____
____	____	_____
____	____	_____

Comments: Manhole Correct as Mapped Yes _____ No _____

N↑

Plan of Manhole

Figure 58: Boston Water and Sewer Commission Manhole Inspection Log (Source: Jewell, 2001)

Methods to isolate intermittent discharges in the storm drain network

Intermittent discharges are often challenging to trace in the storm drain network, although four techniques have been used with some success.

Sandbags

This technique involves placement of sandbags or similar barriers within strategic manholes in the storm drain network to form a temporary dam that collects any intermittent flows that may occur. Any flow collected behind the sandbag is then assessed using visual observations or by indicator sampling. Sandbags are lowered on a rope through the manhole to form a dam along the bottom of the storm drain, taking care not to fully block the pipe (in case it rains before the sandbag is retrieved). Sandbags are typically installed at junctions in the network to eliminate contributing branches from further consideration (Figure 59). If no flow collects behind the sandbag, the upstream pipe network can be ruled out as a source of the intermittent discharge.

Sandbags are typically left in place for no more than 48 hours, and should only be installed when dry weather is forecast. Sandbags should not be left in place during a heavy rainstorm. They may cause a blockage in the storm drain, or, they may be washed downstream and lost. The biggest downside to sandbagging is that it requires at least two trips to each manhole.

Optical Brightener Monitoring (OBM) Traps

Optical brightener monitoring (OBM) traps, profiled in Chapter 12, can also be used to detect intermittent flows at manhole junctions. When these absorbent pads are anchored in the pipe to capture dry weather flows, they can be used to determine the presence of flow and/or detergents. These OBM traps are frequently installed by lowering them into an open-grate drop inlet or storm drain inlet, as shown in Figure 60. The pads are then retrieved after 48 hours and are observed under a fluorescent light (this method is most reliable for undiluted washwaters).

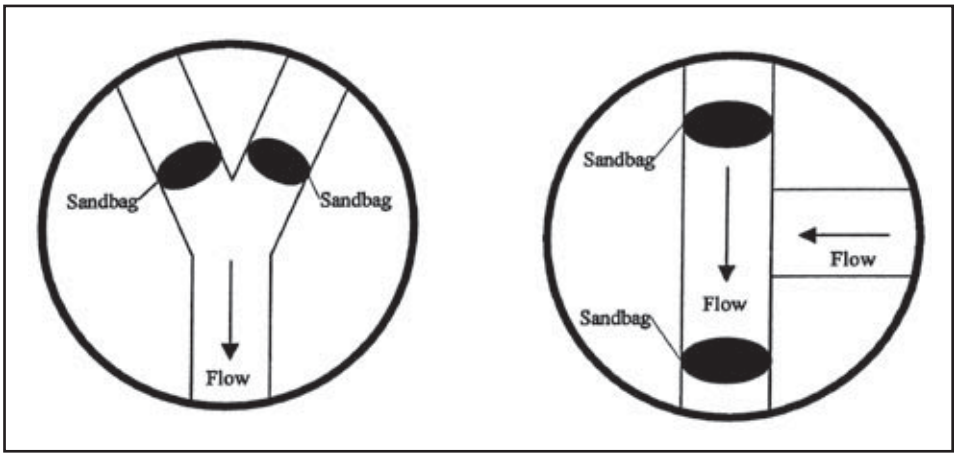


Figure 59: Example sandbag placement (Source: Jewell, 2001)

Figure 60: Optical Brightener Placement in the Storm Drain
(Source: Sargent and Castonguay, 1998)

Automatic Samplers

A few communities have installed automated samplers at strategic points within the storm drain network system that are triggered by small dry weather flows and collect water quality samples of intermittent discharges. Automated sampling can be extremely expensive, and is primarily used in very complex drainage areas that have severe intermittent discharge problems. Automated samplers can pinpoint the specific date and hours when discharges occur, and characterize its chemical composition, which can help crews fingerprint the generating source.

Observation of Deposits or Stains

Intermittent discharges often leave deposits or stains within the storm drain pipe or manhole after they have passed. Thus, crews should note whether any deposits or stains are present in the manhole, even if no dry weather flow is observed. In some cases, the origin of the discharge can be surmised by collecting indicator samples in the water ponded within the manhole sump. Stains and deposits, however, are not always a conclusive way to trace intermittent discharges in the storm drain network.

13.2 Drainage Area Investigations

The source of some illicit discharges can be determined through a survey or analysis of the drainage area of the problem outfall. The simplest approach is a rapid windshield survey of the drainage area to find the potential discharger or generating sites. A more sophisticated approach relies on an analysis of available GIS data and permit databases to identify industrial or other generating sites. In both cases, drainage area investigations are only effective if the discharge observed at an outfall has distinct or unique characteristics that allow crews to quickly ascertain the probable operation or business that is generating it. Often, discharges with a unique color, smell, or off-the-chart indicator sample reading may point to a specific industrial or commercial source. Drainage area investigations are not helpful in tracing sewage discharges, since they are often not always related to specific land uses or generating sites.

Rapid Windshield Survey

A rapid drive-by survey works well in small drainage areas, particularly if field crews are already familiar with its business operations. Field crews try to match the characteristics of the discharge to the most likely type of generating site, and then inspect all of the sites of the same type within the drainage area until the culprit is found. For example, if fuel is observed at an outfall, crews might quickly check every business operation in the catchment that stores or dispenses fuel. Another example is illustrated in Figure 61 where extremely dense algal growth was observed in a small stream during the winter. Field crews were aware of a fertilizer storage site in the drainage area, and a quick inspection identified it as the culprit.

Figure 61: Symptom (left): Discoloration of stream; Diagnosis: Extra hydroseed leftover from an upstream application (middle) was dumped into a storm drain by municipal officials (right).

A third example of the windshield survey approach is shown in Figure 62, where a very thick, sudsy and fragrant discharge was noted at a small outfall. The discharge appeared to consist of wash water, and the only commercial laundromat found upstream was confirmed to be the source. On-site testing may still be needed to identify the specific plumbing or connection generating the discharge.

Detailed Drainage Area Investigations

In larger or more complex drainage areas, GIS data can be analyzed to pinpoint the source of a discharge. If only general land use data exist, maps can at least highlight suspected industrial areas. If more detailed SIC code data are available digitally, the GIS can be used to pull up specific hotspot operations or generating sites that could be potential dischargers. Some of the key discharge indicators that are associated with hotspots and specific industries are reviewed in Appendix K.

13.3 On-site Investigations

On-site investigations are used to pinpoint the exact source or connection producing a discharge within the storm drain network. The three basic approaches are dye, video and smoke testing. While each approach can determine the actual source of a discharge, each needs to be applied under the right conditions and test limitations (see Table 56). It should be noted that on-site investigations are not particularly effective in finding *indirect* discharges to the storm drain network.

Figure 62: The sudsy, fragrant discharge (left) indicates that the laundromat is the more likely culprit than the florist (right).

Table 56: Techniques to Locate the Discharge		
Technique	**Best Applications**	**Limitations**
Dye Testing	• Discharge limited to a very small drainage area (<10 properties is ideal) • Discharge probably caused by a connection from an individual property • Commercial or industrial land use	• May be difficult to gain access to some properties
Video Testing	• Continuous discharges • Discharge limited to a single pipe segment • Communities who own equipment for other investigations	• Relatively expensive equipment • Cannot capture non-flowing discharges • Often cannot capture discharges from pipes submerged in the storm drain
Smoke Testing	• Cross-connection with the sanitary sewer • Identifying other underground sources (e.g., leaking storage techniques) caused by damage to the storm drain	• Poor notification to public can cause alarm • Cannot detect all illicit discharges

TIP

The Wayne County Department of the Environment provides excellent training materials on on-site investigations, as well as other illicit discharge techniques. More information about this training can be accessed from their website: http://www.wcdoe.org/Watershed/Programs___Srvcs_/IDEP/idep.htm.

Figure 63: Dye Testing Plumbing (NEIWPCC, 2003)

Dye Testing

Dye testing is an excellent indicator of illicit connections and is conducted by introducing non-toxic dye into toilets, sinks, shop drains and other plumbing fixtures (see Figure 63). The discovery of dye in the storm drain, rather than the sanitary sewer, conclusively determines that the illicit connection exists.

Before commencing dye tests, crews should review storm drain and sewer maps to identify lateral sewer connections and how they can be accessed. In addition, property owners must be notified to obtain entry permission. For industrial or commercial properties, crews should carry a letter to document their legal authority to gain access to the property. If time permits, the letter can be sent in advance of the dye testing. For residential properties, communication can be more challenging. Unlike commercial properties, crews are not guaranteed access to homes, and should call ahead to ensure that the owner will be home on the day of testing.

Communication with other local agencies is also important since any dye released to the storm drain could be mistaken for a spill or pollution episode. To avoid a costly and embarrassing response to a false alarm,

crews should contact key spill response agencies using a "quick fax" that describes when and where dye testing is occurring (Tuomari and Thomson, 2002). In addition, crews should carry a list of phone numbers to call spill response agencies in the event dye is released to a stream.

At least two staff are needed to conduct dye tests – one to flush dye down the plumbing fixtures and one to look for dye in the downstream manhole(s). In some cases, three staff may be preferred, with two staff entering the private residence or building for both safety and liability purposes.

The basic equipment to conduct dye tests is listed in Table 57 and is not highly specialized. Often, the key choice is the type of dye to use for testing. Several options are profiled in Table 58. In most cases, liquid dye is used, although solid dye tablets can also be placed in a mesh bag and lowered into the manhole on a rope (Figure 64). If a

Table 57: Key Field Equipment for Dye Testing
(Source: Wayne County, MI, 2000)

Maps, Documents
- Sewer and storm drain maps (sufficient detail to locate manholes)
- Site plan and building diagram
- Letter describing the investigation
- Identification (e.g., badge or ID card)
- Educational materials (to supplement pollution prevention efforts)
- List of agencies to contact if the dye discharges to a stream.
- Name of contact at the facility

Equipment to Find and Lift the Manhole Safely (small manhole often in a lawn)
- Probe
- Metal detector
- Crow bar
- Safety equipment (hard hats, eye protection, gloves, safety vests, steel-toed boots, traffic control equipment, protective clothing, gas monitor)

Equipment for Actual Dye Testing and Communications
- 2-way radio
- Dye (liquid or "test strips")
- High powered lamps or flashlights
- Water hoses
- Camera

Figure 64: Dye in a mesh bag is placed into an upstream manhole (left); Dye observed at a downstream manhole traces the path of the storm drain (right)

longer pipe network is being tested, and dye is not expected to appear for several hours, charcoal packets can be used to detect the dye (GCHD, 2002). Charcoal packets can be secured and left in place for a week or two, and then analyzed for the presence of dye. Instructions for using charcoal packets in dye testing can be accessed at the following website: http://bayinfo.tamug.tamu.edu/gbeppubs/ms4.pdf.

The basic drill for dye tests consists of three simple steps. First, flush or wash dye down the drain, fixture or manhole. Second, pop open downgradient sanitary sewer manholes and check to see if any dye appears. If none is detected in the sewer manhole after an hour or so, check downgradient storm drain manholes or outfalls for the presence of dye. Although dye testing is fairly straightforward, some tips to make testing go more smoothly are offered in Table 59.

Table 58: Dye Testing Options

Product	Applications
Dye Tablets	• Compressed powder, useful for releasing dye over time • Less messy than powder form • Easy to handle, no mess, quick dissolve • Flow mapping and tracing in storm and sewer drains • Plumbing system tracing • Septic system analysis • Leak detection
Liquid Concentrate	• Very concentrated, disperses quickly • Works well in all volumes of flow • Recommended when metering of input is required • Flow mapping and tracing in storm and sewer drains • Plumbing system tracing • Septic system analysis • Leak detection
Dye Strips	• Similar to liquid but less messy
Powder	• Can be very messy and must dissolve in liquid to reach full potential • Recommended for very small applications or for very large applications where liquid is undesirable • Leak detection
Dye Wax Cakes	• Recommended for moderate-sized bodies of water • Flow mapping and tracing in storm and sewer drains
Dye Wax Donuts	• Recommended for large sized bodies of water (lakes, rivers, ponds) • Flow mapping and tracing in storm and sewer drains • Leak detection

Table 59: Tips for Successful Dye Testing
(Adapted from Tuomari and Thompson, 2002)

Dye Selection
- Green and liquid dyes are the easiest to see.
- Dye test strips can be a good alternative for residential or some commercial applications. (Liquid can leave a permanent stain).
- Check the sanitary sewer before using dyes to get a "base color." In some cases, (e.g., a print shop with a permitted discharge to the sanitary sewer), the sewage may have an existing color that would mask a dye.
- Choose two dye colors, and alternate between them when testing multiple fixtures.

Selecting Fixtures to Test
- Check the plumbing plan for the site to isolate fixtures that are separately connected.
- For industrial facilities, check most floor drains (these are often misdirected).
- For plumbing fixtures, test a representative fixture (e.g., a bathroom sink).
- Test some locations separately (e.g., washing machines and floor drains), which may be misdirected.
- If conducting dye investigations on multiple floors, start from the basement and work your way up.
- At all fixtures, make sure to flush with plenty of water to ensure that the dye moves through the system.

Selecting a Sewer Manhole for Observations
- Pick the closest manhole possible to make observations (typically a sewer lateral).
- If this is not possible, choose the nearest downstream manhole.

Communications Between Crew Members
- The individual conducting the dye testing calls in to the field person to report the color dye used, and when it is dropped into the system.
- The field person then calls back when dye is observed in the manhole.
- If dye is not observed (e.g., after two separate flushes have occurred), dye testing is halted until the dye appears.

Locating Missing Dye
- The investigation is not complete until the dye is found. Some reasons for dye not appearing include:
- The building is actually hooked up to a septic system.
- The sewer line is clogged.
- There is a leak in the sewer line or lateral pipe.

Video Testing

Video testing works by guiding a mobile video camera through the storm drain pipe to locate the actual connection producing an illicit discharge. Video testing shows flows and leaks within the pipe that may indicate an illicit discharge, and can show cracks and other pipe damage that enable sewage or contaminated water to flow into the storm drain pipe.

Video testing is useful when access to properties is constrained, such as residential neighborhoods. Video testing can also be expensive, unless the community already owns and uses the equipment for sewer inspections. This technique will not detect all types of discharges, particularly when the illicit connection is not flowing at the time of the video survey.

Different types of video camera equipment are used, depending on the diameter and condition of the storm sewer being tested.

Field crews should review storm drain maps, and preferably visit the site before selecting the video equipment for the test. A field visit helps determine the camera size needed to fit into the pipe, and if the storm drain has standing water.

In addition to standard safety equipment required for all manhole inspections, video testing requires a Closed-Circuit Television (CCTV) and supporting items. Many commercially available camera systems are specifically adapted to televise storm sewers, ranging from large truck or van-mounted systems to much smaller portable cameras. Cameras can be self-propelled or towed. Some specifications to look for include:

- The camera should be capable of radial view for inspection of the top, bottom, and sides of the pipe and for looking up lateral connections.
- The camera should be color.
- Lighting should be supplied by a lamp on the camera that can light the entire periphery of the pipe.

When inspecting the storm sewer, the CCTV is oriented to keep the lens as close as possible to the center of the pipe. The camera can be self-propelled through the pipe using a tractor or crawler unit or it may be towed through on a skid unit (see Figures 65 and 66). If the storm drain has ponded water, the camera should be attached to a raft, which floats through the storm sewer from one manhole to the next. To see details of the sewer, the camera and lights should be able to swivel both horizontally and vertically. A video record of the inspection should be made for future reference and repairs (see Figure 67).

Figure 65: Camera being towed

Smoke Testing

Smoke testing is another "bottom up" approach to isolate illicit discharges. It works by introducing smoke into the storm drain system and observing where the smoke surfaces. The use of smoke testing to detect illicit discharges is a relatively new application, although many communities have used it to check for infiltration and inflow into their sanitary sewer network. Smoke testing can find improper

Figure 66: Tractor-mounted camera

Figure 67: Review of an inspection video

connections, or damage to the storm drain system (Figure 68). This technique works best when the discharge is confined to the upper reaches of the storm drain network, where pipe diameters are to small for video testing and gaining access to multiple properties renders dye testing infeasible.

Notifying the public about the date and purpose of smoke testing before starting is critical. The smoke used is non-toxic, but can cause respiratory irritation, which can be a problem for some residents. Residents should be notified at least two weeks prior to testing, and should be provided the following information (Hurco Technologies, Inc., 2003):

- Date testing will occur
- Reason for smoke testing
- Precautions they can take to prevent smoke from entering their homes or businesses
- What they need to do if smoke enters their home or business, and any health concerns associated with the smoke
- A number residents can call to relay any particular health concerns (e.g., chronic respiratory problems)

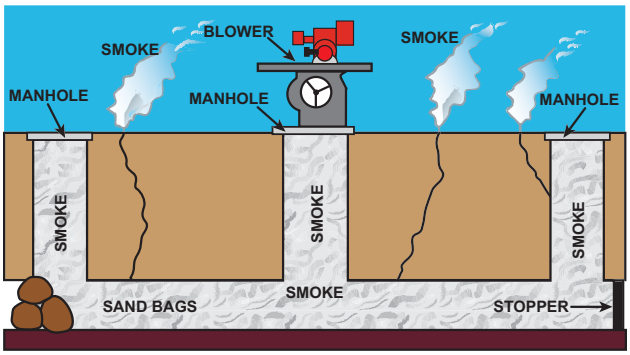


Figure 68: Smoke Testing System Schematic

Program managers should also notify local media to get the word out if extensive smoke testing is planned (e.g., television, newspaper, and radio). On the actual day of testing, local fire, police departments and 911 call centers should be notified to handle any calls from the public (Hurco Technologies, Inc., 2003).

The basic equipment needed for smoke testing includes manhole safety equipment, a smoke source, smoke blower, and sewer plugs. Two smoke sources can be used for smoke testing. The first is a smoke "bomb," or "candle" that burns at a controlled rate and releases very white smoke visible at relatively low concentrations (Figure 69). Smoke bombs are suspended beneath a blower in a manhole. Candles are available in 30 second to three minute sizes. Once opened, smoke bombs should be kept in a dry location and should be used within one year.

The second smoke source is liquid smoke, which is a petroleum-based product that is injected into the hot exhaust of a blower where it is heated and vaporized (Figure 70). The length of smoke production can vary depending on the length of the pipe being

Figure 69: Smoke Candles

Figure 70: Smoke blower

tested. In general, liquid smoke is not as consistently visible and does not travel as far as smoke from bombs (USA Blue Book).

Smoke blowers provide a high volume of air that forces smoke through the storm drain pipe. Two types of blowers are commonly used: "squirrel cage" blowers and direct-drive propeller blowers. Squirrel cage blowers are large and may weigh more than 100 pounds, but allow the operator to generate more controlled smoke output. Direct-drive propeller blowers are considerably lighter and more compact, which allows for easier transport and positioning.

Three basic steps are involved in smoke testing. First, the storm drain is sealed off by plugging storm drain inlets. Next, the smoke is released and forced by the blower through the storm drain system. Lastly, the crew looks for any escape of smoke above-ground to find potential leaks.

One of three methods can be used to seal off the storm drain. Sandbags can be lowered into place with a rope from the street surface. Alternatively, beach balls that have a diameter slightly larger than the drain can be inserted into the pipe. The beach ball is then placed in a mesh bag with a rope attached to it so it can be secured and retrieved. If the beach ball gets stuck in the pipe, it can simply be punctured, deflated and removed. Finally, expandable plugs are available, and may be inserted from the ground surface.

Blowers should be set up next to the open manhole after the smoke is started. Only one manhole is tested at a time. If smoke candles are used, crews simply light the candle, place it in a bucket, and lower it in the manhole. The crew then watches to see where smoke escapes from the pipe. The two most common situations that indicate an illicit discharge are when smoke is seen rising from internal plumbing fixtures (typically reported by residents) or from sewer vents. Sewer vents extend upward from the sewer lateral to release gas buildup, and are not supposed to be connected to the storm drain system.

13.4 Septic System Investigations

The techniques for tracing illicit discharges are different in rural or low-density residential watersheds. Often, these watersheds lack sanitary sewer service and storm water is conveyed through ditches or swales, rather than enclosed pipes. Consequently, many illicit discharges enter the stream as indirect discharges, through surface breakouts of septic fields or through straight pipe discharges from bypassed septic systems.

The two broad techniques used to find individual septic systems—on-site investigations and infrared imagery—are described in this section.

On-Site Septic Investigations

Three kinds of on-site investigations can be performed at individual properties to determine if the septic system is failing, including homeowner survey, surface condition analysis and a detailed system inspection. The first two investigations are rapid and relatively simple assessments typically conducted in targeted watershed areas. Detailed system inspections are a much more thorough investigation of the functioning of the septic system that is conducted by a certified professional. Detailed system inspections may occur at time of sale of a property, or be triggered by poor scores on the rapid homeowner survey or surface condition analysis.

Homeowner Survey

The homeowner survey consists of a brief interview with the property owner to determine the potential for current or future failure of the septic system, and is often done in conjunction with a surface condition analysis.

Table 60 highlights some common questions to ask in the survey, which inquire about resident behaviors, system performance and maintenance activity.

Surface Condition Analysis

The surface condition analysis is a rapid site assessment where field crews look for obvious indicators that point to current or potential production of illicit discharges by the septic system (Figure 71). Some of the key surface conditions to analyze have been described by Andrews *et al*., (1997) and are described below:

- Foul odors in the yard
- Wet, spongy ground; lush plant growth; or burnt grass near the drain field
- Algal blooms or excessive weed growth in adjacent ditches, ponds and streams
- Shrubs or trees with root damage within 10 feet of the system
- Cars, boats, or other heavy objects located over the field that could crush lateral pipes
- Storm water flowing over the drain field
- Cave-ins or exposed system components
- Visible liquid on the surface of the drain field (e.g., surface breakouts)
- Obvious system bypasses (e.g., straight pipe discharges)

Table 60: Septic System Homeowner Survey Questions
(Adapted from Andrews et al., 1997 and Holmes Inspection Services)

- How many people live in the house?[1]
- What is the septic tank capacity?[2]
- Do drains in the house empty slowly or not at all?
- When was the last time the system was inspected or maintained?
- Does sewage back up into the house through drain lines?
- Are there any wet, smelly spots in the yard?
- Is the septic tank effluent piped so it drains to a road ditch, a storm sewer, a stream, or is it connected to a farm drain tile?

[1] Water usage ranges from 50 to 100 gallons per day per person. This information can be used to estimate the wastewater load from the house (Andrews et. al, 1997).
[2] The septic tank should be large enough to hold two days' worth of wastewater (Andrews et. al, 1997).

a.  b. 

Figure 71: (a) Straight pipe discharge to nearby stream. (b) Algal bloom in a nearby pond.
(Sources: a- Snohomish County, WA, b- King County, WA)

Detailed System Inspection

The detailed system inspection is a much more thorough inspection of the performance and function of the septic system, and must be completed by a certified professional. The inspector certifies the structural integrity of all components of the system, and checks the depth of solids in the septic tank to determine if the system needs to be pumped out. The inspector also sketches the system, and estimates distance to groundwater, surface water, and drinking water sources. An example septic system inspection form from Massachusetts can be found at http://www.state.ma.us/dep/brp/wwm/soilsys.htm.

Although not always incorporated into the inspection, dye testing can sometimes point to leaks from broken pipes, or direct discharges through straight pipes that might be missed during routine inspection. Dye can be introduced into plumbing fixtures in the home, and flushed with sufficient running water. The inspector then watches the septic field, nearby ditches, watercourses and manholes for any signs of the dye. The dye may take several hours to appear, so crews may want to place charcoal packets in adjacent waters to capture dye until they can return later to retrieve them.

Infrared Imagery

Infrared imagery is a special type of photography with gray or color scales that represent differences in temperature and emissivity of objects in the image (www.stocktoninfrared.com), and can be used to locate sewage discharges. Several different infrared imagery techniques can be used to identify illicit discharges. The following discussion highlights two of these: aerial infrared thermography[13] and color infrared aerial photography.

Infrared Thermography

Infrared thermography is increasingly being used to detect illicit discharges and failing septic systems. The technique uses the temperature difference of sewage as a marker to locate these illicit discharges. Figure 72 illustrates the thermal difference

[13] Infrared thermography is also being used by communities such as Mecklenburg County and the City of Charlotte in NC to detect illicit discharges at outfalls.

between an outfall discharge (with a higher temperature) and a stream.

The equipment needed to conduct aerial infrared thermography includes an aircraft (plane or helicopter); a high-resolution, large format, infrared camera with appropriate mount; a GPS unit; and digital recording equipment. If a plane is used, a higher resolution camera is required since it must operate at higher altitudes. Pilots should be experienced since flights take place at night, slowly, and at a low altitude. The camera may be handheld, but a mounted camera will provide significantly clearer results for a larger area. The GPS can be combined with a mobile mapping program and a video encoder-decoder that encodes and displays the coordinates, date, and time (Stockton, 2000). The infrared data are analyzed after the flight by trained analysts to locate suspected discharges, and field crews then inspect the ground-truthed sites to confirm the presence of a failing septic system.

Late fall, winter, and early spring are typically the best times of year to conduct these investigations in most regions of the country. This allows for a bigger difference between receiving water and discharge temperatures, and interference from vegetation is minimized (Stockton, 2004b). In addition, flights should take place at night to minimize reflected and direct daylight solar radiation that may adversely affect the imagery (Stockton, 2004b).

Figure 72: Aerial thermography showing sewage leak

Color Infrared Aerial Photography

Color infrared aerial photography looks for changes in plant growth, differences in soil moisture content, and the presence of standing water on the ground to primarily identify failing septic systems (Figure 73).

The Tennessee Valley Authority (TVA) uses color infrared aerial photography to detect failing septic systems in reservoir watersheds. Local health departments conduct follow-up ground-truthing surveys to determine if a system is actually failing (Sagona, 1986). Similar to thermography, it is recommended that flights take place at night, during leaf-off conditions, or when the water table is at a seasonal high (which is when most failures typically occur (U.S. EPA, 1999).

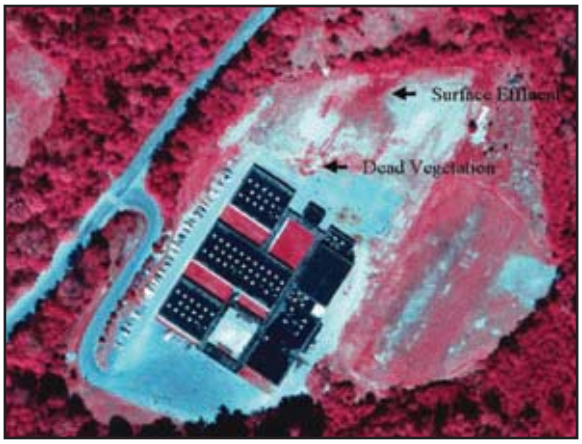


Figure 73: Dead vegetation and surface effluent are evidence of a septic system surface failure.
(Source: U.S. EPA, 1999)

13.5 The Cost to Trace Illicit Discharge Sources

Tracing illicit discharges to their source can be an elusive and complex process, and precise staffing and budget data are difficult to estimate. Experience of Phase I NPDES communities that have done these investigations in the past can shed some light on cost estimates. Some details on unit costs for common illicit discharge investigations are provided below.

Costs for Dye, Video, and Smoke Testing

The cost of smoke, dye, and video testing can be substantial and staff intensive, and often depend on investigation specific factors, such as the complexity of the drainage network, density and age of buildings, and complexity of land use. Wayne County, MI, has estimated the cost of dye testing at $900 per facility. Video testing costs range from $1.50 to $2.00 per foot, although this increases by $1.00 per foot if pipe cleaning is needed prior to testing.

Table 61 summarizes the costs of start-up equipment for basic manhole entry and inspection, which is needed regardless of which type of test is performed. Tables 62 through 64 provide specific equipment costs for dye, video and smoke testing, respectively.

Table 61: Common Field Equipment Needed for Dye, Video, and Smoke Testing

Item	Cost
1 Digital Camera	$200
Clipboards, Pens, Batteries	$25
1 Field vehicle	$15,000 - $35,000
1 First aid kit	$30
1 Spotlight	$40
1 Gas monitor and probe	$900 - $2,100
1 Hand-held GPS Unit	$150
2 Two-way radios	$250 - $750
1 Manhole hook	$80 - $130
1 Mirror	$70 - $130
2 Reflective safety vests	$40
Rubber/latex gloves (box of 100)	$25
1 Can of Spray Paint	$5
4 Traffic Cones	$50

Table 62: Equipment Costs for Dye Testing		
Product	**Water Volume**	**Cost**
Dye Strips	1 strip/500 gallons	$75 – $94 per 100 strips
Dye Tablets	0 – 50,000 gallons	$40 per 200 tablets
Liquid Concentrate (Rhodamine WT)	0 – 50,000 gallons	$80 – $90 per gallon $15 – $20 per pint
Powder	50,000 + gallons	$77 per lb
Dye Wax Cakes	20,000 – 50,000 gallons	$12 per one 1.25 ounce cake
Dye Wax Donuts	50,000 + gallons	$104 – $132 per 42 oz. donut
Price Sources: *Aquatic Eco-Systems http://www.aquaticeco.com/* *Cole Parmer http:/www.coleparmer.com* *USA Blue Book http:/www.usabluebook.com*		

Table 63: Equipment Costs for Video Testing	
Equipment	**Cost**
GEN-EYE 2™ B&W Sewer Camera with VCR & 200' Push Cable	$5,800
100' Push Rod and Reel Camera for 2" – 10" Pipes	$5,300
200' Push Rod and Reel Camera for 8" – 24" Pipes	$5,800
Custom Saturn III Inspection System 500' cable for 6-16" Lines	$32,000 ($33,000 with 1000 foot cable)
OUTPOST • Box with build-out • Generator • Washdown system	 $6,000 $2,000 $1,000
Video Inspection Trailer • 7'x10' trailer & build-out • Hardware and software package • Incidentals	 $18,500 $15,000 $5,000
Sprinter Chassis Inspection Vehicle • Van (with build-out for inspecting 6" – 24" pipes) • Crawler (needed to inspect pipes >24") • Software upgrade (optional but helpful for extensive pipe systems)	 $130,000 $18,000 $8,000
Sources: USA Blue Book and Envirotech	

Table 64: Equipment Costs for Smoke Testing	
Equipment	**Cost**
Smoke Blower	$1,000 to $2,000 each
Liquid Smoke	$38 to $45 per gallon
Smoke Candles, 30 second (4,000 cubic feet)	$27.50 per dozen
Smoke Candles, 60 Second (8,000 cubic feet)	$30.50 per dozen
Smoke Candles, 3 Minute (40,000 cubic feet)	$60.00 per dozen
Sources: Hurco Tech, 2003 and Cherne Industries, 2003	

Costs for Septic System Investigations

Most septic system investigations are relatively low cost, but factors such as private property access, notification, and the total number of sites investigated can increase costs. Unit costs for the three major septic system investigations are described below.

Homeowner Survey and Surface Condition Analysis

Both the homeowner survey and the surface condition analysis are relatively low cost investigation techniques. Assuming that a staff person can investigate one home per hour, the average cost per inspection is approximately $25. A substantial cost savings can be realized by using interns or volunteers to conduct these simple investigations.

Detailed System Inspection

Septic system inspections are more expensive, but a typical unit cost is about $250, and may also include an additional cost of pumping the system, at roughly $150, if pumping is required to complete the inspection (Wayne County, 2003). This cost is typically charged to the homeowner as part of a home inspection.

Aerial Infrared Thermography

The equipment needed to conduct aerial infrared thermography is expensive; cameras alone may range from $250,000 to $500,000 (Stockton, 2004a). However, private contractors provide this service. In general, the cost to contract an aerial infrared thermography investigation depends on the length of the flight (flights typically follow streams or rivers); how difficult it will be to fly the route; the number of heat anomalies expected to be encountered; the expected post-flight processing time (typically, four to five hours of analysis for every hour flown); and the distance of the site from the plane's "home" (Stockton, 2004a). The cost range is typically $150 to $400 per mile of stream or river flown, which includes the flight and post-flight analyses (Stockton, 2004a).

As an alternative, local police departments may already own an infrared imaging system that may be used. For instance, the Arkansas Department of Health used a state police helicopter with a Forward Looking Infrared (FLIR) imaging system, GPS, video equipment, and maps (Eddy, 2000). The disadvantage to this is that the equipment may not be available at optimal times to conduct the investigation. In addition, infrared imaging equipment used by police departments may not be sensitive enough to detect the narrow range of temperature difference (only a few degrees) often expected for sewage flows (Stockton, 2004a).

EPA New England Bacterial Source Tracking Protocol
Draft – January 2012

Purpose

This document provides a common framework for EPA New England ("EPA-NE") staff to develop and implement bacterial source tracking sample events, and provides a recommended approach to watershed association, municipal, and State personnel. Adopted from Boston Water and Sewer Commission ("BWSC") (2004), Pitt (2004), and based upon fieldwork conducted and data collected by EPA-NE, the protocol relies primarily on visual observations and the use of field test kits and portable instrumentation during dry and wet weather to complete a screening-level investigation of stormwater outfall discharges or flows within the drainage system. When necessary, the addition of more conclusive chemical markers may be included. The protocol is applicable to most typical Municipal Separate Storm Sewer Systems ("MS4s") and smaller tributary streams. The smaller the upstream catchment area and/or more concentrated the flow, the greater the likelihood of identifying an upstream wastewater source.

Introduction

The protocol is structured into several phases of work that progress through investigation planning and design, laboratory coordination, sample collection, and data evaluation. The protocol involves the concurrent collection and analyses of water samples for surfactants, ammonia, total chlorine, and bacteria. When more precise confirmation regarding the presence or absence of human sanitary sewage is necessary, and laboratory capacity is available, the additional concurrent collection of samples for select Pharmaceutical and Personal Care Product ("PPCP") analysis is advised. When presented with a medium to large watershed or numerous stormwater outfalls, the recommended protocol is the screening of all outfalls using the surfactant, ammonia, total chlorine, and bacterial analyses, in addition to a thorough visual assessment. The resulting data and information should then be used to prioritize and sample a subset of outfalls for all parameters, including PPCP compounds and additional analyses as appropriate. Ideally, screening-level analyses can be conducted by state, municipal, or local watershed association personnel, and a prioritized sub-set of outfalls can be sampled through a commercial laboratory or by EPA-NE using more advanced confirmatory techniques.

Step I – Reconnaissance and Investigation Design

Each sample event should be designed to answer a specific problem statement and work to identify the source of contamination. Any relevant data or reports from State, municipal, or local watershed associations should be reviewed when selecting sample locations. Aerial photography, mapping services, or satellite imagery resources are available free to the public through the internet, and offer an ideal way to pre-select locations for either field verification or sampling.

Sample locations should be selected to segregate outfall sub-catchment areas or surface waters into meaningful sections. A common investigative approach would be the identification of a

specific reach of a surface water body that is known to be impaired for bacteria. Within this specific reach, stormwater outfalls and smaller tributary streams would be identified by desktop reconnaissance, municipal outfall mapping, and field investigation when necessary. Priority outfalls or areas to field verify the presence of outfalls should be selected based on a number of factors, including but not limited to the following: those areas with direct discharges to critical or impaired waters (e.g. water supplies, swimming beaches); areas served by common/twin-invert manholes or underdrains; areas with inadequate levels of sanitary sewer service, Sanitary Sewer Overflows ("SSOs") or the subject of numerous/chronic sanitary sewer customer complaints; formerly combined sewer areas that have been separated; culverted streams, and; outfalls in densely populated areas with older infrastructure. Pitt (2004) provides additional detailed guidance.

When investigating an area for the first time, the examination of outfalls in dry-weather is recommended to identify those with dry-weather flow, odor, and the presence of white or gray filamentous bacterial growth that is common (but not exclusively present) in outfalls contaminated with sanitary. For those outfalls with dry-weather flow and no obvious signs of contamination, one should never assume the discharge is uncontaminated. Sampling by EPA-NE staff has identified a number of outfalls with clear, odorless discharges that upon sampling and analyses were quite contaminated. Local physical and chemical conditions, in addition to the numerous causes of illicit discharges, create outfall discharges that can be quite variable in appearance. Outfalls with no dry-weather flow should be documented, and examined for staining or the presence of any obvious signs of past wastewater discharges downstream of the outfall.

As discussed in BWSC (2004), the protocol may be used to sample discreet portions of an MS4 sub-catchment area by collecting samples from selected junction manholes within the stormwater system. This protocol expands on the BWSC process and recommends the concurrent collection of bacteria, surfactant, ammonia, and chlorine samples at each location to better identify and prioritize contributing sources of illicit discharges, and the collection of PPCP compounds when more conclusive source identification is necessary.

Finally, as discussed further in Step IV, application of this sampling protocol in wet-weather is recommended for most outfalls, as wet-weather sampling data may indicate a number of illicit discharge situations that may not be identified in dry weather.

Step II – Laboratory Coordination

All sampling should be conducted in accordance with a Quality Assurance Project Plan ("QAPP"). A model QAPP is included as Attachment 1. While the QAPP details sample collection, preservation, and quality control requirements, detailed coordination with the appropriate laboratory staff will be necessary. Often sample events will need to be scheduled well in advance. In addition, the sampling team must be aware of the strict holding time requirements for bacterial samples – typically samples analysis must begin within 6 hours of sample collection. For sample analyses conducted by a commercial laboratory, appropriate coordination must occur to determine each facilities respective procedures and requirements.

The recommendations in this protocol are based on the use of a currently unpublished EPA-NE modification to *EPA Method 1694 – Pharmaceuticals and Personal Care Products in Water, Soil, Sediment, and Biosolids by HPLC/MS/MS*. Several commercial laboratories may offer Method 1694 capability. EPA-NE recommends those entities wishing to utilize a contract laboratory for PPCP analyses ensure that the laboratory will provide quantitative analyses for acetaminophen, caffeine, cotinine, carbamazepine, and 1,7-dimethylexanthine, at Reporting Limits similar to those used by EPA-NE (See Attachment 2). Currently, the EPA-NE laboratory has limited capacity for PPCP sampling, and any proposed EPA-NE PPCP sample events must be coordinated well in advance with the appropriate staff.

Step III – Sample Collection

Once a targeted set of outfalls has been selected, concurrent sampling and analyses for surfactants, ammonia, and total chlorine (which can all be done through the use of field kits), in addition to bacteria (via laboratory analysis) should be conducted. When numerous outfalls with dry-weather flow exist, sample locations should be prioritized according to the criteria mentioned above. In addition, field screening using only the field kits may occur during the field reconnaissance. However, it must be emphasized that the concurrent sampling and analyses of bacteria, surfactant, ammonia, and total chlorine parameters is the most efficient and cost-effective screening method.

When first observed, the physical attributes of each outfall or sampling location should be noted for construction materials, size, flow volume, odor, and all other characteristics listed on the data collection form (Attachment 3). In addition, GPS coordinates should be collected and a photograph of the sample location taken. Whenever possible, the sampling of storm drain outfalls should be conducted as close to the outfall opening as possible. Bacterial samples should be collected first, with care to not disturb sediment materials or collect surface debris/scum as best possible. A separate bottle is used to collect a single water sample from which aliquots will be analyzed for surfactants, ammonia, and total chlorine. A sample for PPCP analysis is recommended to be collected last, as the larger volume required and larger bottle size may cause some sediment disturbance in smaller outfalls or streams. If necessary, a second smaller, sterile and pre-cleaned sampling bottle may be used to collect the surface water which can then be poured into the larger PPCP bottle. Last, a properly calibrated temperature/specific conductance/salinity meter should be used to record all three parameters directly from the stream or outfall. When flow volume or depth is insufficient to immerse the meter probe, a clean sample bottle may be utilized to collect a sufficient volume of water to immerse the probe. In such instances, meter readings should be taken immediately.

As soon as reasonably possible, sample aliquots from the field kit bottle should be analyzed. When concurrent analyses are not possible, ammonia and chlorine samples should be processed first, followed by surfactant analysis, according to each respective Standard Operating Procedure as appropriate based on the particular brand and type of field test kit being used. All waste from the field test kits should be retained and disposed of according to manufacture instructions. Where waste disposal issues would otherwise limit the use of field kits, EPA-NE recommends

that, at a minimum, ammonia test strips with a Reporting Limit below 0.5 mg/L be utilized. Such test strips typically are inexpensive and have no liquid reagents associated with their use. Results should be recorded, samples placed in a cooler on ice, and staff should proceed to the next sample location.

Upon completion of sampling and return to the laboratory, all samples will be turned over to the appropriate sample custodian(s) and accompanied by an appropriate Chain-of-Custody ("COC") form.

Step IV – Data Evaluation

Bacterial results should be compared to the applicable water quality standards. Surfactant and ammonia concentrations should be compared to the thresholds listed in Table 1. Evaluation of the data should include a review for potential positive results due to sources other than human wastewater, and for false negative results due to chemical action or interferences. In the EPA-NE region, field sampling has indicated that the biological breakdown of organic material in historically filled tidal wetlands may cause elevated ammonia readings, as can the discharge from many landfills. In addition, salinity levels greater than 1 part per thousand may cause elevated surfactant readings, the presence of oil may likewise indicate elevated levels, and fine suspended particulate matter may cause inconclusive surfactant readings (for example, the indicator ampule may turn green instead of a shade of blue). Finally, elevated chlorine from leaking drinking water infrastructure or contained in the illicit wastewater discharge may inhibit bacterial growth and cause very low bacterial concentrations. Any detection of total chlorine above the instrument Reporting Limit should be noted.

Table 1 – Freshwater Water Quality Criteria, Threshold Levels, and Example Instrumentation [1]

Analyte/ Indicator	**Threshold Levels/ Single Sample[3]**	**Instrumentation**
E. coli [2]	235 cfu/100ml	Laboratory via approved method
Enterococci [2]	61 cfu/100ml	Laboratory via approved method
Surfactants (as MBAS)	$\geq$ 0.25 mg/l	MBAS Test Kit (e.g. CHEMetrics K-9400)
Ammonia (NH_3)	$\geq$ 0 .5 mg/l	Ammonia Test Strips (e.g. Hach brand)
Chlorine	> Reporting Limit	Field Meter (e.g. Hach Pocket Colorimeter II)
Temperature	See Respective State Regulations	Temperature/Conductivity/Salinity Meter (e.g. YSI Model 30)

[1] The mention of trade names or commercial products does not constitute endorsement or recommendation for use by the U.S. EPA

[2] 314 CMR 4.00 MA - Surface Water Quality Standards - Class B Waters.

[3] Levels that may be indicative of potential wastewater or washwater contamination

Once dry-weather data has been examined and compared to the appropriate threshold values, outfalls or more discreet reaches of surface water can be selected for sampling or further investigation. Wet-weather sampling is also recommended for all outfalls, in particular for those that did not have flow in dry weather or those with dry-weather flow that passed screening thresholds. Wet-weather sampling will identify a number of situations that would otherwise pass unnoticed in dry weather. These wet-weather situations include, but are not limited to the following: elevated groundwater that can now cause an exchange of wastewater between cracked or broken sanitary sewers, failed septic systems, underdrains, and storm drains; increased sewer volume that can exfiltrate through cracks in the sanitary piping; increased sewer volume that can enter the storm drain system in common manholes or directly-piped connections to storm drains; areas subject to capacity-related SSO discharges, and; illicit connections that are not carried through the storm drain system in dry-weather.

Step V – Costs

Use of field test kits and field instruments for a majority of the analytical parameters allows for a significantly reduced analytical cost. Estimated instrument costs and pro-rated costs per 100 samples are included in Table 2. The cost per 100 samples metric allows averaged costs to account for reagent refills that are typically less expensive as they do not include the instrument cost, and to average out the initial capital cost for an instrument such as a temperature/ conductivity/salinity meter. For such capital costs as the meters, the cost over time will continue to decrease.

Table 2 – Estimated Field Screening Analytical Costs [1]

Analyte/ Indicator	Instrument or Meter [2]	Instrument or Meter Cost/No. of Samples	Cost per Sample (Based on 100 Samples) [3]
Surfactants (as MBAS)	Chemetrics K-9400	$77.35/20 samples ($58.08/20 sample refill)	$3.09
Ammonia (NH_3)	Hach brand 0 – 6 mg/l	$18.59/25 samples	$0.74
Total Chlorine	Hach Pocket Colorimeter II	$389/100 samples ($21.89 per 100 sample refill)	$3.89
Temperature/ Conductivity/ Salinity	YSI	$490 (meter and cable probe)	$4.90

1 Estimated costs as of February 2011

2 The mention of trade names or commercial products does not constitute endorsement or recommendation for use by the U.S. EPA

3 One-time meter costs and/or refill kits will reduce sample costs over time

From Table 2, the field analytical cost is approximately $13 per outfall. Typical bacterial analyses costs can vary depending on the analyte, method, and total number of samples to be

performed by the laboratory. These bacterial analyses costs can range from $20 to $60. Therefore, the analytical cost for a single outfall, based on the cost per 100 samples, ranges from $33 to $73. As indicated above, these costs will decrease slightly over time due to one-time capitals costs for the chlorine and temperature/conductivity/salinity meters.

Step VI – Follow-Up

Once all laboratory data has been reviewed and determined final in accordance with appropriate quality assurance controls, results should be reviewed with appropriate stakeholders to determine next steps. Those outfalls or surface water segments that fail to meet the appropriate water quality standard, and meet or exceed the surfactant and ammonia threshold values, in the absence of potential interferences mentioned in Step IV, indicate a high likelihood for the presence of illicit connections upstream in the drainage system or surface water. Whereas illicit discharges are quite variable in nature, the exceedance of the applicable water quality standard and only the ammonia or surfactant threshold value may well indicate the presence of an illicit connection. When available, the concurrent collection and analyses of PPCP data can greatly assist in confirming the presence of human wastewater. However, such data will not be available in all instances, and the collective data set and information regarding the physical characteristics of each sub-catchment or surface water reach should be used to prioritize outfalls for further investigation. As warranted, data may be released to the appropriate stakeholders, and should be accompanied by an explanation of preliminary findings. Release of EPA data should be fully discussed with the case team or other appropriate EPA staff.

References Cited

Boston Water & Sewer Commission, 2004, *A systematic Methodology for the Identification and Remediation of Illegal Connections.* 2003 Stormwater Management Report, chap. 2.1.

Pitt, R. 2004 *Methods for Detection of Inappropriate Discharge to Storm Drain Systems. Internal Project Files*. Tuscaloosa, AL, *in* The Center for Watershed Protection and Pitt, R., *Illicit Discharge Detection and Elimination: A Guidance Manual for Program Development and Technical Assessments*: Cooperative Agreement X82907801-0, U.S. Environmental Protection Agency, variously paged. Available at: http://www.cwp.org.

Instrumentation Cited (Manufacturer URLs)

MBAS Test Kit - CHEMetrics K-9400: http://www.chemetrics.com/Products/Deterg.htm

Portable Colorimeter – Hach Pocket Colorimeter II: http://www.hach.com/

Ammonia (Nitrogen) Test Strips: http://www.hach.com/

Portable Temperature/Conductivity/Salinity Meter: YSI Model 30: http://www.ysi.com/productsdetail.php?30-28

Disclaimer: The mention of trade names or commercial products in this protocol does not constitute endorsement or recommendation for use by the U.S. EPA.

Stormwater Monitoring Quality Assurance Project Plan
2012-2017

RFA #

Sampling Plan Acceptance

EPA OES Enforcement and Project Manager/Coordinator **Signature:**	**Date:**
EPA OEME Project Managers/Coordinator **Signature:**	**Date:**
EPA OEME QA Officer **Signature:**	**Date:**
EPA Chemistry Team Lead **Signature:**	**Date:**

1.0 Background

U.S. EPA Administrative Order 5360.1 requires that "all projects involving environmental monitoring performed by or for the U.S. EPA shall not be undertaken without an adequate Quality Assurance Project Plan (QAPP)." The purpose of this document is to describe the process used to develop, select, manage, and finalize stormwater monitoring projects. In describing this process, quality assurance goals and methods will be established, thus ensuring that the overall program and each monitoring project will meet or exceed EPA requirements for quality assurance.

The objective of these projects will be to collect data that is usable by EPA OES enforcement staff for enforcement actions and information requests. The primary focus of this project will be on urban water stormwater outfalls in the New England Region watersheds.

2.0 Sampling overview

Monitoring will be conducted on pre-scheduled days with the Laboratory. Samples will be retrieved from surface water, in stream or outfalls at suspected hotspots or areas that need further delineation. Sample sites will be located using GPS, with an accuracy goal of $\pm$ 1 meter and PDOP less than 6. Less accurate GPS reading or coordinates from maps will be accepted when site or other conditions do not allow $\pm$ 1 meter accuracy.

The primary focus of this sampling will be used to identify illegal discharges.
Results from the sampling will be used by EPA enforcement staff for enforcement purposes. For this project, sampling will be conducted according to EPA's Ambient Water Sampling SOP (Table 3). Volunteers and watershed association staff may assist in sampling. All procedures will be followed that are specified in Table 3. Parameter to be sampled will be predetermined by enforcement (OES) and OEME staff, based on data needs.

A. Locations

Site locations will be determined from field or desktop reconnaissance by project staff. Sample analyses will be predetermined based on conditions known about the sampling location prior to sampling. These may include data from previous sampling or from data collected from Mass DEP or local watershed associations. Any of the parameters listed in table 2 may be analyzed.

B. Analytical Methods and Reporting limits

Sample analyses will be conducted by EPA Laboratories.

This effort will test and compare the most appropriate analytical methods including, but not limited to; laboratory analysis, test kits and field analysis to determine the most effective and cost-efficient outfall and in-stream sampling approach.
Multiple and repeated testing will occur at each location to compare different method for identifying sewage contamination.

PPCPs, E.coli and enterococcus will be analyzed by EPA's Laboratory. Surfactants, ammonia, total chlorine will be analyzed with field test kits. Potential additional laboratory analyses include nitrogen (nitrate/nitrite), TSS, BOD, surfactants, ammonia and TPH. The Laboratory used

for each sampling event will be determined prior to sampling by the OEME Project Manager based on required analyses Laboratory availability and contract funds available.

Where available, a known concentration sample will be used to evaluate the performance of each test method. The known concentration sample will be processed in the field and Laboratory as a routine sample. The analyst or field technician will not know the concentration of the sample prior to analyzing and reporting the sample result. Sampling for PPCP testing will be done using extreme care not to contaminate the sample. No caffeine products should be consumed prior to sampling.

Table 1: Parameter specifications

Parameter (lab - equipment)	Preservation	Holding time
PH	None	Immediate
Temperature	None	Immediate
Sp Cond	None	Immediate
DO	None	Immediate
Total Phosphorus (EPA)	H_2SO_4 (pH <2) + Ice	28 days
TSS (EPA)	Ice	7 days
TSS (Alpha)	Ice	7 days
BOD (Alpha)	Ice	48 hours
Surfactants (Alpha)	Ice	48 hours
Surfactants (field kit – Chemetrics)	None	Immediate
Ammonia (alpha)	H_2SO_4 (pH <2) + Ice	28 days
Ammonia (test strips)	None	Immediate
TPH Petroleum ID (alpha)	Ice	7 Days to extraction 40 days after extraction
E. Coli (EPA)	Ice	6 hrs to lab
Enterococcus (EPA)	Ice	6 hrs to lab
PPCP	Ice (acidified in Lab)	7 day to extraction 40 days after extraction
Chlorine (Field kit – Hach)	None	Immediate

Table 2: Analytical References and Quality Control Goals

		Water Quality Criteria or Guidelines	Quality Assurance Goals		
Parameter (lab- equipment)	**Reporting Limits**	**(MA or EPA)**	**Precision**	**Accuracy**	**Completeness**
PH	4 to 10 units	6.5 - 8.3	0.02 unit	± 0.3 units	90%
Temperature	0 to +40°C	28.3°C	0.1 °C	± 0.15°C	90%
Sp Cond	0 to 100 mS/cm	NA	5 uS/cm	±10% cal std (µS/cm)	90%
DO	0.5mg/l to Sat	≥5 mg/l , ≥60% saturation	0.02mg/l	± .5 mg/l	90%
Total Phosphorus (EPA)	5.0 ug/l	NA	Field dup 30% RPD	MS 70-130%	90%
TSS (EPA)	5mg/L	NA	Field dup 30% RPD	See SOP	
TSS (Alpha)	5 mg/L	NA	Field dup 30% RPD	See SOP	90%
BOD (Alpha)	2 mg/L	NA	Field dup 30% RPD	See SOP	90%
Surfactants (field kit – Chemetrics)	0.25 mg/L[1]	0.25 mg/L	Field dup 30% RPD	TBD	90%
Ammonia (test strips)	0.25 mg/L[1]	1.0 mg/L	Field dup 30% RPD	TBD	90%
TPH Petroleum ID (alpha)	Variable	NA	Field dup 30% RPD	See SOP	
E. Coli (EPA)	4 col./ 100 ml	<=126 col./100 ml* <= 235 col./100 ml	±100 col/100ml or 30% RPD	N/A	90%
Enterococcus (EPA)	1 col/100ml	<=33 col./100 ml* <= 61 col./100 ml	±100 col/100ml or 30% RPD	See SOP	90%
PPCP	TBD	NA	Field dup 50% RPD	TBD	90%
Chlorine (Field kit – Hach)	0.02 mg/l	NA	Field dup 30% RPD	TBD	90%

Note
*Geometric mean Criteria
TBD = To be determined, Field methods and some colorimeter methods do not have accuracy criteria determined.
[1] Needs field verification to confirm

Table 3: Field and Laboratory References

Parameter	Analytical Method Reference	SOP reference
	Field References- 5/2005	
pH		
Conductivity		
Temperature		
dissolved oxygen	n/a	ECASOP-YSISondes9
Ambient water samples	n/a	ECASop-Ambient Water Sampling2
Chain of custody of samples	n/a	EIASOP-CHAINOFCUST
Sample login, tracking, disposition	n/a	EIASOP-ADMLOG14
	Lab. References- 5/ 2005	
Total Phosphorus (EPA)	EPA 365.3	EIASOP-INGTP8
TSS (EPA)	EPA 160.2	EIASOP-INGTSS-TDS-VRES5
TSS (Alpha)	EPA 160.2,SM2540D	SOP/07-29
BOD (Alpha)	EPA 405.1,SM5210B	SOP/07-13
Surfactants (field kit – Chemetrics)	Chemetrics	Draft
Ammonia (test strips)	Hach	Draft
TPH Petroleum ID (alpha)	8015B (M)	0-017
E. Coli (EPA)	SM9230	ECASOP- TC/EC Colilert2
Enterococcus (EPA)	SM9230	ECASOP-Enterolert1
PPCP	EPA 1694	TBD
Chlorine (Field kit – Hach)	Hach	TBD

*Specific conductance is the only parameter identified as non critical

Bottle list

Table 4: Bottle Sampling List

Parameter (lab - equipment)	Bottle	Preservation
Primary analyses		
E. Coli (EPA)	(2) 120ml or 250ml sterile	Ice
Enterococcus (EPA)		Ice
PPCP	1 Liter Amber	Ice (acidified in Lab)
Optional analyses		
Chlorine (Alpha)	500 ml	Ice
Total Phosphorus (EPA)	125 ml	H_2SO_4 (pH <2) + Ice
TSS (EPA)	1 liter	Ice
TSS (Alpha)	1 liter	Ice
BOD (Alpha)	1 Liter	Ice
TPH Petroleum ID (alpha)	2 -1 Liter Amber Glass tephlon lined	Ice
E. Coli (Alpha)	120 ml sterile	Ice
Enterococcus (Alpha)	120 ml sterile	Ice

C. Quality Control

Calibration:	EPA will calibrate its sondes according to the EPA sonde calibration SOP.
Field duplicate:	One duplicate sample will be collected per sampling event or approximately for every ten samples.
Trip Blank:	OEME Chemist will run appropriate QA samples for PPCP's. One blank sample will be collected for approximately every ten bacteria samples. Reported data that is less than 5 times the trip (field) blank concentration will be flagged.
QC Criteria:	Are specified in table 2, data not meeting this criteria will be reviewed by the Project Manager. Data that does not meet laboratory QA/QC criteria will be flagged by the laboratory.

D. Chain of Custody

Chain of custody procedures will follow the OEME/Investigations Office SOP (Table 3)

3.0 Data Review

EPA Microbiology data will be reviewed by the Biology QAO. Alpha generated microbiology samples will be reviewed by the OEME Project Manager. All field data and draft data reports will be reviewed by the OEME Project manager. Laboratory generated data (from Alpha and EPA) will be reviewed by the Chemistry Team Leader.

4.0 Data reports

Data reports will be reviewed by the Project Coordinator and the OEME Project Manager before a final report is release to the Enforcement Coordinator. Draft reports may be released without a complete review.

5.0 Attachments

1) Standard Operating Procedure Enterococcus (SM9230B), Multiple Tube Technique. SOP/07-01 *Alpha Analytical, Inc. May 28, 2005*

2) Standard Operating Procedure E. Coli (SM9213D). SOP/07-41 *Alpha Analytical, Inc. May 28, 2005*

3) Standard Operating Procedure MBAS, Ionic Surfactants. Draft SOP *EPA Laboratory. January 28, 2010*

4) Standard Operating Procedure Nitrogen Ammonia. Draft SOP *EPA Laboratory. February 10, 2011*

5) Standard Operating Procedure Total Chlorine. Draft SOP *EPA Laboratory. February 12, 2010*

6) Standard Operating Procedure TSS/ TVSS (SM2540 D, EPA 160.2). SOP/07-29 *Alpha Analytical, Inc. September 29, 2007*

7) Standard Operating Procedure BOD-5day, SBOD-5day, and cBOD-5day (SM 5210B, and EPA 405.1). SOP/07-13 *Alpha Analytical, Inc. September 29, 2007*

8) Standard Operating Procedure TPH 8015D – Modified 0-017 (EPA 8015D Modified) *Alpha Analytical, Inc. March 04, 2008*

9) Standard Operating Procedure determination of Trace Elements in Water and Wastes by Inductively Coupled Plasma- Mass Spectrometry (200.8). SOP/06-11 Alpha Analytical, Inc. July 13, 200

10) Standard Operating Procedure Inductively Coupled Plasma – Mass Spectrometry (6020). SOP/06-10 Alpha Analytical, Inc. October 25, 2007

EPA United States Environmental Protection Agency

Target Compounds, Uses, and Reporting Limits

Target Compound	Major Use	RL (ng/L)	Daily Dose (ng)
Caffeine	Natural Stimulant	5.0	200,000,000
1,7-DMX	Metabolite of caffeine	2.5	N/A
Acetaminophen	Pain Reliever	2.5	650,000,000
Carbamazepine	Anti- depressant / bi-polar Anti-convulsant (epilepsy)	0.5	100,000,000
Primidone	Anti- epilepsy drug (AED)	5.0	100,000,000
Atenolol	Beta Blocker High Blood Pressure	2.5	50,000,000
Cotinine	Metabolite of Nicotine	0.5	3,500-7,200 (ng/mL)
Urobilin	By-product of hemoglobin breakdown (mammals)	5.0	1,300,000 ng/g in feces
Azithromycin	Antibiotic	1.6	200,000,000

Attachment 3

STORMWATER MONITORING

Field Collection Requirements (To be recorded at each site)

Sample-
Site Name _____

Time collected_____

Date collected_____

Inspection-
****Take picture at site****
Outfall diameter_____('na' if open stream)

Flow estimate_____('na' if open stream)

Odor_____

Color_____

Turbidity_____

Floatables_____

Other observations_____

_____

YSI Meter (calibrate in lab)-
Salinity_____

Temp_____

Conductivity (give both #'s)

_____

Location information-
Short description of where sample was collected at site_____

_____

_____

GPS_____

_____

Field Kits listed in the order they should be conducted in, include any applicable notes-

NH3 strip_____

Cl2 kit_____
Hach meter – (3 min wait)

Surfactant_____
Chemetrics K-9400 Blue box/detergent test kit

Additional Notes:

(Note any changes in weather conditions)_____

_____

_____

_____

_____

Attachment 3

STORMWATER MONITORING (PAGE 2)

Field Equipment List

Waste Containers (2 total – clearly labeled):

1 liter amber plastic for surfactants/detergents kit waste
1 liter amber plastic for Cl2 kit waste

Sample Bottles (3 total for each sample location)-
120ml sterile – E.coli/entero
1 Liter amber glass: PPCP, *EPA* (Peter Philbrook)
120ml-250ml plastic – Field Kit Bottle – to be used on site for kits listed above

***Fill out chain of custody

In Carboy Container
☐Log book
☐COC forms
☐Extra sample bottles
☐Colored tape
☐Sharpies
☐Write-On-Rain Pens
☐Paper towels
☐GPS
☐Sampling plan & GPS locations
☐Regular length Powder Free Gloves
☐Squirt bottle of DI Water
☐Coolers with Ice
☐Waders/Boots
☐YSI multi parameter Meter

Appendix E

Dry Weather Sampling Results

Stormwater Outfall Dry Weather Sampling for Mendon, MA

TO: Alan Tetreault, Highway Surveyor

FROM: Gabrielle C. Belfit

COPY: Emily Scerbo, P.E.

DATE: June 18, 2015

In June 2015, Tighe & Bond provided services to further develop Mendon's Illicit Discharge Detection and Elimination (IDDE) program by conducting dry weather monitoring for selected municipal outfalls identified as having dry weather flows and not previously screened for evidence of illicit discharges. The EPA defines an illicit (or illegal) discharge as any discharge into a storm drain system that is not composed entirely of stormwater with limited exceptions listed in the National Pollutant Discharge Elimination System (NPDES) General Permit for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems (MS4) in Massachusetts. Outfall screening and sampling for illicit discharges is a requirement in the 2014 Draft MA Small MS4 General Permit, and any illegal discharges found must be eliminated. Mendon's dry weather stormwater monitoring program was developed to be consistent with the draft permit language.

This memo provides detail on the status of stormwater outfall inventory and inspection, the procedures to complete the dry weather monitoring, and the results of field measured parameters and laboratory analysis. A copy of the written procedures including field sampling protocol are included in Appendix A. The results are summarized in Table 2, Table 3, and Appendix B. The results are also available online through the Mendon website hosted by Tighe & Bond and maintained on the ArcGIS website. The website link and log in information were provided to the Town separately.

Stormwater Outfall Inventory and Inspection History

A web-based GIS stormwater inventory and inspection application was developed for Mendon. The GIS system includes mapped catchbasins, manholes, piping, stormwater outfalls and includes geo-referenced photos and data attributes. Web-based inspection forms for the outfalls and catchbasins were developed in 2013 following the Center for Watershed Protection recommended protocol. In November 2013 all Mendon outfalls were field observed, photographed, and data collected with mobile tablet devices. The outfalls were also identified with unique alpha-numeric codes using Plexiglas markers. The results of the November inspection are summarized in Table 1 below. The complete data base was provided to the town in digital format, and is maintained on the ArcGIS website.

Table 1
Mendon Outfalls by Watershed

Watershed	Resource Area	# Outfalls	Flowing	Dry
20008	Charles River	4	0	4
12121	Hop Brook	8	0	8
12120	Mill River	32	9	23
12114	Muddy Brook	78	19	59
12094	Nipmuck Pond	17	5	12
12112	Ohio Brook	10	2	8
12093	Rock Meadow Brook	41	10	31
12117	Round Meadow Brook	5	0	5
12090	Miscoe Brook	5	0	5
12111	Hopedale Pond	0	0	0
12116	Spindleville Pond	9	0	9
	Total Outfalls	209	45	164

Stormwater Outfall Dry Weather Monitoring Procedures

On June 8th, 2015 staff from Tighe & Bond teamed with Highway Department staff to complete dry weather monitoring at outfalls where dry weather flow was initial observed in the Phase 1 November 2013 outfall inspection/screening. The following procedures were followed:

1) The project team met and reviewed a site safety plan before starting field work. Appropriate precautions were taken to avoid field and testing hazards, such as use of gloves, protective clothing, traffic cones, etc.

2) Two teams of two were deployed including Tighe & Bond staff (3) and Town of Mendon staff (1). Tighe & Bond uses the 'buddy system" as a health and safety best practice for this type of work.

3) Weather was carefully tracked prior to setting out for sampling. No observable rainfall was recorded for a period of 72 hours prior to the dry weather sampling event. June 8th was overcast with an average temperature of 61 degrees.

4) The sampling route was determined using maps depicting Mendon's watersheds, EPA urbanized area boundaries, and locations of the target outfalls with previous dry weather flow (Appendix A). Field work was prioritized by location first within the Mill River watershed, then all other urbanized area, and finally remaining outfalls in Mendon. All identified outfalls with dry weather flow were inspected on June 8th.

5) Each outfall was photographed and observed using pre-programed tablet forms. When the tablet data entry was completed for each outfall, the outfall icon would turn from red to green. All data was uploaded to the ArcGIS website.

6) Dry weather monitoring was completed following the EPA New England Bacterial Source Tracking Protocol, January 2012 (Appendix I of the 2014 Draft MS4 Permit). A written sampling project plan was developed and is included in Appendix A.

7) If flow was present, YSI63 portable meters were used to measure salinity, temperature, pH, and conductivity. Field test kits were used to measure ammonia, chlorine and surfactants.

8) Samples were collected for laboratory analysis only when necessary based on screening results and EPA's protocol as described in the sampling plan. Proper sampling, storage and chain of custody procedures were followed as needed. Parameters sampled in the lab included ammonia, surfactants, and E. Coli.

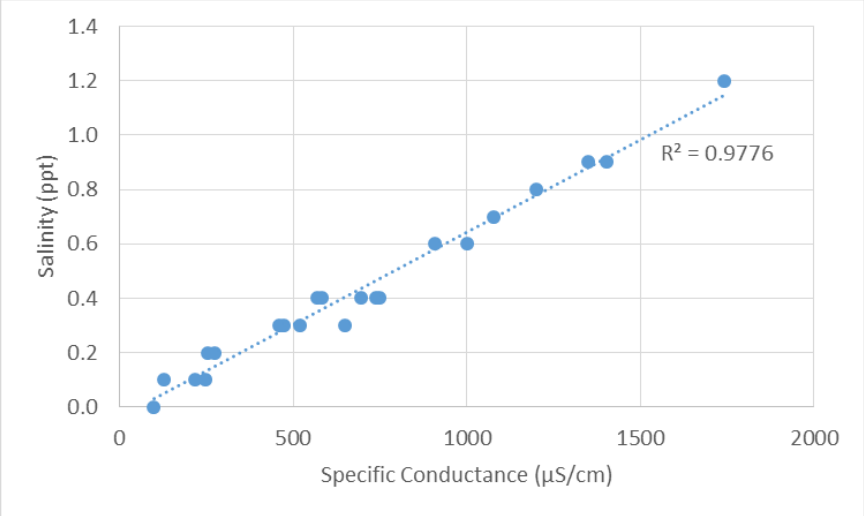
Stormwater Outfall Dry Weather Monitoring Results

The results of the June 8th dry weather inspection and field screening are summarized in Table 2 below. The laboratory analysis is provided in Table 3. Photographs for each outfall are included in Appendix C and also online, linked to each outfall data point in ArcGIS.

As part of the November 2013 outfall inventory 45 outfalls were identified as having dry weather flow. Inspecting the data base prior to the 2015 sampling event, several locations turned out to be duplicates, or were mislabeled. The revised outfall count included only 35 locations. June 8th observations at the 35 locations found that 13 outfalls were dry, with no base flow observed, 6 outfalls contained standing water, 10 were present with tricking flow, and 6 presented with moderate flow.

Field measurements were successfully completed for the 22 outfalls with measurable flow utilizing portable meter and test kits. The majority of field measured data using the YSI 63 were well within the normal range for fresh surface water. Temperature at the outfalls ranged from 11.4 -18.7°C with an average of 14.32 °C. pH ranged from 6.1-8.3 with an average of 6.8. Salinity ranged from 0.1-1.2 ppt with an average of 0.4 ppt. Specific conductance ranged from 99-1740 uS/cm with an average of 695 uS/cm.

One exception was outfall MB-60, which had the highest reading for salinity (1.2 ppt) and specific conductance (1740 µS/cm). These high readings are likely due to road salt runoff. Based on our field screening at 22 outfalls, specific conductance and salinity were very closely correlated as shown in the graph below.



Other noted observations include:

- Petroleum sheen and odor was detected at MR-18.
- Iron staining was commonly found at many outfall locations.
- There was occasional presence of algae, natural bacterial sheen, or sediment build up at several outfalls.

Ammonia, chlorine, and surfactants were measured with the field test kits and were typically not present, or below the reporting threshold with the exception of four outfalls. The four outfalls indicated below, exceeded thresholds for ammonia or surfactants and therefore required taking grab samples for laboratory analysis.

Outfalls exceeding target thresholds and requiring laboratory analysis:

MR-19 - tricking flow, surfactants 0.5 mg/l

MR-24 - tricking flow, surfactants >0.25 mg/l

MR-30 - tricking flow, surfactants >0.25 mg/l

RB-35 - standing water, ammonia 1 mg/l

Table 2

Mendon Outfalls – June 8, 2015 Dry Weather Field Screening Results

Outfall ID	Flow Description	Sediment	Foam	Odor	Sanitary Waste	Orange Staining	Algae	Vegetation	Bacterial Sheen	Petroleum Sheen	Water Height	Ammonia	Ammonia Analytical	Specific Cond	Chlorine	Detergents & Surfactants	Detergents & Surfactants Analytical	pH	Temp	Salinity
MB-03	DRY	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO									
MB-10	TRICKLING	NO	NO	NO	NO	YES	NO	YES	NO	NO		0	NO	649	0			7.3	15.5	0.3
MB-16	MODERATE	NO	NO	NO	NO	NO	NO	NO	NO	NO		0	NO	520	0	0	NO	8.3	14.3	0.3
MB-29	DRY																			
MB-42	STANDING	NO	NO		NO	NO	NO	NO	NO	NO	8in	0	NO	1000	0	0.25	NO	7	14.8	0.6
MB-43	TRICKLING	NO	NO	NO	NO	YES	YES	NO	NO	NO	4in	0.25	NO	1078	0	0.25	NO	7	15.5	0.7
MB-44	DRY																			
MB-45	TRICKLING	NO	NO	NO	NO	YES	NO	NO	NO	NO	3in	0	NO	909	0	0.25	NO	6.8	15.4	0.6
MB-60	STANDING	NO	NO	NO	NO	NO	YES	NO	YES	NO	4in	0	NO	1740	0	0.25	NO	6.6	13.6	1.2
MB-62	MODERATE	NO	NO	NO	NO	NO	NO	NO	NO	NO	.5in	0	NO	473	0	0.25	NO	7	13.8	0.3
MB-70	MODERATE	NO	NO	NO	NO	NO	NO	NO	NO	NO	1in	0	NO	219	0	0	NO	7.8	14.6	0.1
MR-04	STANDING	NO	NO	NO	NO	NO	NO	NO	NO	NO		0	NO	253	0	0	NO	5.8	11.4	0.2
MR-12	DRY																			
MR-13	DRY																			
MR-14	DRY																			
MR-17	DRY																			
MR-18	TRICKLING	YES	NO	YES	NO	YES	YES	NO	YES	YES	<.25in	0	NO	569	0	0.25	NO	6.1	13.7	0.4
MR-19	TRICKLING	YES	NO	NO	NO	YES	YES	YES	NO	NO		0	YES	1402	0	0.5	YES	6.4	15	0.9
MR-20	MODERATE		NO	NO	NO	NO	YES	NO	NO	NO		0	NO	584	0	0.25	NO	6.8	12.2	0.4
MR-24	TRICKLING	YES	NO	NO	NO	NO	YES	NO	YES	NO		0	YES	1200	0	>0.25	YES	7.5	12.3	0.8
MR-30	TRICKLING	NO	NO	NO	NO	YES	NO	NO	NO	NO		0	YES	273.3	0	>0.25	YES	6.4	14.1	0.2
NP-03	STANDING	NO	NO	NO	NO	NO	NO	NO	YES	NO		0	NO	127.6	0	0	NO	6.6	14.2	0.1
NP-04	DRY																			
NP-08	STANDING	NO	NO	NO	NO	NO	NO	NO	NO	NO	7in	0	NO	1349	0	0.25	NO	6.5	15.6	0.9
NP-14	DRY																			
NP-16	DRY																			
OB-06	TRICKLING	NO	NO	YES	NO	NO	NO	YES	NO	NO	<.25in	0.25	NO	99	0	0	NO	6.1	13.5	0
RB-07	MODERATE	NO	NO	NO	NO	YES	NO	NO	NO	NO	.25in	0	NO	460	0	0	NO	7	12.7	0.3
RB-13	DRY																			
RB-23	DRY																			
RB-26	DRY																			
RB-29	TRICKLING	NO	YES	NO	NO	NO	NO	NO	NO	NO	<.25in	0	NO	696	0	0.25	NO	7.2	14.2	0.4
RB-30	MODERATE	NO	NO	NO	NO	NO	NO	NO	NO	NO	7in	0	NO	246	0	0.25	NO	5.8	18.7	0.1
RB-35	STANDING	NO	YES	NO	NO	YES	NO	NO	YES	NO		1	YES	750	0	0.25	YES	6.2	15.8	0.4
RB-42	TRICKLING	NO	NO	NO	NO	YES	NO	YES	NO	NO	3in	0	NO	740	0	0	NO	6.4	12.2	0.4

Table 3
Mendon Outfalls – Laboratory Results

Outfall ID	Ammonia (mg/l)	Surfactants (mg/l)	E.Coli (CFU/100)
MR-19	0.17	<0.1	<1
MR-24	0.16	0.14	<1
MR-30	0.16	<0.1	<1
RB-35	**0.59**	0.1	100

Laboratory results are included in Appendix B. Please note that the lab samples for outfalls MR-24 and MR-30 were incorrectly labeled, and are marked on the lab results as MB-24 and MB-30. The field sheets were correctly labeled and are included in Appendix B.

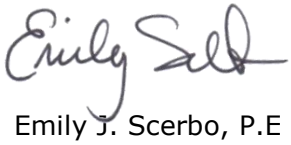
Conclusions and Recommendations

Based on the results of the field screening, outfall inspections, and laboratory analysis, **Tighe & Bond found no indication of an illicit discharge at any of the 35 outfalls visited on June 8, 2015**. Town staff should revisit MB-60 and MR-18 for additional observation of potential sources contributing to high salinity, specific conductance levels, and fuel odor.

If you have any questions or need any additional information, please contact me at 508- 564-7285 or Emily J. Scerbo at 508-471-9606.

Very truly yours,

TIGHE & BOND, INC.



Gabrielle C. Belfit
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Emily J. Scerbo, P.E
Project Manager
ejscerbo@tighebond.com

Enclosures: Appendix A – Map of Outfalls to Investigate and Mendon Dry Weather Sampling Procedure
Appendix B – Final Lab Report and Relevant Field Forms
Appendix C – Photo Log

\\srv\projects\M\M0799 Town of Mendon Stormwater Mapping\Stormwater Compliance\2014 Stormwater Action Plan\Deliverables\2014 12 08 Mendon Stormwater Action Plan.docx

CERTIFICATE OF ANALYSIS

Amanda Crouch-Smith
Tighe & Bond
4 Barlows Landing Road, Unit 15
Pocasset, MA 02559

RE: Mendon Dry Weather Outfall Sampling (22-0799-6-03-02)
ESS Laboratory Work Order Number: 1506228

This signed Certificate of Analysis is our approved release of your analytical results. These results are only representative of sample aliquots received at the laboratory. ESS Laboratory expects its clients to follow all regulatory sampling guidelines. Beginning with this page, the entire report has been paginated. This report should not be copied except in full without the approval of the laboratory. Samples will be disposed of thirty days after the final report has been delivered. If you have any questions or concerns, please feel free to call our Customer Service Department.

Laurel Stoddard
Laboratory Director

REVIEWED
By ESS Laboratory at 1:20 pm, Jun 17, 2015

Analytical Summary
The project as described above has been analyzed in accordance with the ESS Quality Assurance Plan. This plan utilizes the following methodologies: US EPA SW-846, US EPA Methods for Chemical Analysis of Water and Wastes per 40 CFR Part 136, APHA Standard Methods for the Examination of Water and Wastewater, American Society for Testing and Materials (ASTM), and other recognized methodologies. The analyses with these noted observations are in conformance to the Quality Assurance Plan. In chromatographic analysis, manual integration is frequently used instead of automated integration because it produces more accurate results.

The test results present in this report are in compliance with NELAC Standards, A2LA and/or client Quality Assurance Project Plans (QAPP). The laboratory has reviewed the following: Sample Preservations, Hold Times, Initial Calibrations, Continuing Calibrations, Method Blanks, Blank Spikes, Blank Spike Duplicates, Duplicates, Matrix Spikes, Matrix Spike Duplicates, Surrogates and Internal Standards. Any results which were found to be outside of the recommended ranges stated in our SOPs will be noted in the Project Narrative.

Subcontracted Analyses

BAL Laboratory - Cranston, RI	E Coli
RI Analytical Laboratories, Inc. - Warwick, RI	Surfactants

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Mendon Dry Weather Outfall Sampling ESS Laboratory Work Order: 1506228

SAMPLE RECEIPT

The following samples were received on June 08, 2015 for the analyses specified on the enclosed Chain of Custody Record.

The samples and analyses listed below were analyzed in accordance with the Guidelines Establishing Test Procedures for the Analysis of Pollutants, 40 CFR Part 136, as amended.

Lab Number	Sample Name	Matrix	Analysis
1506228-01	MR-19	Surface Water	§, 300.0, 350.1, 9222G
1506228-02	MB-24	Surface Water	§, 300.0, 350.1, 9222G
1506228-03	MB-30	Surface Water	§, 300.0, 350.1, 9222G
1506228-04	RB-35	Surface Water	§, 300.0, 350.1, 9222G

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Mendon Dry Weather Outfall Sampling ESS Laboratory Work Order: 1506228

PROJECT NARRATIVE

No unusual observations noted.

End of Project Narrative.

DATA USABILITY LINKS

Definitions of Quality Control Parameters

Semivolatile Organics Internal Standard Information

Semivolatile Organics Surrogate Information

Volatile Organics Internal Standard Information

Volatile Organics Surrogate Information

EPH and VPH Alkane Lists

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Mendon Dry Weather Outfall Sampling ESS Laboratory Work Order: 1506228

CURRENT SW-846 METHODOLOGY VERSIONS

Analytical Methods

1010A - Flashpoint
6010C - ICP
6020A - ICP MS
7010 - Graphite Furnace
7196A - Hexavalent Chromium
7470A - Aqueous Mercury
7471B - Solid Mercury
8011 - EDB/DBCP/TCP
8015D - GRO/DRO
8081B - Pesticides
8082A - PCB
8100M - TPH
8151A - Herbicides
8260B - VOA
8270D - SVOA
8270D SIM - SVOA Low Level
9014 - Cyanide
9038 - Sulfate
9040C - Aqueous pH
9045D - Solid pH (Corrosivity)
9050A - Specific Conductance
9056A - Anions (IC)
9060A - TOC
9095B - Paint Filter
MADEP 04-1.1 - EPH / VPH

Prep Methods

3005A - Aqueous ICP Digestion
3020A - Aqueous Graphite Furnace / ICP MS Digestion
3050B - Solid ICP / Graphite Furnace / ICP MS Digestion
3060A - Solid Hexavalent Chromium Digestion
3510C - Separatory Funnel Extraction
3520C - Liquid / Liquid Extraction
3540C - Manual Soxhlet Extraction
3541 - Automated Soxhlet Extraction
3546 - Microwave Extraction
3580A - Waste Dilution
5030B - Aqueous Purge and Trap
5030C - Aqueous Purge and Trap
5035 - Solid Purge and Trap

SW846 Reactivity Methods 7.3.3.2 (Reactive Cyanide) and 7.3.4.1 (Reactive Sulfide) have been withdrawn by EPA. These methods are reported per client request and are not NELAP accredited.

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Mendon Dry Weather Outfall Sampling
Client Sample ID: MR-19
Date Sampled: 06/08/15 11:45
Percent Solids: N/A

ESS Laboratory Work Order: 1506228
ESS Laboratory Sample ID: 1506228-01
Sample Matrix: Surface Water

All methods used are in accordance with 40 CFR 136.

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Ammonia as N	**0.17** (0.10)		350.1		1	EEM	06/11/15 12:10	mg/L	CF51006
Chloride	**467** (100)		300.0		200	JLK	06/13/15 13:43	mg/L	CF51308
Surfactants (MBAS)	ND (0.10)		§		1	SUB	06/09/15 15:20	mg/L	CF51229

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Mendon Dry Weather Outfall Sampling
Client Sample ID: MR-19
Date Sampled: 06/08/15 11:45
Percent Solids: N/A

ESS Laboratory Work Order: 1506228
ESS Laboratory Sample ID: 1506228-01
Sample Matrix: Surface Water
Units: CFU/100 ml

All methods used are in accordance with 40 CFR 136.

Microbiology

Analyte	Results (MRL)	MDL	Method	Limit	Analyst	Analyzed
E. Coli	**< 1** (N/A)		9222G		BAM	06/08/15 17:45

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Mendon Dry Weather Outfall Sampling
Client Sample ID: MB-24
Date Sampled: 06/08/15 10:20
Percent Solids: N/A

ESS Laboratory Work Order: 1506228
ESS Laboratory Sample ID: 1506228-02
Sample Matrix: Surface Water

All methods used are in accordance with 40 CFR 136.

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Ammonia as N	**0.16** (0.10)		350.1		1	EEM	06/11/15 12:11	mg/L	CF51006
Chloride	**462** (50.0)		300.0		100	JLK	06/12/15 17:40	mg/L	CF51230
Surfactants (MBAS)	**0.14** (0.10)		§		1	SUB	06/09/15 15:20	mg/L	CF51229

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Mendon Dry Weather Outfall Sampling
Client Sample ID: MB-24
Date Sampled: 06/08/15 10:20
Percent Solids: N/A

ESS Laboratory Work Order: 1506228
ESS Laboratory Sample ID: 1506228-02
Sample Matrix: Surface Water
Units: CFU/100 ml

All methods used are in accordance with 40 CFR 136.

Microbiology

Analyte	Results (MRL)	MDL	Method	Limit	Analyst	Analyzed
E. Coli	**< 1** (N/A)		9222G		BAM	06/08/15 17:45

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Mendon Dry Weather Outfall Sampling
Client Sample ID: MB-30
Date Sampled: 06/08/15 11:00
Percent Solids: N/A

ESS Laboratory Work Order: 1506228
ESS Laboratory Sample ID: 1506228-03
Sample Matrix: Surface Water

All methods used are in accordance with 40 CFR 136.

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Ammonia as N	**0.16** (0.10)		350.1		1	EEM	06/11/15 12:12	mg/L	CF51006
Chloride	**75.9** (50.0)		300.0		100	JLK	06/12/15 18:29	mg/L	CF51230
Surfactants (MBAS)	ND (0.10)		§		1	SUB	06/09/15 15:20	mg/L	CF51229

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Mendon Dry Weather Outfall Sampling
Client Sample ID: MB-30
Date Sampled: 06/08/15 11:00
Percent Solids: N/A

ESS Laboratory Work Order: 1506228
ESS Laboratory Sample ID: 1506228-03
Sample Matrix: Surface Water
Units: CFU/100 ml

All methods used are in accordance with 40 CFR 136.

Microbiology

Analyte	Results (MRL)	MDL	Method	Limit	Analyst	Analyzed
E. Coli	**< 1** (N/A)		9222G		BAM	06/08/15 17:45

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Mendon Dry Weather Outfall Sampling
Client Sample ID: RB-35
Date Sampled: 06/08/15 14:40
Percent Solids: N/A

ESS Laboratory Work Order: 1506228
ESS Laboratory Sample ID: 1506228-04
Sample Matrix: Surface Water

All methods used are in accordance with 40 CFR 136.

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Ammonia as N	**0.59** (0.10)		350.1		1	EEM	06/11/15 12:14	mg/L	CF51006
Chloride	**174** (50.0)		300.0		100	JLK	06/12/15 19:18	mg/L	CF51230
Surfactants (MBAS)	**0.10** (0.10)		§		1	SUB	06/09/15 15:20	mg/L	CF51229

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Mendon Dry Weather Outfall Sampling
Client Sample ID: RB-35
Date Sampled: 06/08/15 14:40
Percent Solids: N/A

ESS Laboratory Work Order: 1506228
ESS Laboratory Sample ID: 1506228-04
Sample Matrix: Surface Water
Units: CFU/100 ml

All methods used are in accordance with 40 CFR 136.

Microbiology

Analyte	Results (MRL)	MDL	Method	Limit	Analyst	Analyzed
E. Coli	**100** (N/A)		9222G		BAM	06/08/15 17:45

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Mendon Dry Weather Outfall Sampling ESS Laboratory Work Order: 1506228

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Classical Chemistry										
Batch CF51006 - NH4 Prep										
Blank										
Ammonia as N	ND	0.10	mg/L							
LCS										
Ammonia as N	0.12	0.10	mg/L	0.09994		115	80-120			
LCS										
Ammonia as N	0.93	0.10	mg/L	0.9994		93	80-120			
Batch CF51230 - General Preparation										
Blank										
Chloride	ND	0.5	mg/L							
LCS										
Chloride	2.5		mg/L	2.500		98	90-110			
Batch CF51308 - General Preparation										
Blank										
Chloride	ND	0.5	mg/L							
LCS										
Chloride	2.5		mg/L	2.500		98	90-110			

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Mendon Dry Weather Outfall Sampling ESS Laboratory Work Order: 1506228

Notes and Definitions

U	Analyte included in the analysis, but not detected
D	Diluted.
<	Less than the Method Detection Limit.
ND	Analyte NOT DETECTED at or above the MRL (LOQ), LOD for DoD Reports, MDL for J-Flagged Analytes
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference
MDL	Method Detection Limit
MRL	Method Reporting Limit
LOD	Limit of Detection
LOQ	Limit of Quantitation
DL	Detection Limit
I/V	Initial Volume
F/V	Final Volume
§	Subcontracted analysis; see attached report
1	Range result excludes concentrations of surrogates and/or internal standards eluting in that range.
2	Range result excludes concentrations of target analytes eluting in that range.
3	Range result excludes the concentration of the C9-C10 aromatic range.
Avg	Results reported as a mathematical average.
NR	No Recovery
[CALC]	Calculated Analyte
SUB	Subcontracted analysis; see attached report

CERTIFICATE OF ANALYSIS

Client Name: Tighe & Bond
Client Project ID: Mendon Dry Weather Outfall Sampling ESS Laboratory Work Order: 1506228

ESS LABORATORY CERTIFICATIONS AND ACCREDITATIONS

ENVIRONMENTAL

Department of Defense (DoD) Environmental Laboratory Accreditation Program (ELAP)
A2LA Accredited: Testing Cert# 2864.01
http://www.a2la.org/scopepdf/2864-01.pdf

Rhode Island Potable and Non Potable Water: LAI00179
http://www.health.ri.gov/find/labs/analytical/ESS.pdf

Connecticut Potable and Non Potable Water, Solid and Hazardous Waste: PH-0750
http://www.ct.gov/dph/lib/dph/environmental_health/environmental_laboratories/pdf/OutofStateCommercialLaboratories.pdf

Maine Potable and Non Potable Water, and Solid and Hazardous Waste: RI0002
http://www.maine.gov/dhhs/mecdc/environmental-health/water/dwp-services/labcert/documents/AllLabs.xls

Massachusetts Potable and Non Potable Water: M-RI002
http://public.dep.state.ma.us/Labcert/Labcert.aspx

New Hampshire (NELAP accredited) Potable and Non Potable Water, Solid and Hazardous Waste: 2424
http://des.nh.gov/organization/divisions/water/dwgb/nhelap/index.htm

New York (NELAP accredited) Non Potable Water, Solid and Hazardous Waste: 11313
http://www.wadsworth.org/labcert/elap/comm.html

New Jersey (NELAP accredited) Non Potable Water, Solid and Hazardous Waste: RI006
http://datamine2.state.nj.us/DEP_OPRA/OpraMain/pi_main?mode=pi_by_site&sort_order=PI_NAMEA&Select+a+Site:=58715

United States Department of Agriculture Soil Permit: P330-12-00139

Pennsylvania: 68-01752
http://www.depweb.state.pa.us/portal/server.pt/community/labs/13780/laboratory_accreditation_program/590095

CHEMISTRY

A2LA Accredited: Testing Cert # 2864.01
Lead in Paint, Phthalates, Lead in Children's Metals Products (Including Jewelry)
http://www.A2LA.org/dirsearchnew/newsearch.cfm

CPSC ID# 1141
Lead Paint, Lead in Children's Metals Jewelry
http://www.cpsc.gov/cgi-bin/labapplist.aspx

CERTIFICATE OF ANALYSIS

ESS Laboratory
Attn: Mr. Shawn Morrell
185 Frances Avenue
Cranston, RI 02910-2211

Date Received: 6/9/2015
Date Reported: 6/11/2015
P.O. #: B02190
Work Order #: 1506-11761

DESCRIPTION: PROJECT #1506228

Subject sample(s) has/have been analyzed by our Warwick, R.I. laboratory with the attached results.

Reference: All parameters were analyzed by U.S. EPA approved methodologies.
The specific methodologies are listed in the methods column of the Certificate of Analysis.

Data qualifiers (if present) are explained in full at the end of a given sample's analytical results.
The Detection Limit is defined as the lowest level that can be reliably achieved during routine laboratory conditions.
The Certificate of Analysis shall not be reproduced except in full, without written approval of R.I. Analytical.
Results relate only to samples submitted to the laboratory for analysis.
Test results are not blank corrected.

Certification # (as applicable to the sample's origin state):
RI LAI0033, MA M-RI015, CT PH-0508, ME RI00015, NH 2537, NY 11726

If you have any questions regarding this work, or if we may be of further assistance, please contact our customer service department.

Approved by:

Sharon Baker
MIS / Data Reporting

enc: Chain of Custody

R.I. Analytical Laboratories, Inc.

CERTIFICATE OF ANALYSIS

ESS Laboratory
Date Received: 6/9/2015
Work Order #: 1506-11761

Sample # 001
SAMPLE DESCRIPTION: 1506228-01
SAMPLE TYPE:GRAB **SAMPLE DATE/TIME:** 6/08/2015 @ 11:45

PARAMETER	SAMPLE RESULTS	DET. LIMIT	UNITS	METHOD	DATE/TIME ANALYZED	ANALYST
Surfactants (MBAS)	<0.10	0.10	mg/l	SM5540C 18-21ed	6/9/2015 15:20	JDC

Surfactants (MBAS) - Calculated as LAS, mol wt. 342.

Sample # 002
SAMPLE DESCRIPTION: 1506228-02
SAMPLE TYPE:GRAB **SAMPLE DATE/TIME:** 6/08/2015 @ 10:20

PARAMETER	SAMPLE RESULTS	DET. LIMIT	UNITS	METHOD	DATE/TIME ANALYZED	ANALYST
Surfactants (MBAS)	0.14	0.10	mg/l	SM5540C 18-21ed	6/9/2015 15:20	JDC

Surfactants (MBAS) - Calculated as LAS, mol wt. 342.

Sample # 003
SAMPLE DESCRIPTION: 1506228-03
SAMPLE TYPE:GRAB **SAMPLE DATE/TIME:** 6/08/2015 @ 11:00

PARAMETER	SAMPLE RESULTS	DET. LIMIT	UNITS	METHOD	DATE/TIME ANALYZED	ANALYST
Surfactants (MBAS)	<0.10	0.10	mg/l	SM5540C 18-21ed	6/9/2015 15:20	JDC

Surfactants (MBAS) - Calculated as LAS, mol wt. 342.

Sample # 004
SAMPLE DESCRIPTION: 1506228-04
SAMPLE TYPE:GRAB **SAMPLE DATE/TIME:** 6/08/2015 @ 14:40

PARAMETER	SAMPLE RESULTS	DET. LIMIT	UNITS	METHOD	DATE/TIME ANALYZED	ANALYST
Surfactants (MBAS)	0.10	0.10	mg/l	SM5540C 18-21ed	6/9/2015 15:20	JDC

Surfactants (MBAS) - Calculated as LAS, mol wt. 342.

QA/QC Report

Client: ESS Laboratory
WO #: 1506-11761
Date: 6/11/15

-Method Blanks Results-

Parameter	Units	Results	Date Analyzed
Surfactants (MBAS)	mg/l	<0.10	6/9/2015

-Laboratory Control Standard-

Parameter	Units	Spike Conc.	Detected Conc.	% Rec.	Date Analyzed
Surfactants (MBAS)	mg/l	0.60	0.565	94	6/9/2015

-Duplicate Sample Results-

Parameter	Units	Sample #	Rep 1 Conc.	Rep 2 Conc.	Mean Conc.	Reported Value	% RPD	Date Analyzed
Surfactants (MBAS)	mg/l	1506-11679-001	<0.10	<0.10	<0.10	N/A	0	6/9/2015

-Matrix Spike Results-

Parameter	Units	Sample #	Sample Conc.	Spike Conc.	Detected Conc.	% Rec.	Date Analyzed
Surfactants (MBAS)	mg/l	1506-11679-001	N/A	0.30	0.27	90	6/9/2015

ESS Laboratory — RIAL

Division of Thielsch Engineering, Inc.

185 Frances Avenue,Cranston RI 02910-2211
Tel. (401)461-7181 Fax (401)461-4486
www.esslaboratory.com

CHAIN OF CUSTODY

ESS Lab # 1506228

Turn Time ___ **Standard** Other_____

Regulatory State: **MA** RI CT NH NJ NY ME Other_____

Is this project for any of the following:(please circle)
MA-MCP Navy USACE CT DEP Other_____

Reporting Limits - _____

Electonic Deliverables Excel Access PDF

Co. Name: **ESS Laboratory**	Project #	Project Name: **1506228**	
Contact Person: **Shawn Morrell**	Proj. Location		
Address	City , State	Zip	PO #: B02190
Tel.: ext 3083	email: smorrell@thielsch.com		

ESS Lab ID	Date	Collection Time	Grab -G Composite-C	Matrix	Sample ID	Pres Code	# of Containers	Type of Container	Vol of Container	Analysis		SURFACTANTS							
	6/8/15	**1145**	**G**	**SW**	**1506228-01**	**1**	**1**	**P**	**500mL**			**X**							
	6/8/15	**1020**	**G**	**SW**	**1506228-02**	**1**	**1**	**P**	**500mL**			**X**							
	6/8/15	**1100**	**G**	**SW**	**1506228-03**	**1**	**1**	**P**	**500mL**			**X**							
	6/8/15	**1440**	**G**	**SW**	**1506228-04**	**1**	**1**	**P**	**500mL**			**X**							
						4													

Container Type: P-Poly G-Glass AG-Amber Glass S-Sterile V-VOA

Matrix: S-Soil SD-Solid D-Sludge WW-Wastewater GW-Groundwater SW-Surface Water DW-Drinking Water O-Oil W-Wipes F-Filter

Cooler Present ✓ Yes ____No

Seals Intact ____ Yes ____No NA:____

Cooler Temperature: 2.8

Internal Use Only

[ ] Pickup

[ ] Technician____

Preservation Code: 1-NP, 2-HCl, 3-H2SO4, 4-HNO3, 5-NaOH, 6-MeOH, 7-Asorbic Acid, 8-ZnAct, 9-_____

Sampled by :

Comments:

Relinquished by: (Signature, Date & Time)	Received by: (Signature, Date & Time)	Relinquished by: (Signature, Date & Time)	Received by: (Signature, Date & Time)
6/9/15 11:07	6-9-15 11:07		
Relinquished by: (Signature, Date & Time)	Received by: (Signature, Date & Time)	Relinquished by: (Signature, Date & Time)	Received by: (Signature, Date & Time)
			1506-11761

* By circling MA-MCP, client acknowledges sampels were collected in accordance with MADEP CAM VIIA

Please fax to the laboratory all changes to Chain of Custody

Report Method Blank & Laboratory Control Sample Results

BAL

ESS Laboratory

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www.esslaboratory.com

CHAIN OF CUSTODY

ESS Lab # 1506228

Turn Time X Standard Other_____

Regulatory State: MA RI CT NH NJ NY ME Other_____

Is this project for any of the following:(please circle)
MA-MCP Navy USACE CT DEP Other_____

Reporting Limits - _____

Electonic Deliverables **Excel** Access PDF

Co. Name: **Tighe & Bond**	Project #: **22-0799-6-03-02**	Project Name: **Mendon Dry Weather Outfall Sampling**	
Contact Person: **Gabrielle Belfit**	Proj. Location: **66 ProvidenceStreet Mendon, MA**		
Address: **4 Barlows Landing Rd**	City, State: **Pocasset, MA**	Zip: **02559**	PO #
Tel.	email: gcbelfit@tighebond.com		

ESS Lab ID	Date	Collection Time	Grab -G Composite-C	Matrix	Sample ID	Pres Code	# of Containers	Type of Container	Vol of Container	Analysis: Ammonia	Bacteria (E. Coli)	Chloride	pH	Surfactants					
1	6-8-15	11:45 AM	G	SW	MR-19 A	3	1	P	250	X									
1	6-8-15	11:45 AM	G	SW	MR-19 B	9	1	P			X								
1	6-8-15	11:45 AM	G	SW	MR-K C		1	P	250			X	X						
1	6-8-15	11:45 AM	G	SW	MR-19 D		1	P	500					X					
			G	SW		3	1	P	250	X									
			G	SW		9	1	P			X								
			G	SW			1	P	250			X	X						
			G	SW			1	P	500					X					

Container Type: P-Poly G-Glass AG-Amber Glass S-Sterile V-VOA

Matrix: S-Soil SD-Solid D-Sludge WW-Wastewater GW-Groundwater SW-Surface Water DW-Drinking Water O-Oil W-Wipes F-Filter

Cooler Present ✓ Yes ____ No

Seals Intact ____ Yes ____ No NA:____

Cooler Temperature: 5.5 c 6/8/15 mc

Internal Use Only

[ ] ~~Pickup~~

[ ] Technician

Preservation Code: 1-NP, 2-HCl, 3-H2SO4, 4-HNO3, 5-NaOH, 6-MeOH, 7-Asorbic Acid, 8-ZnAct, 9-_sterile____

Sampled by :

Comments:

Relinquished by: (Signature, Date & Time)	Received by: (Signature, Date & Time)	Relinquished by: (Signature, Date & Time)	Received by: (Signature, Date & Time)
6/8/15 15:55	6/8/15 1555	6/8/15 1707	6/8/15 1722
6/8/15 1735	6/8/15 1735		

* By circling MA-MCP, client acknowledges sampels were collected in accordance with MADEP CAM VIIA

Please fax to the laboratory all changes to Chain of Custody

Report Method Blank & Laboratory Control Sample Results

ESS Laboratory

BAL

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www.esslaboratory.com

CHAIN OF CUSTODY

ESS Lab # 1506228

Turn Time X Standard Other_____

Regulatory State: MA RI CT NH NJ NY ME Other_____

Is this project for any of the following:(please circle)
MA-MCP Navy USACE CT DEP Other_____

Reporting Limits - _____

Electonic Deliverables **Excel** Access PDF

Co. Name: Tighe & Bond	Project # 22-0799-6-03-02	Project Name: Mendon Dry Weather Outfall Sampling	
Contact Person: Gabrielle Belfit	Proj. Location: 66 ProvidenceStreet Mendon, MA		
Address: 4 Barlows Landing Rd	City, State: Pocasset, MA	Zip 02559	PO #
Tel.	email: gbelfit@tighebond.com		

ESS Lab ID	Date	Collection Time	Grab -G Composite-C	Matrix	Sample ID	Pres Code	# of Containers	Type of Container	Vol of Container	Analysis: Ammonia	Bacteria (E. Coli)	Chloride	pH	Surfactants					
2	6-8-15	10:20 AM	G	SW	MB-24 A	3	1	P	250	X									
2	6-8-15	10:20 AM	G	SW	MB-24 B	9	1	P			X								
2	6-8-15	10:20 AM	G	SW	MB-24 C		1	P	250			X	X						
2	6-8-15	10:20 AM	G	SW	MB-24 D		1	P	500					X					
3	6-8-15	11:00 AM	G	SW	MB-30 A	3	1	P	250	X									
3	6-8-15	11:00 AM	G	SW	MB-30 B	9	1	P			X								
3	6-8-15	11:00 AM	G	SW	MB-30 C		1	P	250			X	X						
3	6-8-15	11:00 AM	G	SW	MB-30 D		1	P	500					X					

Container Type: P-Poly G-Glass AG-Amber Glass S-Sterile V-VOA

Matrix: S-Soil SD-Solid D-Sludge WW-Wastewater GW-Groundwater SW-Surface Water DW-Drinking Water O-Oil W-Wipes F-Filter

Cooler Present ✓ Yes ____ No

Seals Intact ____ Yes ____ No NA: ✓

Cooler Temperature: 5.8 °C

Internal Use Only

[ ] Pickup

[ ] Technician____

Preservation Code: 1-NP, 2-HCl, 3-H2SO4, 4-HNO3, 5-NaOH, 6-MeOH, 7-Asorbic Acid, 8-ZnAct, 9-_sterile____

Sampled by: GUBAR

Comments:

Relinquished by: (Signature, Date & Time)	Received by: (Signature, Date & Time)	Relinquished by: (Signature, Date & Time)	Received by: (Signature, Date & Time)
GUBAR 6/8/15 15:55	6/8/15 1555	6/8/15 1707	6/8/15 1722
Relinquished by: (Signature, Date & Time)	Received by: (Signature, Date & Time)	Relinquished by: (Signature, Date & Time)	Received by: (Signature, Date & Time)
6/8/15 1735	6/8/15 1735		

By circling MA-MCP, client acknowledges samples were collected in accordance with MADEP CAM VIIA

Please fax to the laboratory all changes to Chain of Custody

Report Method Blank & Laboratory Control Sample Results

BAL

ESS Laboratory

Division of Thielsch Engineering, Inc.

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www.esslaboratory.com

CHAIN OF CUSTODY

ESS Lab # 156228

Turn Time X Standard Other_____

Regulatory State: MA RI CT NH NJ NY ME Other_____

Is this project for any of the following:(please circle)
MA-MCP Navy USACE CT DEP Other_____

Reporting Limits - _____

Electonic Deliverables **Excel** Access PDF

Co. Name: **Tighe & Bond**	Project #: **22-0799-6-03-02**	Project Name: **Mendon Dry Weather Outfall Sampling**	
Contact Person: **Gabrielle Belfit**	Proj. Location: **66 ProvidenceStreet Mendon, MA**		
Address: **4 Barlows Landing Rd**	City, State: **Pocasset, MA**	Zip: **02559**	PO #
Tel. [illegible]	email: [illegible]		

ESS Lab ID	Date	Collection Time	Grab -G Composite-C	Matrix	Sample ID	Pres Code	# of Containers	Type of Container	Vol of Container	Analysis: Ammonia	Bacteria (E. Coli)	Chloride	pH	Surfactants
4	[illegible]	[illegible]	G	SW	[illegible]	3	1	P	250	x				
4	[illegible]	[illegible]	G	SW	[illegible]	9	1	P			x			
4	[illegible]	[illegible]	G	SW	[illegible]		1	P	250			x	x	
4	[illegible]	[illegible]	G	SW	[illegible]		1	P	500					x
			G	SW		3	1	P	250	x				
			G	SW		9	1	P			x			
			G	SW			1	P	250			x	x	
			G	SW			1	P	500					x

Container Type: P-Poly G-Glass AG-Amber Glass S-Sterile V-VOA

Matrix: S-Soil SD-Solid D-Sludge WW-Wastewater GW-Groundwater SW-Surface Water DW-Drinking Water O-Oil W-Wipes F-Filter

Cooler Present _____Yes _____No

Seals Intact _____Yes _____No NA:_____

Cooler Temperature: 5.5 ice

Internal Use Only

[T] Pickup

[ ] Technician

Preservation Code: 1-NP, 2-HCl, 3-H2SO4, 4-HNO3, 5-NaOH, 6-MeOH, 7-Asorbic Acid, 8-ZnAct, 9-_sterile____

Sampled by : [illegible]

Comments:

Relinquished by: (Signature, Date & Time)	Received by: (Signature, Date & Time)	Relinquished by: (Signature, Date & Time)	Received by: (Signature, Date & Time)
[illegible] 15:55	[illegible] 6/8/15 1555	[illegible] 6/8/15 1707	[illegible] 6/8/15 1722
[illegible] 6/8/15 1735	[illegible] 1735		

* By circling MA-MCP, client acknowledges sampels were collected in accordance with MADEP CAM VIIA

Please fax to the laboratory all changes to Chain of Custody

Report Method Blank & Laboratory Control Sample Results

ESS Laboratory

Division of Thielsch Engineering, Inc.

185 Frances Avenue,Cranston RI 02910-2211
Tel. (401)461-7181 Fax (401)461-4486
www.esslaboratory.com

CHAIN OF CUSTODY

ESS Lab # 1506228

Turn Time X Standard Other_____

Regulatory State: MA RI CT NH NJ NY ME Other_____

Is this project for any of the following:(please circle)
MA-MCP Navy USACE CT DEP Other_____

Reporting Limits - _____

Electonic Deliverables Excel Access PDF

Co. Name: Tighe & Bond	Project # 22-0799-6-03-02	Project Name: Mendon Dry Weather Outfall Sampling	
Contact Person: Gabrielle Belfit	Proj. Location: 66 ProvidenceStreet Mendon, MA		
Address: 4 Barlows Landing Rd	City , State: Pocasset, MA	Zip 02559	PO #
Tel.	email: gbelfit@tighebond.com		

ESS Lab ID	Date	Collection Time	Grab -G Composite-C	Matrix	Sample ID	Pres Code	# of Containers	Type of Container	Vol of Container	Analysis: Ammonia	Bacteria (E. Coli)	Chloride	pH	Surfactants					
1	6-8-15	11:45 AM	G	SW	MR-19 A	3	1	P	250	x									
1	6-8-15	11:45 AM	G	SW	MR-19 B	9	1	P			x								
1	6-8-15	11:45 AM	G	SW	MR-19 C		1	P	250			x	x						
1	6-8-15	11:45 AM	G	SW	MR-19 D		1	P	500					x					
			G	SW		3	1	P	250	x									
			G	SW		9	1	P			x								
			G	SW			1	P	250			x	x						
			G	SW			1	P	500					x					

Container Type: P-Poly G-Glass AG-Amber Glass S-Sterile V-VOA

Matrix: S-Soil SD-Solid D-Sludge WW-Wastewater GW-Groundwater SW-Surface Water DW-Drinking Water O-Oil W-Wipes F-Filter

Cooler Present ✓ Yes _____ No

Seals Intact ____ Yes _____ No NA:____

Cooler Temperature: 5.5°C 6/8/15 mc

Internal Use Only

[ ] Pickup

[ ] Technician

Preservation Code: 1-NP, 2-HCl, 3-H2SO4, 4-HNO3, 5-NaOH, 6-MeOH, 7-Asorbic Acid, 8-ZnAct, 9-_sterile____

Sampled by :

Comments:

Relinquished by: (Signature, Date & Time)	Received by: (Signature, Date & Time)	Relinquished by: (Signature, Date & Time)	Received by: (Signature, Date & Time)
6/8/15 15:55	6/8/15 1555	6/8/15 1707	6/8/15 1722
Relinquished by: (Signature, Date & Time)	Received by: (Signature, Date & Time)	Relinquished by: (Signature, Date & Time)	Received by: (Signature, Date & Time)

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CHAIN OF CUSTODY

ESS Lab # 1506228

Turn Time X Standard Other_____

Regulatory State: MA RI CT NH NJ NY ME Other_____

Is this project for any of the following:(please circle)
MA-MCP Navy USACE CT DEP Other_____

Reporting Limits - _____

Electonic Deliverables Excel Access PDF

Co. Name: Tighe & Bond	Project #: 22-0799-6-03-02	Project Name: Mendon Dry Weather Outfall Sampling	
Contact Person: Gabrielle Belfit	Proj. Location: 66 ProvidenceStreet Mendon, MA		
Address: 4 Barlows Landing Rd	City , State: Pocasset, MA	Zip: 02559	PO #:
Tel.	email: gbelfit@tighebond.com		

ESS Lab ID	Date	Collection Time	Grab -G Composite-C	Matrix	Sample ID	Pres Code	# of Containers	Type of Container	Vol of Container	Analysis: Ammonia	Bacteria (E. Coli)	Chloride	pH	Surfactants				
2	6-8-15	10:20 AM	G	SW	MB-24 A	3	1	P	250	x								
2	6-8-15	10:20 AM	G	SW	MB-24 B	9	1	P			x							
2	6-8-15	10:20 AM	G	SW	MB-24 C		1	P	250			x	x					
2	6-8-15	10:20 AM	G	SW	MB-24 D		1	P	500					x				
		#7																
3	6-8-15	11:00 AM	G	SW	MB-30 A	3	1	P	250	x								
3	6-8-15	11:00 AM	G	SW	MB-30 B	9	1	P			x							
3	6-8-15	11:00 AM	G	SW	MB-30 C		1	P	250			x	x					
3	6-8-15	11:00 AM	G	SW	MB-30 D		1	P	500					x				

Container Type: P-Poly G-Glass AG-Amber Glass S-Sterile V-VOA

Matrix: S-Soil SD-Solid D-Sludge WW-Wastewater GW-Groundwater SW-Surface Water DW-Drinking Water O-Oil W-Wipes F-Filter

Cooler Present ✓ Yes _____No

Seals Intact _____ Yes _____No NA:_____

Cooler Temperature: 5.8 ice 6/8/15 mc

Internal Use Only

[ ] Pickup

[ ] Technician_____

Preservation Code: 1-NP, 2-HCl, 3-H2SO4, 4-HNO3, 5-NaOH, 6-MeOH, 7-Asorbic Acid, 8-ZnAct, 9-_sterile_____

Sampled by : GLBart

Comments:

Relinquished by: (Signature, Date & Time)	Received by: (Signature, Date & Time)	Relinquished by: (Signature, Date & Time)	Received by: (Signature, Date & Time)
GLBart 6/8/15 15:55	6/8/15 1555	6/8/15 1707	6/8/15 1722
Relinquished by: (Signature, Date & Time)	Received by: (Signature, Date & Time)	Relinquished by: (Signature, Date & Time)	Received by: (Signature, Date & Time)

* By circling MA-MCP, client acknowledges sampels were collected in accordance with MADEP CAM VIIA

Please fax to the laboratory all changes to Chain of Custody

Report Method Blank & Laboratory Control Sample Results

ESS Laboratory

Division of Thielsch Engineering, Inc.

185 Frances Avenue,Cranston RI 02910-2211
Tel. (401)461-7181 Fax (401)461-4486
www.esslaboratory.com

CHAIN OF CUSTODY

ESS Lab # 1506228

Turn Time X Standard Other_____

Regulatory State: (MA) RI CT NH NJ NY ME Other_____

Is this project for any of the following:(please circle)
MA-MCP Navy USACE CT DEP Other [redacted]

Reporting Limits - _____

Electonic Deliverables Excel Access PDF

Co. Name: Tighe & Bond	Project # 22-0799-6-03-02	Project Name: Mendon Dry Weather Outfall Sampling	
Contact Person: Gabrielle Belfit	Proj. Location: 66 ProvidenceStreet Mendon, MA		
Address: 4 Barlows Landing Rd	City , State: Pocasset, MA	Zip: 02559	PO #
Tel. 508-564-7285	email: GCBelfit@tighebond.com		

ESS Lab ID	Date	Collection Time	Grab -G Composite-C	Matrix	Sample ID	Pres Code	# of Containers	Type of Container	Vol of Container	Analysis: Ammonia	Bacteria (E. Coli)	Chloride	pH	Surfactants				
4	6/8/2015	2:40 pm	G	SW	RB-35	3	1	P	250	x								
4	6/8/2015	2:40 pm	G	SW	RB-35	9	1	P			x							
4	6/8/2015	2:40 pm	G	SW	RB-35		1	P	250			x	x					
4	6/8/2015	2:40 pm	G	SW	RB-35		1	P	500					x				
			G	SW		3	1	P	250	x								
			G	SW		9	1	P			x							
			G	SW			1	P	250			x	x					
			G	SW			1	P	500					x				

Container Type: P-Poly G-Glass AG-Amber Glass S-Sterile V-VOA

Matrix: S-Soil SD-Solid D-Sludge WW-Wastewater GW-Groundwater SW-Surface Water DW-Drinking Water O-Oil W-Wipes F-Filter

Cooler Present ✓ Yes ____No

Seals Intact ____ Yes ____No NA:____

Cooler Temperature: 5.5 ice

Internal Use Only

[ ] Pickup

[ ] Technician

Preservation Code: 1-NP, 2-HCl, 3-H2SO4, 4-HNO3, 5-NaOH, 6-MeOH, 7-Asorbic Acid, 8-ZnAct, 9-_sterile____

Sampled by : ACS | MJG

Comments:

Relinquished by: (Signature, Date & Time)	Received by: (Signature, Date & Time)	Relinquished by: (Signature, Date & Time)	Received by: (Signature, Date & Time)
6/8/2015 15:55	6/8/15 1555	6/8/15 1707	6/8/15 1722
Relinquished by: (Signature, Date & Time)	Received by: (Signature, Date & Time)	Relinquished by: (Signature, Date & Time)	Received by: (Signature, Date & Time)

* By circling MA-MCP, client acknowledges sampels were collected in accordance with MADEP CAM VIIA

Please fax to the laboratory all changes to Chain of Custody

Report Method Blank & Laboratory Control Sample Results

Appendix F

IDDE Statement of Responsibility

This document establishes a written protocol that clearly identifies responsibilities with regard to eliminating illicit discharges. This protocol describes:

1. Identification of a suspected illicit discharge to Mendon's MS4;
2. Contact information to report suspected illicit discharges;
3. Responsibility for elimination of identified illicit discharges;
4. Standard operating procedures for enforcement and appropriate methods for elimination of the illicit connection or identified problem; and
5. Process for documentation and verification of removal of the connection or the discharge.

1. IDENTIFICATION OF A SUSPECTED ILLICIT DISCHARGE TO MENDON'S MS4

There are a variety of ways that an illicit discharge to the MS4 might be discovered and reported to the Town.

Residents and Businesses of Mendon. Through the Town's public education and outreach efforts, residents and businesses of Mendon are becoming more aware that the municipal storm drain discharges directly into Mendon's water bodies. The public may report illicit connections or illegal dumping to the Highway Department through the Public Response System.

Maintenance Field Crews. Both municipal staff and contractors that conduct Mendon's drainage and roadway operation and maintenance activities are some of the observers available to the Town to detect illicit discharges and illegal dumping activities.

Inspectors. Both municipal staff and private inspectors may conduct inspections of construction sites, buildings, and other operations and maintenance on public or private parties.

Personnel Conducting Outfall Screening. Through the Town's outfall screening program, pollutant concentrations may indicate the presence of an illicit discharge. In this case, a follow up investigation may be necessary to identify the source of the contamination.

As part of its public education and outreach and employee training programs, people involved in these activities should be *encouraged* to report any signs of illegal dumping or a suspected illicit discharge. It is important that the information observed in the field is communicated to the appropriate staff for follow up and outreach.

2. CONTACT INFORMATION TO REPORT SUSPECTED ILLICIT DISCHARGES

The following contact information should be advertised on any **educational materials** regarding illicit discharges and illegal dumping, as well as on the **Town website**.

- **For Imminent Emergency Situations where there is an immediate risk to public health and safety: Call 911**
- **For Urgent Situations, where public health, safety, and/or the environment are at risk and there are possibly hazardous chemicals,** tell your Foreman or call the Fire Department's non-emergency line at **508-478-2737.**

- **Any other situation (non-emergencies):** Tell your Foreman or call **the Highway Department at 508-473-0737.**
- **When in doubt, call 911.**

3. RESPONSIBILITY FOR ELIMINATION OF IDENTIFIED ILLICIT DISCHARGES

This section defines the parties responsible for eliminating reported illicit discharges under three scenarios.

Imminent Emergency Situations

Take **immediate action** in the event of encountering one of the following situations:

- Individuals actively in the process of introducing possible illegal substances or materials into the MS4;
- Presence of fumes or smoke emanating from the MS4;
- Visible significant stream of a controlled chemical or petroleum product flowing in the storm drain system or in downstream waters;
- Large chemical plume in stream or river downstream of a Town outfall; or
- Any condition that poses or could pose an immediate threat to property, human health or safety, or aquatic life.

If one of the above situations is encountered, take the following steps:

1. Ensure safety of municipal employees and/or the public by instructing the people to stay away from the area
2. **Call 911** to report **active illegal dumping** or **potential fire** or **significant chemical incident that has the potential to be hazardous to public health or the environment**.
3. Be prepared to provide the following information to the Fire Department or other Emergency Responders:
    - Where is the emergency or spill?
    - What is the emergency or what spilled?
    - How much spilled?
    - Who spilled the material?
    - Is anyone cleaning up the material?
    - Are there resource damages (such as dead fish or oily birds)?
    - Who is reporting the emergency and/or spill?
    - Your contact information
4. Take detailed notes and photos for subsequent investigation by the Town or other agencies.

911 will receive the call and dispatch the Fire Department and/or Police Department. Fire and Police may coordinate with other Town Departments and Boards such as the Highway Department, Board of Health, or Conservation Commission, as necessary.

Urgent Situations

Take **immediate action** in the event of encountering one of the following situations:

- Very strong chemical odor emanating from the MS4;
- Suspicion of hazardous chemicals in the MS4; or
- Public health and safety or the environment may be urgently at risk.

If one of the above situations is encountered, take the following steps:

1. Tell your foreman or call the Fire Department's **non-emergency line** and report the situation.
2. Be prepared tell the Fire Department or other Emergency Responders what the situation is, where the illicit discharge is, and any other information about the situation. Take notes and photographs for subsequent investigation by the Town or other agencies.

The Foreman will call the Fire Department's non-emergency line and report the situation and may coordinate as necessary with other Departments.

The Fire Department will respond to the situation and follow its Emergency Response Procedures and its Spill Response Procedures and may coordinate as necessary with other Town Departments.

Records of illicit discharges should be forwarded to the **Highway Department.**

Non-Emergency Situations

The Foreman will report the situation to the Highway Department and may coordinate with other applicable Town Departments such as the Board of Health or Conservation Commission.

4. ILLICIT DISCHARGES ENFORCEMENT STANDARD OPERATING PROCEDURES (SOP)

The following SOP has been developed from requirements of Chapter XXIII of the Mendon General Bylaws (*Non-Storm Water Discharge*). When the Highway Department is notified of or discovers an illicit discharge, illicit connection, or obstruction of the municipal drain system that is the responsibility of an entity other than the Town (i.e., located on or emanating from non-municipally-owned property), it should use the following Standard Operating Procedure, with adjustments as appropriate for the specific circumstances of each enforcement action. (The Board of Health should consult this SOP as well, but may also or instead rely on another legal authority for enforcement, such as Title 5.) For simplicity, this SOP assumes that the property owner is the violator; make the necessary adjustments if they are different people or entities.

1. Start a file (hard copy or electronic) in which all relevant information regarding the enforcement action will be maintained. Log all communications with the property owner.
2. Compile existing information regarding the violation, such as: location and apparent source of the discharge, description of the discharge, method of discovery, date of discovery, observations made by Town staff or contractors (including when, where, and by whom), property address, and property owner, and log physical evidence (e.g., photos, samples, etc.).
3. Determine whether the matter should be referred to the Board of Health or handled by the Highway Department. If the latter, continue to follow the subsequent steps below.
4. Contact the property owner in person or by telephone to discuss the situation and attempt to get voluntary compliance. If the property owner promises to fix the situation, follow up with a letter memorializing the conversation and noting that failure to address the violation will result in enforcement action.
5. If the property owner cannot be contacted, send a "Notice of Violation" letter detailing the apparent violation and asking the property owner to contact the Highway Surveyor (or other appropriate Highway Department staff) to discuss addressing the violation.
6. If entry onto private property is necessary to gather additional information, attempt to get consent from the property owner. If no consent is obtained, consult Town Counsel for assistance in obtaining an administrative warrant. Except in a true emergency, do not enter onto private property without consent or a warrant.
7. If voluntary compliance is not obtained, issue a written order under Section 11.3 of the Bylaw (after review by Town Counsel, if possible).
    a. The order shall include the name and address of the alleged violator, the address at which the violation is occurring or has occurred, a statement specifying the nature of the violation, a description of the actions needed to resolve the violation and come into compliance, the deadline within which such actions must be completed, and a statement that, if the violator fails to come into compliance by the specified deadline, they will be subject to a fine not to exceed $300.00 for each day such violation continues.
    b. The order may require, without limitation:
        i. Elimination of illicit connections or discharges to the storm drain system;
        ii. Termination of access to the storm drainage system;
        iii. Performance of monitoring, analyses, and reporting;
        iv. Cessation of unlawful discharges, practices, or operations; and
        v. Remediation of contamination in connection therewith.
8. If the written order is not complied with, consult with Town Counsel to determine next steps, which may include one or more of the following: imposing fines; filing of a non-criminal disposition; and direct action by the Town to remedy the violation at the expense of the violator or property owner.
9. Pursuant to Section 9.1 of the Bylaw, the Highway Department may suspend municipal storm drain system access to any person or property without prior written notice when

such suspension is necessary to stop an actual or threated illegal discharge that presents or may present imminent risk of harm to the public health, safety, welfare, or the environment.

10. Violations shall be subject to a fine not to exceed $300 for each day such violation occurs or continues, or subject to non-criminal disposition for which the penalties are: $100 fine for the first violation, $200 fine for the second violation, and $300 fine for the third violation. Each day or part thereof that a violation occurs or continues constitutes a separate offense.
11. All hard copy written correspondence to the property owner should be hand-delivered (with a record made of such delivery) or sent both by first class mail and certified mail (return receipt requested). (Certified mail provides proof of mailing; first class mail is a backup to ensure that the correspondence is received even if the property owner refuses the certified mail delivery.) All such correspondence should be copied to the Board of Health, Town Administrator, and Town Counsel.
12. Consult Town Counsel if civil or criminal court action is required.

Table 1: Appropriate Methods for Elimination of the Illicit Discharge

Type of Discharge	Source	Elimination Actions by Town
Sewage	• Infrequent/transient discharge (e.g., RV dumping • Septic • Pet Waste	• Enforcement; Spill Response • Enforcement; Incentive or aid • Warning; Education; Enforcement
Wash Water	• Commercial or Industrial Direct Connection • Residential Direct Connection • Commercial Car Wash • Household maintenance related activities	• Enforcement • Enforcement • Enforcement • Warning and Education
Liquid Wastes	• Professional oil change / car maintenance • Heating oil / solvent dumping • Homeowner oil change and other liquid waste disposal (e.g., paint) • Spill (trucking) • Other industrial wastes	• Enforcement; Spill Response • Enforcement; Spill Response • Education; Enforcement • Spill Response • Spill Response
Solid Waste or Obstructions	• Trash or garbage • Erosion from Construction • Erosion from Landscaping (e.g., mulch, loam)	• Enforcement • Enforcement • Warning; Education; Enforcement

5. PROCESS FOR DOCUMENTATION AND VERIFICATION OF REMOVAL OF THE CONNECTION OR THE DISCHARGE

At a minimum, documentation will include a description of the following:

- discharge and source location,
- a description of the discharge,
- the method of discovery,
- date of discovery,
- date of elimination,
- repair or enforcement action or planned corrective measures and a schedule for completing the illicit discharge removal,
- date and method to confirm removal, and
- estimate of flow volume removed.

Documentation will be kept in Appendix H of the IDDE Plan. Verification of removal of the connection must include water quality sampling for sanitary wastewater and may include visual inspection, dye-testing, CCTV inspections, or damming techniques.

Appendix G

IDDE Employee Training Log

EMPLOYEE TRAINING LOG

Training date:	
Title of Training:	
Training Duration (minutes):	
Subject(s) covered during Training: (Briefly describe or attach copy of training materials)	
Employee(s) Trained:	**Signature:**

Appendix H

Record Keeping