Illicit Discharge Detection and Elimination (IDDE) Plan

June 28, 2019

This template was compiled by VHB for use by members of the Cape Cod Stormwater Managers Group as part of a 604(b) Grant funded by the Massachusetts Department of Environmental Protection. This template was developed by modifying a template created by the Central Massachusetts Regional Stormwater Coalition (CMRSWC) and Fuss & O’Neill and integrated with content from the Buzzards Bay Action Committee’s Stormwater Collaborative Stormwater Monitoring Guidelines and Barnstable County Water Quality Laboratory.
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1 Introduction

1.1 MS4 Program
This Illicit Discharge Detection and Elimination (IDDE) Plan has been developed by the Town of Sandwich to address the requirements of the United States Environmental Protection Agency’s (USEPA’s) 2016 National Pollutant Discharge Elimination System (NPDES) General Permit for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems (MS4) in Massachusetts, hereafter referred to as the “2016 Massachusetts MS4 Permit” or “MS4 Permit.”

The 2016 Massachusetts MS4 Permit requires that each permittee, or regulated community, address six Minimum Control Measures. These measures include the following:

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

Under Minimum Control Measure 3, the permittee is required to 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. The IDDE program must also be recorded in a written (hardcopy or electronic) document. This IDDE Plan has been prepared to address this requirement.

1.2 Illicit Discharges
An “illicit discharge” is any discharge to a drainage system that is not composed entirely of stormwater, with the exception of discharges pursuant to a NPDES permit (other than the NPDES permit for discharges from the MS4) and discharges resulting from fire-fighting activities.

Illicit discharges may take a variety of forms. Illicit discharges may enter the drainage system through direct or indirect connections. Direct connections may be relatively obvious, such as cross-connections of sewer services to the storm drain system. Indirect illicit discharges may be more difficult to detect or address, such as failing septic systems that discharge untreated sewage to a ditch within the MS4, or a sump pump that discharges contaminated water on an intermittent basis.

Some illicit discharges are intentional, such as dumping used oil (or other pollutants) into catch basins, a resident or contractor illegally tapping a new sewer lateral into a storm drain pipe to avoid the costs of a sewer connection fee and service, and illegal dumping of yard wastes into surface waters.

Some illicit discharges are related to the unsuitability of original infrastructure to the modern regulatory environment. Examples of illicit discharges in this category include connected floor drains...
in old buildings, as well as sanitary sewer overflows that enter the drainage system. Sump pumps legally connected to the storm drain system may be used inappropriately, such as for the disposal of floor washwater or old household products, in many cases due to a lack of understanding on the part of the homeowner.

### 1.3 Allowable Non-Stormwater Discharges

The following categories of non-storm water discharges are allowed under the 2016 MS4 Permit unless the permittee, EPA or Massachusetts Department of Environmental Protection (MassDEP) identifies any category or individual discharge of non-stormwater discharge as a significant contributor of pollutants to the MS4:

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

If these discharges are identified as significant contributors to the MS4, they must be considered an "illicit discharge" and addressed in this IDDE Plan (i.e., control these sources so they are no longer significant contributors of pollutants, and/or eliminate them entirely).

### 1.4 Receiving Waters and Impairments

**Table 1-1** lists the "impaired waters" within the boundaries of Sandwich’s regulated area based on the 2014 Massachusetts Integrated List of Waters produced by MassDEP every two years. Impaired waters are water bodies that do not meet water quality standards for one or more designated use(s) such as recreation or aquatic habitat. Table 1-2 lists IDDE-related requirements for water bodies with total maximum daily loads (TMDLs).

<table>
<thead>
<tr>
<th>Water Body Name</th>
<th>Segment ID</th>
<th>Category</th>
<th>Impairment(s)</th>
<th>Associated Approved TMDL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower Shawme Pond (Shawme Lower Lake)</td>
<td>MA96288</td>
<td>5</td>
<td>Nutrient/Eutrophication Biological Indicators</td>
<td>N.A.</td>
</tr>
<tr>
<td>Mill Creek</td>
<td>MA96-85</td>
<td>4a</td>
<td>Fecal Coliform</td>
<td>43266</td>
</tr>
<tr>
<td>Scorton Creek</td>
<td>MA96-30</td>
<td>4a</td>
<td>Fecal Coliform</td>
<td>36771</td>
</tr>
<tr>
<td>Dock Creek (Old Dock)</td>
<td>MA96-86</td>
<td>4a</td>
<td>Fecal Coliform</td>
<td>42354</td>
</tr>
</tbody>
</table>
Table 1-2. TMDL IDDE-Related Requirements

<table>
<thead>
<tr>
<th>Water Body Name</th>
<th>Associated Approved TMDL</th>
<th>TMDL IDDE-Related Requirement(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dock Creek (Old Dock Creek)</td>
<td>42354</td>
<td>• Recommend additional source tracking</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Recommended review of residential septic/ cesspool sources</td>
</tr>
<tr>
<td>Mill Creek</td>
<td>43266</td>
<td>• None listed</td>
</tr>
<tr>
<td>Springhill Creek</td>
<td>42362</td>
<td>• None listed</td>
</tr>
<tr>
<td>Old Harbor Creek</td>
<td>42367</td>
<td>• None listed</td>
</tr>
<tr>
<td>Springhill Creek</td>
<td>36771</td>
<td>• None listed</td>
</tr>
</tbody>
</table>

1.5 IDDE Program Goals, Framework, and Timeline

The goals of the IDDE program are to find and eliminate illicit discharges to municipal separate storm sewer system and to prevent illicit discharges from happening in the future. The program consists of the following major components as outlined in the MS4 Permit:

- Legal authority and regulatory mechanism to prohibit illicit discharges and enforce this prohibition
- Storm system mapping
- Inventory and ranking of outfalls
- Dry weather outfall screening
- Catchment investigations
- Identification/confirmation of illicit sources
- Illicit discharge removal
The IDDE investigation procedure framework is shown in **Figure 1-1**. The required timeline for implementing the IDDE program is shown in **Figure 1-2**.

**Figure 1-1. IDDE Investigation Procedure Framework**

1. **Inventory and Rank Outfalls**
2. **Re-rank Outfalls**
3. **Map/investigate Catchments**
4. **Follow-up Screening**
5. **Dry Weather Screening**
6. **Conduct Investigations**
7. **Remove Illicits**
8. **System has been fully investigated**

**Figure 1-2. IDDE Program Implementation Timeline**
2 Authority and Statement of IDDE Responsibilities

2.1 Legal Authority

The established legal framework of state statute, bylaws, and regulations provide the Town of Sandwich with 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
- Implement appropriate enforcement procedures and actions.

The Town of Sandwich will review the legal framework on an annual basis for consistency with the 2016 MS4 Permit. A summary of applicable code is provided in Appendix A.

2.2 Statement of Responsibilities

The Engineering Department will lead implementation of the IDDE program. Other agencies or departments that will support these efforts include:

- Department of Public Works
- Building Inspector/Code Enforcement Officer
- Health Department
- Department of Natural Resources
3 Stormwater System Mapping

The Town of Sandwich originally developed mapping of its stormwater system to meet the mapping requirements of the 2003 MS4 Permit. A copy of the existing storm system map is provided in Appendix B. The 2016 MS4 Permit requires a more detailed storm system map than was required by the 2003 MS4 Permit. The revised mapping is intended to facilitate the identification of key infrastructure, factors influencing proper system operation, and the potential for illicit discharges.

The 2016 MS4 Permit requires the storm system map to be updated in two phases as outlined below. The Engineering Department is responsible for updating the stormwater system mapping pursuant to the 2016 MS4 Permit. The Town of Sandwich will report on the progress towards completion of the storm system map in each annual report. Updates to the stormwater mapping will be included in Appendix B and online viewing at:

https://sandwichma.mapgeo.io/datasets/properties?abuttersDistance=120&latlng=41.71518%2C-70.47563&panel=themes&themes=%5B%22drainage-system%22%5D&zoom=12

3.1 Phase I Mapping

Phase I mapping must be completed within two (2) years of the effective date of the permit (by July 1, 2020) and include the following information:

- Outfalls and receiving waters (previously required by the MS4-2003 permit)
- Open channel conveyances (swales, ditches, etc.)
- Interconnections with other MS4s and other storm sewer systems
- Municipally owned stormwater treatment structures
- Water bodies identified by name and indication of all use impairments as identified on the most recent EPA approved Massachusetts Integrated List of Waters report
- Initial catchment delineations. Topographic contours and drainage system information may be used to produce initial catchment delineations.

The Town of Sandwich has completed the following updates to its stormwater mapping to meet the Phase I requirements:

- Outfalls and receiving waters (previously required by the MS4-2003 permit)
- Open channel conveyances (swales, ditches, etc.)
- Municipally owned stormwater treatment structures
- Interconnections with other MS4s and other storm sewer systems

The Town of Sandwich will update its stormwater mapping by July 1, 2020 to include the remaining Phase I information.
• Water bodies identified by name and indication of all use impairments as identified on the most recent EPA approved Massachusetts Integrated List of Waters report
• Initial catchment delineations. Any available system data and topographic information may be used to produce initial catchment delineations

3.2 Phase II Mapping
Phase II mapping must be completed within ten (10) years of the effective date of the permit (by July 1, 2028) and include the following information:

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

The Town of Sandwich has completed the following updates to its stormwater mapping to meet the Phase II requirements:

• Outfall spatial location (latitude and longitude with a minimum accuracy of +/-30 feet)
• Pipes
• Manholes
• Catch basins

The Town of Sandwich will update its stormwater mapping by July 1, 2028 to include the remaining following Phase II information.

• 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)

3.3 Additional Recommended Mapping Elements
Although not a requirement of the 2016 MS4 Permit, the Town of Sandwich intends to include the following recommended elements in its storm system mapping as resources allow:

• Storm sewer material, size (pipe diameter), year of installation
• Sanitary sewer system material, size (pipe diameter), year of installation
• 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
• Seasonal high water table elevations impacting sanitary alignments
• Topography
• Orthophotography
• Alignments, dates and representation of work completed of past illicit discharge investigations
• Locations of suspected confirmed and corrected illicit discharges with dates and flow estimates.
4 Sanitary Sewer Overflows (SSOs)

The 2016 MS4 Permit requires municipalities to prohibit illicit discharges, including sanitary sewer overflows (SSOs), to the separate storm sewer system. SSOs are discharges of untreated sanitary wastewater from a municipal sanitary sewer that can contaminate surface waters, cause serious water quality problems and property damage, and threaten public health. SSOs can be caused by blockages, line breaks, sewer defects that allow stormwater and groundwater to overload the system, power failures, improper sewer design, and vandalism.

As of 2019, municipal sanitary sewer does not exist in The Town of Sandwich. As such, there are no SSOs that have discharged to the MS4 within the five (5) years prior to the effective date of the 2016 MS4 Permit. (Table 4-1).

Should the Town of Sandwich construct a municipal sewer system, SSOs will not be allowed. Should an illegal SSO be detected, the Town of Sandwich will eliminate it as expeditiously as possible and take interim measures to minimize the discharge of pollutants to and from its MS4 until the SSO is eliminated. Upon becoming aware of an SSO to the MS4, the Town of Sandwich will provide oral notice to EPA within 24 hours and written notice to EPA and MassDEP within five (5) days of becoming aware of the SSO occurrence.

The inventory in Table 4-1 will be updated by the Town of Sandwich if a municipal sanitary sewer system is constructed and new SSOs are detected. The SSO inventory will be included in the annual report, including the status of mitigation and corrective measures to address each identified SSO.

SSO Reporting

An overflow or bypass must be reported within 24 hours by phone to MassDEP, EPA, and other relevant parties. Town of Sandwich will follow up from the verbal notification with a written report following MassDEP’s Sanitary Sewer Overflow (SSO)/Bypass notification form within 5 calendar days of the time Town of Sandwich becomes aware of the overflow, bypass, or backup.

DEP 24-hour Emergency Line 1-888-304-1133
DEP Northeast Region (978) 694-3215
205B Lowell Street Wilmington, MA 01887
DEP Central Region (508) 792-7650
8 New Bond Street Worcester, MA 01606
DEP Southeast Region (508) 946-2750
20 Riverside Drive Lakeville, MA 02347
DEP Western Region (413) 784-1100
436 Dwight Street Springfield, MA 01103
EPA New England (617) 918-1510
5 Post Office Square Boston, MA 02109
### Table 4-1. SSO Inventory

Town of Sandwich, Massachusetts  
Revision Date: 6/18/2019

<table>
<thead>
<tr>
<th>SSO Location¹</th>
<th>Discharge Statement²</th>
<th>Date³</th>
<th>Time Start³</th>
<th>Time End³</th>
<th>Estimated Volume⁴</th>
<th>Description⁵</th>
<th>Mitigation Completed⁶</th>
<th>Mitigation Planned⁷</th>
</tr>
</thead>
<tbody>
<tr>
<td>N.A.</td>
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</tbody>
</table>

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  
⁷ Mitigation and corrective measures planned with implementation schedules
5 Assessment and Priority Ranking of Outfalls

The 2016 MS4 Permit requires an assessment and priority ranking of outfalls in terms of their potential to have illicit discharges and SSOs and the related public health significance. The ranking helps determine the priority order for performing IDDE investigations and meeting permit milestones.

5.1 Outfall Catchment Delineations

A catchment is the area that drains to an individual outfall or interconnection. The catchments for each of the MS4 outfalls will be delineated to define contributing areas for investigation of potential sources of illicit discharges. Catchments are typically delineated based on topographic contours and mapped drainage infrastructure, where available. As described in Section 3, initial catchment delineations will be completed as part of the Phase I mapping, and refined catchment delineations will be completed as part of the Phase II mapping to reflect information collected during catchment investigations.

5.2 Outfall and Interconnection Inventory and Initial Ranking

The Engineering Department will complete an initial outfall and interconnection inventory and priority ranking to assess illicit discharge potential based on existing information. The initial inventory and ranking will 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 will be updated annually to include data collected in connection with dry weather screening and other relevant inspections.

Outfalls and interconnections will be classified into one of the following categories:

1. **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. Likely sewer input indicators are any of the following:

---

1. **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. 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.

2. **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.
• Olfactory or visual evidence of sewage,
• Ammonia ≥ 0.5 mg/L, surfactants ≥ 0.25 mg/L, and bacteria levels greater than the water quality criteria applicable to the receiving water, or
• Ammonia ≥ 0.5 mg/L, surfactants ≥ 0.25 mg/L, and detectable levels of chlorine.

Dry weather screening and sampling, as described in Section 6 of this IDDE Plan and Part 2.3.4.7.b of the MS4 Permit, is not required for Problem Outfalls.

2. **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.

3. **Low Priority Outfalls**: Outfalls/interconnections determined by the permittee as low priority based on the characteristics listed below or other available information.

4. **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.

Outfalls will be ranked into the above priority categories (except for excluded outfalls, which may be excluded from the IDDE program) based on the following characteristics of the defined initial catchment areas, where information is available. The characteristics below present provide an overview; details are provided in Table 5-1. Additional relevant characteristics, including location-specific characteristics, may be considered but must be documented in this IDDE Plan.

- **Previous screening results** – previous screening/sampling results indicate likely sewer input (see criteria above for Problem Outfalls).
- **Past discharge complaints and reports.**
- **Discharging to Area of Concern to Public Health** – outfalls or interconnections that discharge to public beaches, recreational areas, drinking water supplies and/or shellfish beds
- **Impaired Waterbodies** – discharges to waters impaired for bacteria according to the most recent 303(d) list.
- **TMDL Watershed** – discharges to waters with an approved TMDL where illicit discharges may contribute to the pollutant of concern.
- **Density of generating sites within Catchment** – Generating sites are those places, including institutional, municipal, commercial, or industrial sites, with a potential to generate pollutants that could contribute to illicit discharges, based on land use codes or local knowledge.

- **Culverted streams** – Any river or stream that is culverted for distances greater than a simple roadway crossing may have a high illicit discharge potential.

- **Additional Characteristics** – as defined by the permittee and may include age of infrastructure, historic combined sewer systems, age of surrounding septic systems, recent septic to sewer conversion areas

Table 5-1 provides a sample format for an outfall inventory and priority ranking matrix.
## Table 5-1. Outfall Inventory and Priority Ranking Matrix

**Revision Date:** 6/14/2019

<table>
<thead>
<tr>
<th>Outfall ID</th>
<th>Receiving Water</th>
<th>Previous Screening Results</th>
<th>Reports or Complaints of Potential Illicit Discharges?</th>
<th>Discharging to Area of Concern to Public Health?</th>
<th>Receiving Water Quality</th>
<th>TMDL Watershed</th>
<th>Density of Generating Sites within Catchment</th>
<th>Culverted Streams?</th>
<th>Additional Characteristics</th>
<th>Score</th>
<th>Priority Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Information Source</td>
<td>Outfall inspections and sample results</td>
<td>Town/Agency Records</td>
<td>a</td>
<td>b</td>
<td>c</td>
<td>d</td>
<td>Impaired Waters List</td>
<td>MassDEP</td>
<td>Land Use/GIS Maps, GIS and Storm System Maps</td>
<td>Other</td>
</tr>
<tr>
<td>OU05-500-040</td>
<td>WEEKS POND</td>
<td>Yes = 40 (Problem Outfall) No = 0</td>
<td>Yes = 40 (Problem Outfall) No = 0</td>
<td>Yes = 6 No = 0</td>
<td>Bacteria = 6 Other = 2 None = 0</td>
<td>Yes = 2 No = 0</td>
<td>High = 3 Medium = 2 Low = 0</td>
<td>Yes = 3 No = 0</td>
<td>TBD</td>
<td>Problem = ≥40 High Priority = ≥6 Low Priority = &lt;6</td>
<td></td>
</tr>
<tr>
<td>PW06-500-048</td>
<td>OVERLAND TO SNAKE POND</td>
<td>Yes = 40 (Problem Outfall) No = 0</td>
<td>Yes = 40 (Problem Outfall) No = 0</td>
<td>Yes = 6 No = 0</td>
<td>Bacteria = 6 Other = 2 None = 0</td>
<td>Yes = 2 No = 0</td>
<td>High = 3 Medium = 2 Low = 0</td>
<td>Yes = 3 No = 0</td>
<td>TBD</td>
<td>Problem = ≥40 High Priority = ≥6 Low Priority = &lt;6</td>
<td></td>
</tr>
<tr>
<td>PW06-500-049</td>
<td>WEEKS POND</td>
<td>Yes = 40 (Problem Outfall) No = 0</td>
<td>Yes = 40 (Problem Outfall) No = 0</td>
<td>Yes = 6 No = 0</td>
<td>Bacteria = 6 Other = 2 None = 0</td>
<td>Yes = 2 No = 0</td>
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### Scoring Criteria:

1. Previous screening results indicate likely sewer input if any of the following are true:
   - Any river or stream that is culverted for distance greater than a simple roadway crossing (where information exists).
   - Density of generating sites based on MassGIS Land Use layer: https://docs.digital.mass.gov/dataset/massgis-data-land-use-2005

2. Previous reports of dumping, failing septic systems, odors, or other indications of potential illicit discharges.


4. Scoring Criteria:

   | PW36-500-996 | WETLAND TO DOCK CREEK | 60 | 60 | 6 | High Priority |

5. Discharges to waters with an approved TMDL where illicit discharges have the potential to contain the pollutant identified as the cause of the impairment. Listing of approved TMDLs can be found here: https://www.mass.gov/lists/total-maximum-daily-loads-by-watershed


7. Any river or stream that is culverted for distance greater than a simple roadway crossing (where information exists).

   - Medium Density: 50% or more of catchment area is made of up of Land Use Codes = 5, Mining; 7, Participation Recreation; 8, Spectator Recreation; 9, Water-Based Recreation; 12, Medium Density Residential; 13, Low Density Residential; 26, Golf Course; 29, Marina

   - Low Density: 50% or more of catchment area is made of up of Land Use Codes = 1, Cropland; 2, Pasture; 3, Forest; 4, Non-Forested Wetland; 6, Open Land; 14, Saltwater Wetland; 20, Water; 23, Cranberry Bog; 24, Powerline/Utility; 25, Saltwater Sandy Beach; 34, Cemetery; 35, Orchard, 37, Forested Wetland; 38, Very Low Density Residential; 40, Brushland/Succesional

8. Additional Characteristics to be defined by the permittee. May be removed if data on additional characteristics are not available. Examples of additional characteristics include:
- Age of infrastructure
- Historic combined sewer systems
- Age of surrounding septic systems
- Recent septic to sewer conversion areas
6 Illicit Discharge Detection and Elimination Program

This section outlines the IDDE program to be implemented by Town of Sandwich to comply with the 2016 MS4 Permit. This section reflects the requirements and timelines outlined in Sections 2.3.4.7 and 2.3.4.8 of the Permit. Field procedures are outlined in Section 7 of this document, including Field Work Safety Procedures in Section 7.4.

6.1 Dry Weather Outfall Screening and Sampling

Dry weather flow is a common indicator of potential illicit connections. The MS4 Permit requires all outfalls/interconnections (excluding Problem and excluded Outfalls) to be inspected for the presence of dry weather flow by three (3) years of the effective date of the permit (July 1, 2021). The Engineering Department is responsible for conducting dry weather outfall screening, starting with High Priority outfalls, followed by Low Priority outfalls, based on the initial priority rankings described in the previous section.

In dry weather circumstances, the expected outcome is the storm drain systems will be dry (no flow). All No Flow observations must be documented. If water is flowing within a storm drain system during dry weather, the site must be monitored as indicated in the instructions outlined in Section 7.1. All data collected as part of the dry weather outfall screenings will be recorded and reported in each annual report.

When flow is observed, samples shall be collected and analyzed for the following parameters:

- 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 (as indicated in the most recent 303(d) list)

Section 7 provides detailed procedures for collecting and analyzing samples for the parameters listed above, including equipment to be used for each (provided in Table 7-1).

Previous outfall screening/sampling conducted under the 2003 MS4 Permit may be used to satisfy the dry weather outfall/screening requirements of the 2016 MS4 Permit only if the previous screening and sampling was substantially equivalent to that required by the 2016 MS4 Permit, including the list of analytes outlined in Section 2.3.4.7.b.iii.4 of the 2016 permit. The following sections include general information on dry weather screening and sampling, with more specific field work information presented in Section 7.
Dry Weather Conditions
Dry weather outfall screening and sampling may occur when no more than 0.1 inches of rainfall has occurred in the previous 24-hour period and no significant snow melt is occurring. For purposes of determining dry weather conditions, program staff will use precipitation data from the nearest available NOAA weather station reporting hourly rainfall depths. It is anticipated that the Hyannis station will be primary and Plymouth secondary.

Note: Because rainfall events can be localized, Field Team Leaders can also determine a monitoring event provided there is adequate notification to the ## STORMWATER PROGRAM SUPERVISOR and the parameters regarding weather and tides are met.

Interpreting Outfall Sampling Results
Outfall analytical data from dry weather sampling can be used to help identify the major type or source of discharge. Table 6-1 shows values identified by the U.S. EPA and the Center for Watershed Protection as typical screening values for select parameters. These represent the typical concentration (or value) of each parameter expected to be found in stormwater. Screening values that exceed these benchmarks may be indicative of pollution and/or illicit discharges.

Table 6-1. Benchmark Field Measurements for Select Parameters

<table>
<thead>
<tr>
<th>Analyte or Parameter</th>
<th>Benchmark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ammonia</td>
<td>&gt;0.5 mg/L</td>
</tr>
<tr>
<td>Conductivity</td>
<td>&gt;2,000 μS/cm</td>
</tr>
<tr>
<td>Surfactants</td>
<td>&gt;0.25 mg/L</td>
</tr>
<tr>
<td>Chlorine</td>
<td>&gt;0.02 mg/L (detectable levels per the 2016 MS4 Permit)</td>
</tr>
<tr>
<td>Indicator Bacteria:&lt;br&gt; E.coli</td>
<td><em>E.coli:</em> the geometric mean of the five most recent samples taken during the same bathing season shall not exceed 126 colonies per 100 ml and no single sample taken during the bathing season shall exceed 235 colonies per 100 ml</td>
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<tr>
<td></td>
<td><em>Enterococcus:</em> the geometric mean of the five most recent samples taken during the same bathing season shall not exceed 33 colonies per 100 ml and no single sample taken during the bathing season shall exceed 61 colonies per 100 ml</td>
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</table>

Follow-up Ranking of Outfalls and Interconnections
The Town of Sandwich will update and re-prioritize the initial outfall and interconnection rankings based on information gathered during dry weather screening. The rankings will be updated periodically as dry weather screening information becomes available but will be completed within three (3) years of the effective date of the permit (July 1, 2021).

Outfalls/interconnections where relevant information was found indicating sewer input to the MS4 or sampling results indicating sewer input are highly likely to contain illicit discharges from sanitary sources. Such outfalls/interconnections will be ranked at the top of the High Priority Outfalls category for catchment investigation. Other outfalls and interconnections may be re-ranked based on any new information from the dry weather screening.

6.2 Catchment Investigations
The MS4 permit requires catchment investigations for each outfall (except excluded ones). Any outfall with the potential for illicit discharges is defined as a problem outfall. Catchment investigations for problem outfalls are required to be completed within seven years of the permit effective date (June 30, 2025). All other outfalls need to have catchment investigations completed within 10 years of the permit effective date (June 30, 2028).

Catchment investigation techniques include but are not limited to review of maps, historic plans, and records; manhole observation; dry and wet weather sampling; video inspection; smoke testing; and dye testing. This section outlines a systematic procedure to investigate outfall catchments to trace the source of potential illicit discharges. All data collected as part of the catchment investigations will be recorded and reported in each annual report.

System Vulnerability Factors
The Engineering Department will review relevant mapping and historic plans and records to identify areas within the catchment with higher potential for illicit connections. The following information will be reviewed:

- Plans related to the construction of the drainage network
- Plans related to the construction of the sewer drainage network
- Prior work on storm drains or sewer lines
- Board of Health or other municipal data on septic systems
- Complaint records related to SSOs
- Septic system breakouts

Based on the review of this information, the presence of any of the following System Vulnerability Factors (SVFs) will be identified for each catchment:

- 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
• 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).

An SVF inventory will be documented for each catchment (see Table 6-2), retained as part of this IDDE Plan, and included in the annual report.
Table 6-2. Outfall Catchment System Vulnerability Factor (SVF) Inventory

Town of Sandwich, Massachusetts
Revision Date: #DATE OF LAST UPDATE

<table>
<thead>
<tr>
<th>Outfall ID</th>
<th>Receiving Water</th>
<th>1 History of SSOs</th>
<th>2 Common or Twin Invert Manholes</th>
<th>3 Common Trench Construction</th>
<th>4 Storm/Sanitary Crossings (Sanitary Above)</th>
<th>5 Sanitary Lines with Underdrains</th>
<th>6 Inadequate Sanitary Level of Service</th>
<th>7 Areas Formerly Served by Combined Sewers</th>
<th>8 Sanitary Infrastructure Defects</th>
<th>9 SSO Potential in Event of System Failures</th>
<th>10 Sanitary and Storm Drain Infrastructure &gt;40 years Old</th>
<th>11 Septic with Poor Soils or Water Table Separation</th>
<th>12 History of BOH Actions Addressing Septic Failure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample 1</td>
<td>XYZ River</td>
<td>Yes/No</td>
<td>Yes/No</td>
<td>Yes/No</td>
<td>Yes/No</td>
<td>Yes/No</td>
<td>Yes/No</td>
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</tbody>
</table>

Presence/Absence Evaluation Criteria:
1. History of SSOs, including, but not limited to, those resulting from wet weather, high water table, or fat/oil/grease blockages
2. Common or twin-invert manholes serving storm and sanitary sewer alignments
3. Common trench construction serving both storm and sanitary sewer alignments
4. Crossings of storm and sanitary sewer alignments where the sanitary system is shallower than the storm drain system
5. Sanitary sewer alignments known or suspected to have been constructed with an underdrain system
6. Inadequate sanitary sewer level of service (LOS) resulting in regular surcharging, customer back-ups, or frequent customer complaints
7. Areas formerly served by combined sewer systems
8. 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
9. Sewer pump/lift stations, siphons, or known sanitary sewer restrictions where power/equipment failures or blockages could readily result in SSOs
10. Any sanitary sewer and storm drain infrastructure greater than 40 years old
11. 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)
12. 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)
Dry Weather Manhole Inspections
The Town of Sandwich will implement a dry weather storm drain network investigation that involves systematically and progressively observing, sampling and evaluating key junction manholes in the MS4 to determine the approximate location of suspected illicit discharges or SSOs.

The Engineering Department will be responsible for implementing the dry weather manhole inspection program and making updates as necessary. Infrastructure information will be incorporated into the storm system map, and catchment delineations will be refined based on the field investigation, where necessary. The SVF inventory will also be updated based on information obtained during the field investigations, where necessary.

Field manhole inspection procedures are outlined in Section 7.2 of this plan.

6.3 Wet Weather Outfall Sampling
Where a minimum of one (1) System Vulnerability Factor (SVF) is identified based on previous information or the catchment investigation, a wet weather investigation must also be conducted at the associated outfall. Wet weather sampling at required outfalls must be completed within 10 years of the permit effective date (June 30, 2028). The Engineering Department will be responsible for implementing the wet weather outfall sampling program and making updates as necessary.

Outfalls will be inspected and sampled 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.

At least one wet weather sample will be collected at the outfall for the same parameters required during dry weather screening (See Section 7).

Wet Weather Conditions
Wet weather sampling will occur during or after a storm event of sufficient depth or intensity to produce a stormwater discharge at the outfall. There is no specific rainfall amount that will trigger sampling, although minimum storm event intensities that are likely to trigger sanitary sewer interconnections are preferred. To the extent feasible, sampling should occur during the spring (March through June) when groundwater levels are relatively high. Additional information on Cape Cod groundwater levels can be obtained from the USGS (https://groundwaterwatch.usgs.gov/countymap.asp?sa=MA&cc=001) and Cape Cod Commission (www.capecodcommission.org).

Follow up Wet Weather Investigations
If wet weather outfall sampling indicates a potential illicit discharge, then additional wet weather source sampling will be performed, as warranted, or source isolation and confirmation procedures will be followed as described in Section 6.4.
If wet weather outfall sampling does not identify evidence of illicit discharges, and no evidence of an illicit discharge is found during dry weather manhole inspections, catchment investigations will be considered complete.

### 6.4 Source Isolation and Confirmation

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

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

Public notification is an important aspect of a detailed source investigation program. Prior to smoke testing, dye testing, or TV inspections, the Engineering Department will notify property owners in the affected area. Smoke testing notification will include HANGING NOTIFICATIONS for single family homes, businesses and building lobbies for multi-family dwellings.

#### Sandbagging

This technique can be particularly useful when attempting to isolate intermittent illicit discharges or those with very little perceptible flow. The technique involves placing sandbags or similar barriers (e.g., caulking, weirs/plates, or other temporary barriers) within outlets to manholes to form a temporary dam that collects any intermittent flows that may occur. Sandbags are typically left in place for 48 hours and should only be installed when dry weather is forecast. If flow has collected behind the sandbags/barriers after 48 hours, it can be assessed using visual observations or by sampling. If no flow collects behind the sandbag, the upstream pipe network can be ruled out as a source of the intermittent discharge. Finding appropriate durations of dry weather and the need for multiple trips to each manhole makes this method both time-consuming and somewhat limiting.

#### Smoke Testing

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

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

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

Dye Testing

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

A team of two or more people is needed to perform dye testing (ideally, all with two-way radios). One person is inside the building, while the others are stationed at the appropriate storm sewer and sanitary sewer manholes (which should be opened) and/or outfalls. The person inside the building adds dye into a plumbing fixture (i.e., toilet or sink) and runs a sufficient amount of water to move the dye through the plumbing system. The person inside the building then radios to the outside crew that the dye has been dropped, and the outside crew watches for the dye in the storm sewer and sanitary sewer, recording the presence or absence of the dye. The test can be relatively quick (about 30 minutes per test), effective (results are usually definitive), and inexpensive. Dye testing is best used when the likely source of an illicit discharge has been narrowed down to a few specific houses or businesses.

CCTV/Video Inspection

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

Optical Brightener Monitoring

Optical brighteners are fluorescent dyes that are used in detergents and paper products to enhance their appearance. The presence of optical brighteners in surface waters or dry weather discharges suggests there is a possible illicit discharge or insufficient removal through adsorption in nearby septic systems or wastewater treatment. Optical brightener monitoring can be done in two ways. The most common, and least expensive, methodology involves placing a cotton pad in a wire cage and securing it in a pipe, manhole, catch basin, or inlet to capture intermittent dry weather flows. The pad is retrieved at a later date and placed under UV light to determine the presence/absence of brighteners during the monitoring period. A second methodology uses handheld fluorometers to detect optical brighteners in water sample collected from outfalls or ambient surface waters. Use of a fluorometer, while more quantitative, is typically more costly and is not as effective at isolating intermittent discharges as other source isolation techniques.
IDDE Canines
Dogs specifically trained to smell human related sewage are becoming a cost-effective way to isolate and identify sources of illicit discharges. While not widespread at the moment, the use of IDDE canines is growing as is their accuracy. The use of IDDE canines is not recommended as a standalone practice for source identification; rather it is recommended as a tool to supplement other conventional methods, such as dye testing, in order to fully verify sources of illicit discharges.

6.5 Illicit Discharge Removal
When the specific source of an illicit discharge is identified, the Town of Sandwich will exercise its authority as necessary to require its removal. The annual report will include the status of IDDE investigation and removal activities including the following information for each confirmed source:

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

Confirmatory Outfall Screening
Within one (1) year of removal of all identified illicit discharges within a catchment area, confirmatory outfall or interconnection screening will be conducted. The confirmatory screening will be conducted in dry weather unless System Vulnerability Factors have been identified, in which case both dry weather and wet weather confirmatory screening will be conducted. If confirmatory screening indicates evidence of additional illicit discharges, the catchment will be scheduled for additional investigation.

6.6 Ongoing Screening
Upon completion of all catchment investigations and illicit discharge removal and confirmation (if necessary), each outfall or interconnection will be re-prioritized for screening and scheduled for ongoing screening once every five (5) years. Ongoing screening will consist of dry weather screening and sampling consistent with the procedures described in Section 7 of this plan. Ongoing wet weather screening and sampling will also be conducted at outfalls where wet weather screening was required due to System Vulnerability Factors (Section 6.2) and will be conducted in accordance with the procedures described in Section 7. All sampling results will be reported in the annual report.
7 Field Screening and Sampling Procedures

This section outlines specific field procedures to be followed during IDDE sampling, screening, and investigation work required by the MS4 Permit, as described in the previous sections. Closely following these procedures is important for the collection of consistent and high-quality data. Additionally, this section outlines necessary equipment and safety considerations for field work.

7.1 Dry Weather Screening/Sampling Procedures

Pre-Sampling Procedure
1. **Ice:** Prepare a freezer “ice pack,” and store it in your freezer.
2. **Paperwork/Data Entry:** Fill out as much of the data sheet as possible prior to leaving vehicle at each station, including date and location. A sample inspection form is provided in Appendix C.
3. **Equipment Check:** Check through your storage bin/equipment to be sure that you have everything and that it is all in good working order (e.g. test your flashlight). See Table 7.4 for a checklist of equipment.
4. **Equipment Calibration:** Calibrate Conductivity/Salinity/Temperature/pH meter(s) every three weeks (see below). If meters have not been used in a while, fill meter cup with de-ionized water, put meter electrodes in cup, allow to soak for 2 minutes. Calibration instructions are included in Appendix D.

Sampling Procedure
The dry weather outfall inspection and sampling procedure consists of the following general steps. A sample inspection form is provided in Appendix C.
1. **Identify outfall(s) to be screened/sampled based on initial outfall inventory and priority ranking.**
2. **Acquire the necessary staff, mapping, and field equipment (see Table 7.4 for list of potential field equipment).**
3. **Using paper maps and/or tablet, carefully determine the location of the Facility ID for the discharge pipe to be sampled. Take notes on condition and maintenance requirements of discharge location, and any access or parking requirements.** Take notes regarding observations (trash, waste products, unusual color or sheen) or smells. Observe discharge and tide, make estimate of tidal condition (high, mid, low). In the event that an outfall is submerged, either partially or completely, or inaccessible, field staff will proceed to the first accessible upstream manhole (MH) for the observation and sampling and report the location with the screening results. If the storm drain system does not have MHs, go to the first upstream catch basin (CB) or structure. Use Outfall Notes as a guide for deciding the correct MH or CB. If a monitoring site is in inaccessible, the Field Team should make a note as to the reason. Examples: embankment too steep, fenced private property, excessive brush, unable to remove cover or grate, sediment in sump. Obstructions that can be removed, but require additional tools or support (brush, covers, grates, sediment) should be removed by the DPW before the next monitoring event. If discharge pipe is partially blocked with sediment or land...
that can be easily removed, remove blockage and let stormwater flow out for a few minutes before taking samples.

4. Field staff will continue to the next upstream structure until there is no longer an influence from the receiving water on the visual inspection or sampling.

5. Begin filling out Water Quality Sampling Sheet, Confirm Facility ID on Sampling Sheet with Location Map. Fill out as much of the information as possible before beginning sampling. Draw a Sketch Location. Each Sampling Sheet must have a Station Sketch to determine the location of the actual monitoring site (CBs and MHs can have more than one pipe associated with them).

6. Conduct the outfall inspection during dry weather. If sampling at a MH or CB:
   a. Mark and photograph the outfall
   b. Public Works staff should remove cover or grate and place off to the side (see Section 7.4: Field Work Safety Procedures). Using flashlight, look inside MH (but do not place head inside MH), make notes regarding condition of MH (presence of sump, presence of sediment, functioning, cracks, etc.) in comment section. If available use carpenter’s ruler or measuring device to approximate the amount of sediment in sump, make notation in comment section and then rinse ruler off.
   c. Record the inspection information and outfall characteristics (using paper forms or digital form using a tablet or similar device) (see form in Appendix C). Draw sketch of inlet pipes entering MH or CB both from other MHs or CBs and location of discharge pipe. Label pipes on sketch in accordance with Instructions for Sampling Form page 17). Note if the pipes are free-flowing, partially-submerged or submerged. If Free-flowing, estimate how much of the pipe is flowing (<1/10, 1/4, 1/2, 3/4, or full).
   d. Look for and record visual/olfactory evidence of pollutants in flowing outfalls including odor, color, turbidity, and floatable matter (suds, bubbles, excrement, toilet paper or sanitary products). Also observe outfalls for deposits and stains, vegetation, and damage to outfall structures.
   e. If no flow is observed, but evidence of illicit flow exists (illicit discharges are often intermittent or transitory), revisit the outfall during dry weather within one week of the initial observation, if practicable, to perform a second dry weather screening and sample any observed flow. Other techniques can be used to detect intermittent or transitory flows including conducting inspections during evenings or weekends and using optical brighteners.

If flow is observed, sample and test the flow following the procedures described in the following steps:
   i. Fill out all sample information on sample bottles, container labels, and field sheets (see Appendix C for Sample Labels and Field Sheets). Make sure Sample ID on containers is the same as the Sample ID on Sampling Sheet. Sample information should also clearly indicate which structure the sample is being collected at.
   ii. Place labels onto the 100ml (bacteria) and 500ml containers and label tape on the 125ml contain. No labeling or sample marking shall be applied to lids, only to the body of the sampling container.
   iii. Put on protective gloves (nitrile/latex/other) before sampling.
iv. Sample Collection: Start each sample collection with a sterile 100ml bottle (for bacteria). Make sure not to touch bottle opening or inside cap lid during sample collection. If cap needs to be on the ground during sample, make sure it is placed cap up and preferably on a solid surface (rock, sand, road surface, etc.) and out of rain.

v. Collect sample with dipper or directly in sample containers. If possible, collect water from the flow directly in the sample bottle. Be careful not to disturb sediments. If easily accessible, collect sample from the discharge pipe (or roadcut or flowing inlet pipes in CB or MH) directly into the 100ml bottle. If submerged or partially submerged pipes appear to be flowing, take a sample as close to the pipe as possible.

vi. If flowing inlet pipes are not easily accessible (MH or CB only), use sample pole (dipper or other device) and 100ml bottle to collect samples. Triple rinse the device with distilled water and then in water to be sampled (not for bacteria sampling). Place bottle into holder attached to bottom of pole and uncap. Lower pole into MH or CB, trying not to touch sides of MH or CB. If contact with MH or CB wall cannot be avoided, make a note in the comment section.

vii. To collect from a free-flowing pipe, tilt the bottle towards the water while avoiding collecting any “sump water” (NOTE: if sump water cannot be avoided, make a note in the comment section). To collect from a submerged or partially submerges pipe, tilt the bottle and collect sample as close to the pipe as possible. Even though the assumption is the sample will contain sump water, make a note in the comment section that the sample is a mixture of pipe and sump water.

viii. Once the 100ml bottle is filled bring the bottle to the surface, replace lid and put in cooler. Then fill the 125ml (clean) container, use the water in this bottle for on-site field testing. Tests should be done in this order Conductivity/Temperature/Salinity/pH, and then Ammonia and Chlorine. Once Field Tests are completed cap bottle and place in cooler for offsite testing. Collect any other laboratory analysis samples in a clean 500 ml bottle, cap and place in cooler. Use test strips, test kits, and field meters (rinse similar to dipper) for most parameters (see Table 7-1 and Table 7-2).

ix. If more than 1 free-flowing inlet pipe in CB or MH, repeat steps above for each flowing inlet pipe. Use a new sterile container for bacteria and a clean 125ml and 500ml bottle for each pipe. Collect samples from all free-flowing inlet pipes (stations on Sampling Sheet) found in MHS or CBs. Fill all the bottles and containers and complete all the field tests (conductivity/temperature/salinity, pH, and ammonia) for each station within the MH or CB before starting the next station in the same MH or CB.

x. Place laboratory samples on ice for analysis of bacteria and pollutants of concern.

xi. Fill out chain-of-custody form (Appendix C) for laboratory samples, record Time Depart on Sampling Sheet.

xii. Deliver samples to Barnstable County Water Quality Laboratory, 3195 Main Street, Barnstable, MA 02630.
xiii. Dispose of used test strips and test kit ampules properly.
xiv. Decontaminate all testing personnel and equipment.

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

General Procedures

Recording Data and Chain of Custody: All data and field observations are recorded on water quality sampling sheet or tablet. The sampling sheet will be printed on waterproof paper making it easier to record data during rainy weather. Once monitoring is completed, all sampling sheets will be signed by the Field Team Leader (Chain of Custody) and given to the Stormwater Program Supervisor. The Stormwater Program Supervisor will also sign the sampling sheets when samples are taken from the Field Team Leaders. If feasible, copies will be made of the sampling sheets before the samples are transported to the Barnstable County Laboratory. Once the samples are delivered to the lab, the sampling sheet or a Chain of Custody Form supplied by the laboratory will be signed by lab personnel with a copy remaining with the lab. The original sampling sheet and the Chain of Custody Form will be returned to the Town. The conducted offsite testing will be recorded on the original sampling sheet, which will then be filed at the Town office as part of the permanent record for the individual monitored site.

Bottles and Laboratory Containers: Organize sample bottles and laboratory containers. For each sampling site, there should be a minimum of two containers or bottles, a 100 ml container for bacteria and a 125 ml container for in-the-field and office testing. Additional 500 ml bottles may also be utilized at the discretion of the sampler (discharges flowing into impaired waters requiring pollutant of concern samples). Attach a sampling label to all bottles and containers requiring laboratory analysis (100 and 500ml). To the "in-the-field/office" containers (125ml), affix a piece of labeling tape to the container and label with the Sample ID. A sample container label is included in Appendix C.

Use a sharpie permanent marker to label all appropriate information Identify the correct laboratory analysis for the individual containers/bottles, the 100ml is for bacteria, the 500 ml is for all others. Be sure that the location from which the sample is being collected matches the identification on the bottle (i.e. don’t grab the wrong bottle when you are out sampling).

Each sampled discharge pipe, inlet pipe or sump sample will involve at least 2 bottles, one sterile 100 ml bottle for bacteria (lab analysis) and one 125 ml container (for on-site and off-site testing). The Field Teams must use a sterile 100 ml bottle at each discharge pipe, inlet pipe and or sump. These bottles should not be reused. At the discretion of the sampler, additional samples for laboratory analysis may also be collected (500 ml bottles). Duplicate samples are recommended for each site.

All meters (Conductivity, pH) must be rinsed three times with de-ionized water, wiped dry and capped between uses.

All samplers must wear clean nitrile gloves prior to collecting samples. The gloves must be changed for each new sample taken. Place used gloves in trash bag.
Sample Collection and Analysis

If flow is present during a dry weather outfall inspection, a sample will be collected and analyzed for the required permit parameters listed in Table 7-1.¹

Field test kits or field instrumentation are permitted for all parameters except indicator bacteria and any pollutants of concern. Field kits need to have appropriate detection limits and ranges. Table 7-1 lists various field test kits and field instruments that can be used for outfall sampling associated with the 2016 MS4 Permit parameters, with the exceptions of indicator bacteria and any pollutants of concern. Analytic procedures and user’s manuals for field test kits and field instrumentation are provided in Appendix D.

Table 7-1. Sampling Parameters and Analysis Methods

<table>
<thead>
<tr>
<th>Analyte or Parameter</th>
<th>Instrumentation (Portable Meter)</th>
<th>Field Test Kit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ammonia</td>
<td>CHEMetrics™ V-2000 Colorimeter</td>
<td>CHEMetrics™ K-1410</td>
</tr>
<tr>
<td></td>
<td>Hach™ DR/890 Colorimeter</td>
<td>CHEMetrics™ K-1510 (series)</td>
</tr>
<tr>
<td></td>
<td>Hach™ Pocket Colorimeter™ II</td>
<td>Hach™ NI-SA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hach™ Ammonia Test Strips</td>
</tr>
<tr>
<td>Surfactants (Detergents)</td>
<td>CHEMetrics™ I-2017</td>
<td>CHEMetrics™ K-9400 and K-9404</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hach™ DE-2</td>
</tr>
<tr>
<td>Chlorine</td>
<td>CHEMetrics™ V-2000, K-2513</td>
<td>Hach™ Ammonia Test Strips</td>
</tr>
<tr>
<td></td>
<td>Hach™ Pocket Colorimeter™ II</td>
<td>CHEMetrics™ I-2001</td>
</tr>
<tr>
<td>Conductivity</td>
<td>CHEMetrics™ I-1200</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td>YSI Pro30</td>
<td></td>
</tr>
<tr>
<td></td>
<td>YSI EC300A</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Oakton 450</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pocket Pro™+ Multi 2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Exstick II</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Oakton PCTSTestr 50</td>
<td></td>
</tr>
<tr>
<td>Temperature</td>
<td>YSI Pro30</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td>YSI EC300A</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Oakton 450</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pocket Pro™+ Multi 2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Exstick II</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Oakton PCTSTestr 50</td>
<td></td>
</tr>
<tr>
<td>Salinity</td>
<td>YSI Pro30</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td>YSI EC300A</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Oakton 450</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pocket Pro™+ Multi 2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Exstick II</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Oakton PCTSTestr 50</td>
<td></td>
</tr>
</tbody>
</table>

¹ Other potentially useful parameters, although not required by the MS4 Permit, include fluoride (indicator of potable water sources in areas where water supplies are fluoridated), potassium (high levels may indicate the presence of sanitary wastewater), and optical brighteners (indicative of laundry detergents).
<table>
<thead>
<tr>
<th>Analyte or Parameter</th>
<th>Instrumentation (Portable Meter)</th>
<th>Field Test Kit</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>YSI Pro30</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td>YSI EC300A</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td>Oakton 450</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td>Pocket Pro™+ Multi 2</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td>Hach™ Pocket Pro pH Tester</td>
<td>NA</td>
</tr>
<tr>
<td>Indicator Bacteria:</td>
<td>EPA certified laboratory procedure (40 CFR § 136)</td>
<td>NA</td>
</tr>
<tr>
<td>E. coli (freshwater)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>or Enterococcus (saline water)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pollutants of Concern</td>
<td>EPA certified laboratory procedure (40 CFR § 136)</td>
<td>NA</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1 Where the discharge is directly into a water quality limited water or a water subject to an approved TMDL, the sample must be analyzed for the pollutant(s) of concern identified as the cause of the water quality impairment.

Testing for indicator bacteria and any pollutants of concern must be conducted using analytical methods and procedures found in 40 CFR § 136.3 Samples for laboratory analysis must also be stored and preserved in accordance with procedures found in 40 CFR § 136. Table 7-2 lists analytical methods, detection limits, hold times, and preservatives for laboratory analysis of dry weather sampling parameters.

Table 7-2. Required Analytical Methods, Detection Limits, Hold Times, and Preservatives

<table>
<thead>
<tr>
<th>Analyte or Parameter</th>
<th>Analytical Method</th>
<th>Detection Limit</th>
<th>Max. Hold Time</th>
<th>Preservative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ammonia</td>
<td>EPA: 350.2, SM: 4500- NH3C</td>
<td>0.05 mg/L</td>
<td>28 days</td>
<td>Cool ≤6°C, H₂SO₄ to pH &lt;2, No preservative required if analyzed immediately</td>
</tr>
<tr>
<td>Surfactants</td>
<td>SM: 5540-C</td>
<td>0.01 mg/L</td>
<td>48 hours</td>
<td>Cool ≤6°C</td>
</tr>
<tr>
<td>Chlorine</td>
<td>SM: 4500-Cl G</td>
<td>0.02 mg/L</td>
<td>Analyze within 15 minutes</td>
<td>None Required</td>
</tr>
<tr>
<td>Temperature</td>
<td>SM: 2550B</td>
<td>NA</td>
<td>Immediate</td>
<td>None Required</td>
</tr>
<tr>
<td>Specific Conductance</td>
<td>EPA: 120.1, SM: 2510B</td>
<td>0.2 µs/cm</td>
<td>28 days</td>
<td>Cool ≤6°C</td>
</tr>
<tr>
<td>Salinity</td>
<td>SM: 2520</td>
<td>-</td>
<td>28 days</td>
<td>Cool ≤6°C</td>
</tr>
<tr>
<td>Indicator Bacteria:</td>
<td>E.coli</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E. coli</td>
<td>EPA: 1603</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SM: 9221B, 9221F, 9223 B</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other: Colilert®,</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E.coli</td>
<td>EPA: 1 cfu/100mL</td>
<td>8 hours</td>
<td>Cool ≤10°C, 0.0008% Na₂S₂O₃</td>
<td></td>
</tr>
<tr>
<td>SM: 2 MPN/100mL</td>
<td>Other: 1 MPN/100mL</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3 40 CFR § 136: [http://www.ecfr.gov/cgi-bin/text-idx?SID=b3b41fdea0b7b0b8cd6c4304d86271b7&m=pt40.25.136&rgn=div5](http://www.ecfr.gov/cgi-bin/text-idx?SID=b3b41fdea0b7b0b8cd6c4304d86271b7&m=pt40.25.136&rgn=div5)
### Analyte or Parameter

<table>
<thead>
<tr>
<th>Analyte or Parameter</th>
<th>Analytical Method</th>
<th>Detection Limit</th>
<th>Max. Hold Time</th>
<th>Preservative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colilert-18®&lt;sup&gt;®&lt;/sup&gt;</td>
<td>Enterococcus&lt;br&gt;EPA: 1600&lt;br&gt;SM: 9230 C&lt;br&gt;Other: Enterolert&lt;sup&gt;®&lt;/sup&gt;</td>
<td>Enterococcus&lt;br&gt;EPA: 1 cfu/100mL&lt;br&gt;SM: 1 MPN/100mL&lt;br&gt;Other: 1 MPN/100mL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Phosphorus</td>
<td>EPA: Manual-365.3, Automated Ascorbic acid digestion-365.1 Rev. 2, ICP/AES4-200.7 Rev. 4.4&lt;br&gt;SM: 4500-P E-F</td>
<td>EPA: 0.01 mg/L&lt;br&gt;SM: 0.01 mg/L</td>
<td>28 days</td>
<td>Cool ≤6°C, H₂SO₄ to pH &lt;2</td>
</tr>
<tr>
<td>Total Nitrogen (Ammonia + Nitrate/Nitrite, methods are for Nitrate-Nitrite and need to be combined with Ammonia listed above.)</td>
<td>EPA: Cadmium reduction (automated)-353.2 Rev. 2.0, SM: 4500-NO₃ E-F</td>
<td>EPA: 0.05 mg/L&lt;br&gt;SM: 0.05 mg/L</td>
<td>28 days</td>
<td>Cool ≤6°C, H₂SO₄ to pH &lt;2</td>
</tr>
</tbody>
</table>

SM = Standard Methods

### 7.2 Catchment Investigation Procedures

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

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

- **Junction Manhole** is a manhole or structure with two or more inlets accepting flow from two or more MS4 alignments. Manholes with inlets solely from private storm drains, individual catch basins, or both are not considered junction manholes for these purposes.

- **Key Junction Manholes** are those junction manholes that can represent one or more junction manholes without compromising adequate implementation of the illicit discharge program. Adequate implementation of the illicit discharge program would not be compromised if the exclusion of a particular junction manhole as a key junction manhole would not affect the permittee’s ability to determine the possible presence of an upstream illicit discharge. A permittee may exclude a junction manhole located upstream from another...
located in the immediate vicinity or that is serving a drainage alignment with no potential for illicit connections.

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

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

For most catchments, manhole inspections will proceed from the outfall moving up into the system. However, the decision to move up or down the system depends on the nature of the drainage system and the surrounding land use and the availability of information on the catchment and drainage system. Moving up the system can begin immediately when an illicit discharge is detected at an outfall, and only a map of the storm drain system is required. Moving down the system requires more advance preparation and reliable drainage system information on the upstream segments of the storm drain system but may be more efficient if the sources of illicit discharges are believed to be located in the upstream portions of the catchment area. Once a manhole inspection methodology has been selected, investigations will continue systematically through the catchment.

Inspection of key junction manholes will proceed as follows:

1. Manholes will be opened and inspected for visual and olfactory evidence of illicit connections. A sample field inspection form is provided in Appendix C.
2. If flow is observed, a sample will be collected and analyzed at a minimum for ammonia, chlorine, and surfactants. Field kits can be used for these analyses. Sampling and analysis will be in accordance with procedures outlined in Section 7-1. Additional indicator sampling may assist in determining potential sources (e.g., bacteria for sanitary flows, conductivity to detect tidal backwater, etc.).
3. Where sampling results or visual or olfactory evidence indicate potential illicit discharges or SSOS, the area draining to the junction manhole will be flagged for further upstream manhole investigation and/or isolation and confirmation of sources.
4. Subsequent key junction manhole inspections will proceed until the location of suspected illicit discharges or SSOS can be isolated to a pipe segment between two manholes.
5. If no evidence of an illicit discharge is found, catchment investigations will be considered complete upon completion of key junction manhole sampling.

7.3 Wet Weather Sampling Procedures

For each catchment where one or more SVF has been identified, outfall sampling during wet weather must be completed. The same procedures for sample collection should be followed as outlined in Section 7.1. During wet weather sampling, flow should always be present. Weather considerations
outlined in Section 6.1 should be followed to ensure sampling is conducted during the appropriate conditions to meet MS4 Permit requirements.

### 7.4 Field Work Safety Procedures

The collection of monitoring data, including dry and wet weather data, will be acquired only under safe conditions. Please read the following safety precautions carefully prior to field efforts.

In the event of a medical emergency: Contact appropriate emergency personnel first and/or dial 911.

<table>
<thead>
<tr>
<th>Table 7-3. Standard Operating Safety Procedures</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hazard</strong></td>
</tr>
<tr>
<td>Heat Stress</td>
</tr>
<tr>
<td>Slips/trips/falls</td>
</tr>
<tr>
<td>Drowning</td>
</tr>
<tr>
<td>Caught-in Mud</td>
</tr>
<tr>
<td>Confined Space Entry</td>
</tr>
<tr>
<td>Insects General Hazards</td>
</tr>
<tr>
<td>Wasps &amp; Bees</td>
</tr>
<tr>
<td>Ticks</td>
</tr>
<tr>
<td>Noxious Plants (poison ivy, poison oak, poison sumac)</td>
</tr>
</tbody>
</table>
Working On, Over, or Near Water
Note: Normal monitoring events may require the use of (knee-high) waders. Any sampling that requires “above the knees” waders or utilization of a boat, is considered hazardous and should not be attempted without the direct supervision and/or approval of the Stormwater Program Supervisor. If municipal staff or volunteers will be working over or near water where a risk of drowning could occur (per OSHA > 2 feet deep), then employees and volunteers must be provided with and use United States Coast Guard (USCG) approved personal flotation devices (PFDs, i.e., life jackets).

Noise Exposure / Hearing Conservation
Note: Normal monitoring events will not require the collection of samples at or near construction sites. If samples are needed on or through a construction site, Stormwater Program Supervisor will obtain permission from the property owner and/or construction supervisor. When monitoring at or near a construction site, Field Teams must wear appropriate safety gear/ equipment including but not limited to hard hat, safety vest and hearing protection devices (ear plugs and/or muffs).

Weather-Related Hazards
In addition to heat and cold temperatures, weather-related hazards should be anticipated, and appropriate protective measures must be taken. Given the multi-season work schedule and unpredictable New England weather, adverse weather should be anticipated. Field teams should always re-check the weather forecast prior to each sampling event. The following are some possible weather-related hazards and protective measures:
- Lightning - Do not work during electrical storms. Stay off high areas (e.g., top of the landfill) and hazardous areas (e.g., on water) that attract lightning.
- Hurricane/Tornado/Flash Flooding/Hail/Hazardous Weather-Do not schedule monitoring when weather reports indicate potential high winds, excessive rains, flash flooding, hail, hurricane or tornado warnings or watches. If weather becomes hazardous during monitoring, the Field Team Leader should stop all monitoring activities and send Field Teams to an appropriate safety location.

Reagents for Field Test Kits
The handling of certain reagents may be required for field test kits, such as test kits for Surfactants and the Chlorine colorimeter. When handling and use is required, ensure that the user has reviewed the Safety Data Sheet, is aware of the associated hazards and first aid measures, and that the appropriate personal protective equipment is selected and used.

Roadway Infrastructure Safety Awareness
Field Teams may work in areas that are in close proximity to roadways, parking lots, or associated with the highway infrastructure (e.g., bridges, tunnels). Under no circumstances will Field Teams acquire samples within MassDOT road infrastructure without the direct supervision and/or approval of the Stormwater Program Supervisor.

Monitoring within municipal infrastructure, Field Teams may be exposed to hazards both inside and outside the work zone. Depending on the specific project and work task, this may include the risk of
injury from passing motor vehicle traffic as well as the potential risk from the movement of construction vehicles and equipment near the work zones (very rare).

When working alongside of roadways:
   1. Locate a safe place to park vehicles for each sampling site.
   2. If practical, park appropriate municipal maintenance vehicles between on-coming traffic and work area to serve as a warning barricade.
   3. Use temporary traffic control devices, such as cones, signage, warning devices, barricades, and similar whenever necessary based on the type and location of work to be performed, the duration of operations, time of day, the characteristics of the roadway, and/or the volume and speed of traffic.
   4. Wear high visibility safety apparel at all times during sampling. This safety apparel must be inspected regularly to ensure that color has not faded and that reflective properties have not been lost.
   5. Always use extreme care when sampling at the edge of a roadway or bridge with guard rails, stonewalls, etc. Test railing firmly before leaning out over them.

When working within the road infrastructure (manholes and catch basins):
   1. Removal and placement of manhole and catch basin covers is to be considered hazardous and is the responsibility of Trained Municipal Maintenance staff only. Under no circumstance will untrained municipal staff, interns, or volunteers engage in the removal of such covers.
   2. Use extreme caution when removing manhole and catch basin covers as they are very heavy and require a pick or lifting device. Wear heavy-duty gloves and hard-toed boots to protect fingers and toes. Make sure on-coming traffic has plenty of visual warnings and traffic cones/ signs to alert drivers of crew members on and along the roadway.
   3. When lifting a manhole or catch basin covers always use proper lifting techniques when in the field. Never lift more than you are capable of lifting. Follow the lifting techniques below:
      a. First, test the weight of the load by tipping it. If in doubt, ask for help. Do not attempt to lift a heavy load alone.
      b. Take a good stance. Plant your feet firmly with legs apart, one foot farther back than the other. Make sure you stand on a level area with no slippery spots or loose gravel, etc.
      c. Get a firm grip. Use as much of your hands as possible, not just your fingers.
      d. Keep your back straight, almost vertical. Bend at the hips if you bend.
      e. Hold load close to your body. Keep the weight of your body over your feet for good balance.
      f. Use large leg muscles to lift. Push up with the foot positioned in the rear as you start to lift.
      g. Lift steadily and smoothly. Avoid quick, jerky movements.
      h. Avoid twisting motions. Turn the forward foot and point it in the direction of the eventual movement.
      i. Never try to lift more than you are accustomed to.
      j. Always get help when you have to lift bulky loads.
7.5 Field Equipment

Table 7-4 lists field equipment commonly used for outfall screening and sampling.
### Table 7-4. Field Equipment – Outfall Screening and Sampling

<table>
<thead>
<tr>
<th>Testing Equipment</th>
<th>Check</th>
<th>Use/Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ammonia test strips (or kits)</td>
<td>Have extra kits on hand to sample more outfalls than are anticipated to be screened in a single day</td>
</tr>
<tr>
<td></td>
<td>chlorine test strips (or kits)</td>
<td>Have extra kits on hand to sample more outfalls than are anticipated to be screened in a single day</td>
</tr>
<tr>
<td></td>
<td>conductivity, salinity, pH and temperature meter (sonde)</td>
<td>Hand held meter, if available, for testing for various water quality parameters such as ammonia, surfactants and chlorine and if needed, for sampling conductivity, temperature, pH</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sampling Equipment</th>
<th>Check</th>
<th>Use/Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>map with sampling location and Facility ID's (if not using tablet)</td>
<td>For orientation</td>
</tr>
<tr>
<td></td>
<td>GPS receiver (tablet or handheld GPS)</td>
<td>For taking spatial location data</td>
</tr>
<tr>
<td></td>
<td>clipboard (if not using tablet)</td>
<td>For organization of field sheets and writing surface</td>
</tr>
<tr>
<td></td>
<td>100 ml pre-labeled laboratory bacteria sample bottles (bacteria)</td>
<td>Make sure all sample containers are clean. Keep extra sample containers on hand at all times.</td>
</tr>
<tr>
<td></td>
<td>500 ml pre-labeled laboratory bacteria sample bottles (other laboratory analysis)</td>
<td>Make sure there are proper sample containers for what is being sampled for (i.e., bacteria requires sterile containers).</td>
</tr>
<tr>
<td></td>
<td>125 ml pre-labeled laboratory sample bottles (for on-site testing and BBAC off-site testing)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>additional sample containers as needed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>data sheet and chain of custody forms</td>
<td>Field sheets for both dry weather inspection and dry weather sampling should be available with extras. Chain of custody form is needed to ensure proper handling of all samples</td>
</tr>
<tr>
<td></td>
<td>de-ionized water or laboratory purified water in squeeze bottle and extra squeeze bottles as necessary</td>
<td>For sample procedures</td>
</tr>
<tr>
<td></td>
<td>pens, pencils, and/or permanent markers</td>
<td>For proper labeling</td>
</tr>
<tr>
<td></td>
<td>label tape</td>
<td>For labeling sample containers</td>
</tr>
<tr>
<td></td>
<td>sampling pole, dipper, sampling cage, and/or hand-held vacuum pump</td>
<td>For accessing hard to reach outfalls and manholes</td>
</tr>
<tr>
<td></td>
<td>disinfecting (wet) wipes and/or hand sanitizer</td>
<td>Disinfectant/decontaminant</td>
</tr>
<tr>
<td>Sample Transport</td>
<td>Use/Notes</td>
<td></td>
</tr>
<tr>
<td>------------------------------------------------------</td>
<td>----------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Check</td>
<td>Equipment</td>
<td></td>
</tr>
<tr>
<td></td>
<td>coolers</td>
<td></td>
</tr>
<tr>
<td></td>
<td>frozen blue ice</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tools</th>
<th>Use/Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check</td>
<td>Equipment</td>
</tr>
<tr>
<td></td>
<td>flashlight and/or headlamp with extra batteries</td>
</tr>
<tr>
<td></td>
<td>For looking in outfalls or manholes, helpful in early mornings as well</td>
</tr>
<tr>
<td></td>
<td>manhole hook (from local DPW)</td>
</tr>
<tr>
<td></td>
<td>For opening manholes</td>
</tr>
<tr>
<td></td>
<td>measuring tape and/or carpenters ruler</td>
</tr>
<tr>
<td></td>
<td>Measuring distances and depth of flow</td>
</tr>
<tr>
<td></td>
<td>shovel (from local DPW)</td>
</tr>
<tr>
<td></td>
<td>For opening, propping, prying as needed</td>
</tr>
<tr>
<td></td>
<td>pry bar or pick</td>
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<td></td>
<td>For opening catch basins and manholes when necessary</td>
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<td></td>
<td>sandbags</td>
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<td></td>
<td>For damming low flows in order to take samples</td>
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<td></td>
<td>small Mallet or Hammer</td>
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<td></td>
<td>Helping to free stuck manhole and catch basin covers</td>
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<td></td>
<td>utility Knife</td>
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<td>Multiple uses</td>
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<td></td>
<td>safety glasses</td>
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<td>safety vests</td>
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<td></td>
<td>rubber knee boots and/or waders for accessing shallow streams/areas</td>
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<td>safety (traffic) cones</td>
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<thead>
<tr>
<th>Other</th>
<th>Use/Notes</th>
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<tr>
<td>Check</td>
<td>Equipment</td>
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<tr>
<td></td>
<td>bug spray (the CDC recommends products with: DEET (exposed skin and clothing) or Permethrin (on clothing)</td>
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<tr>
<td></td>
<td>Protection</td>
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<td></td>
<td>poison ivy wash (e.g., Tecnu, Zanfel)</td>
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<td></td>
<td>Protection (especially if allergic to poison ivy)</td>
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<td>water (drinking water quality)</td>
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<td>For drinking, washing as needed</td>
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<td>digital camera (smartphone or tablet)</td>
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<td>For documenting field conditions at time of inspection</td>
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<td>field log books</td>
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<td>Documentation</td>
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<td>nitrile gloves</td>
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<td>To protect the sampler as well as the sample from contamination</td>
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<td>paper towels</td>
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<td>Cleaning</td>
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<td>sealable bags</td>
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<td>Miscellaneous storage, organization</td>
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8 Training

Annual IDDE training will be made available to all employees involved in the IDDE program. This training will at a minimum include information on how to identify illicit discharges and SSOs and may also include additional training specific to the functions of particular personnel and their function within the framework of the IDDE program. Training records will be maintained in Appendix E. The frequency and type of training will be included in the annual report.

9 Progress Reporting

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

- Number of SSOs and illicit discharges identified and removed
- Number and percent of total outfall catchments served by the MS4 evaluated using the catchment investigation procedure
- Number of dry weather outfall inspections/screenings
- Number of wet weather outfall inspections/sampling events
- Number of enforcement notices issued
- All dry weather and wet weather screening and sampling results
- Estimate of the volume of sewage removed, as applicable
- Number of employees trained annually.

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

Summary of Legal Authority
Summary of Current Policies/Regulations

Regulatory Authority – The Town of Sandwich addressed each compliance criteria required by the 2003 General Permit through the existing framework of Town bylaws and regulations. This was explained in the Town’s 2004 Stormwater Management Plan and further described in the 2019 SWMP. The primary entities that establish authority include the Town Bylaws, Town Regulations, Zoning Bylaws, and Subdivision Rules and Regulations. Each of these has been in existence for many years and are duly amended/revised as needed to adapt the Town’s requirements. Some of the rules cited were adopted long before the 2003 General Permit came to be. For example, Illicit Discharge Detection and Elimination Authority was put into place long ago for public health purposes, and then strengthened in 1991 as part of the Town’s efforts to eliminate stormwater pollution impacting estuaries and shellfish growing areas. These were used by the Town as part of an aggressive effort to eliminate illicit connections from septic systems and other pollution sources and restore water quality. The program took time to implement, but was successful, and water quality has improved sufficiently to reopen significant shellfish growing areas in Town. In summary, each of the Regulatory Authority compliance criteria have been addressed, and the dates provided on the NOI form reflect amendments/revisions where relevant rules were incorporated. The stormwater laws and regulations are enforced by the Building Department, Zoning Board of Appeals, Planning Board Health Department, and the Conservation Commission and inspected by the Building Department, Engineering Department, Health Department, and the Department of Natural Resources. While too extensive to list, below is a description of some of the current laws and regulations directly or indirectly related to stormwater impacts. More detailed information on these laws and regulations may be found on the Town’s website at: www.SandwichMass.org

Town By-Laws
The Town Bylaws include the following laws related to stormwater impacts:
• **Illegal Disposal (Section 4.00)** – Prohibits the dumping of materials and wastes on Town-owned properties and lists fines for such violations.
• **Excavations (Section 6.25)** - Addresses illegal removal of soil, loam and gravel and covers permit requirements.
• **Wetland Protection (Chapter 7)** – Details the wetlands protection laws and the requirements of the Conservation Commission.
• **Boat Operations and Use of Waterways (Pollution - Section 9.07 and 9.09)** – Addresses discharge or disposal of pollutants on, into or near water bodies in Sandwich.
• **Driveway Regulations (Bylaw Appendix)** – Requires temporary driveway apron of crushed stone to minimize erosion and runoff onto adjacent streets.

These provisions are administered and enforced by various Town Departments.

Protective Zoning By-Laws
The Zoning By-law is administered and enforced by the Zoning Board of Appeals and the Building Commissioner.
• **Enforcement and Fines (1240 and 1250)** – Covers enforcements and fines related to violations of the Zoning ByLaw, including erosion control standards.
• **Performance Bonds for Erosion Control (1260)** – Requires performance bond or deposit as security against possible costs due to erosion or damage on town streets.
• **Minimum Lot Requirements (2600.l)** – Minimum lot sizes for new subdivisions must be 2 acres within the Water Resource District.
• **On-Site Waste Disposal (3430 & 3431)** – Addresses control of wastes and required permits.
• **Landscaping (3500)** – Regulates lot coverage areas and requires re-vegetation.
• **Erosion Control (3530)** – Lists regulations for erosion control during construction.
• **Site Requirements (3853)** – Stormwater runoff shall be contained on-site.
• **Earth Moving Regulations (4200)** – Regulates earthwork and requires permits from the ZBA.
• **Water Protection Districts (5000)** – A Water Resource Overlay District and Surface Water Protection District have been established to preserve the quality and quantity of the Town’s groundwater resources in order to ensure a safe and healthy public water supply. The Water Resource Overlay District can be seen in Figure 3-2. The Surface Water District includes surface water bodies. Section 5000 includes regulations and performance standards dealing issues such as stormwater runoff, limits on fertilizer applications and nutrient loading.
• **Water Quality Review Committee (5050)** – A Water Quality Review Committee (WQRC) was established to enforce the regulations of the Water Resource Overlay District. The committee comprises of one member each from the Board of Selectman, Board of Health, Planning Board, Conservation Commission, Water District and the Health Agent. Certificates of Water Quality Compliance shall be obtained from the WQRC for new construction within the District.
• **Three Ponds District (7000)** – The Three Ponds District was established to preserve the environmental, scenic and natural qualities of this sensitive area, including the protection of surface and groundwater resources. The District, including Lawrence Pond, Triangle Pond and Spectacle Pond can be seen on the Three Ponds District map (Figure 4-1). The District includes 692 acres of land and 313 acres of pond surface. Regulations address issues such as land use, stormwater, septic systems, pesticides, and fertilizers to protect this sensitive environment.

**Subdivision Rules and Regulations**

The Subdivision Rules and Regulations address erosion control and stormwater runoff during construction and post-development.

• **Contents (Section 3.0)** – Requires plan and profile of drainage system and calculations from a registered Professional Engineer. Requires an erosion control plan and a landscape plan including methods of slope stabilization. Requires a Subdivision Maintenance Plan detailing inspection and maintenance practices for the street pavement, drainage facilities, landscaped areas, open spaces, and other common features.
• **Design Requirements (Drainage, Section 4.C)** – Established standards requiring compliance with MassDEP standards and design up to the 100-year storm for all subdivisions. No stormwater flow shall be conveyed over or under town ways.
• **Construction Specifications (Drainage, Section 5.C)** – Addresses drainage requirements during construction.
• **Construction Specifications (Erosion, Section 5T)** – Erosion shall be controlled as approved by the Planning Board.
• **Maintenance (Section 5R)** – Requires maintenance of the drainage facilities during construction activities.

Subdivision inspections are typically performed by the Engineering Department and enforcement is in conjunction with the Planning Board and Building Department.

**Conservation Commission – Wetland Protection**

The State wetland protection laws are incorporated in the Town Bylaws and enforced by the Conservation Commission. The Department of Natural Resources has developed a guideline, pursuant to the Wetlands Bylaw and Conservation Commission Regulations that establishes criteria and standards for the submission of filings and information to the Commission. Together,
these set stringent rules and enforcement procedures governing runoff flowing into wetlands and other resource areas.

**Board of Health Regulations**
The Health Department administers and enforces various state and local laws and regulations. These include the State Sanitary Code Title V and Board of Health Regulations governing installation and use of on-site septic systems, as well as regulations pertaining to waste hauling and disposal, floor drains, and other issues affecting stormwater runoff quality.
Appendix B

Storm System Mapping
Appendix C

Field Forms, Sample Bottle Labels, and Chain of Custody Forms
Sample Bottle Label

Sandwich Water Quality Sampling Program Sample

Date/Time: ___________ Sample ID: ___________

Sample Type: W or D

Laboratory Analysis: _______________

Preservative_____________________

Collected By: _____________________

Barnstable County Laboratory Bottle Label

<table>
<thead>
<tr>
<th>Client</th>
<th>Date</th>
<th>Time</th>
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<tbody>
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<td></td>
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<table>
<thead>
<tr>
<th>Location</th>
<th>Sample ID</th>
</tr>
</thead>
<tbody>
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<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Collected By</th>
<th>Preservative</th>
</tr>
</thead>
<tbody>
<tr>
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<table>
<thead>
<tr>
<th>Analysis Requested</th>
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<tbody>
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</table>

Barnstable County Department of Health and the Environment
Barnstable, MA 02630 508-375-6605
### Sample Inspection Form

#### IDDE Outfall Screening Form

<table>
<thead>
<tr>
<th>Date of Inspection:</th>
<th>Date of Last Storm:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start Time:</td>
<td>End Time:</td>
</tr>
<tr>
<td>Inspector Name:</td>
<td></td>
</tr>
</tbody>
</table>

**Type of Inspection:**
- [ ] Dry Weather
- [ ] Wet Weather

**Structure Found:**
- [ ] Yes
- [ ] No

**Outfall Condition:**
- [ ] Good: Inspect Within 2 Years
- [ ] Fair: Inspect Within 1 Year
- [ ] Poor: Requires Maintenance
- [ ] Failing: Requires Immediate Action
- [ ] Unknown

**Sedimentation:**
- [ ] No Sedimentation
- [ ] Slight Sedimentation
- [ ] High Sedimentation

**IDDE Class:**
- [ ] Potential
- [ ] Obvious
- [ ] Unlikely

**Reason for Illicit Suspicion:**

#### Visual Inspection:

**Staining:**
- [ ] No Staining
- [ ] Some Staining
- [ ] Significant Staining

**Scour Protection Condition:**
- [ ] Good: Inspect Within 2 Years
- [ ] Fair: Inspect Within 1 Year
- [ ] Poor: Requires Maintenance
- [ ] Failing: Requires Immediate Action
- [ ] Unknown

**Vegetative Growth:**
- [ ] None
- [ ] 50% Vegetated
- [ ] < 25% Vegetated
- [ ] < 50% Vegetated
- [ ] 50% Vegetated
- [ ] > 50% Vegetated
- [ ] 100% Vegetated
- [ ] Unknown

**Flow:**
- [ ] Yes
- [ ] No

**Flow Clarity:**
- [ ] Clear
- [ ] Cloudy
- [ ] Opaque

**Color of Flow:**
- [ ] N/A
- [ ] Clear
- [ ] Tea/Coffee
- [ ] Clear Black
- [ ] Orange-Red
- [ ] Tan to Light Brown
- [ ] Milky/Dirty Dishwater Gray
- [ ] Milky White
- [ ] White Crusty Deposits
- [ ] Greenish-Bluish
- [ ] Blue
- [ ] Purple
- [ ] Dark Red
- [ ] Other (describe in notes)

**Floatables:**
- [ ] Yes
- [ ] No

**Sewage, Sheens & Scum:**
- [ ] Yes
- [ ] No

**Odor:**
- [ ] None
- [ ] Rotten Eggs/Hydrogen Sulfide
- [ ] Musty Odor
- [ ] Sharp, Pungent
- [ ] Sweet, Fruit
- [ ] Gasoline, Petroleum
- [ ] Chlorine
- [ ] Other (describe in notes)

#### Water Quality Sampling

<table>
<thead>
<tr>
<th>Temperature (deg C):</th>
<th>Conductivity (micro-Siemens/cm):</th>
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<tbody>
<tr>
<td>ph:</td>
<td>Salinity (ppm):</td>
</tr>
<tr>
<td>Ammonia (mg/L):</td>
<td>Chlorine (mg/L):</td>
</tr>
<tr>
<td>Surfactants (mg/L):</td>
<td></td>
</tr>
</tbody>
</table>

**Additional Parameters Screened:**

**Sample for Lab Collected:**
- [ ] Yes
- [ ] No

**Lab Sample 1 Test:**

**Lab Sample 1 Results:**

**Lab Sample 2 Test:**

**Lab Sample 2 Results:**

**Lab Sample 3 Test:**

**Lab Sample 3 Results:**
## Barnstable County Laboratory Chain of Custody Form

**CHAIN OF CUSTODY**

**BARNSTABLE COUNTY DEPARTMENT OF HEALTH & ENVIRONMENT**  
**WATER QUALITY LABORATORY**  
3195 Main Street, PO Box 427, Barnstable, MA 02630  
Phone: 508-375-6005, Fax: 508-382-7103

<table>
<thead>
<tr>
<th>LAB ID</th>
<th>SAMPLE LOCATION / IDENTIFICATION</th>
<th>COLLECTION</th>
<th>MA DEP LOCATION ID OR MAP PARCEL</th>
<th>SAMPLE TYPE</th>
<th>ANALYSIS</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Street Address + City + State)</td>
<td>DATE</td>
<td>TIME</td>
<td>Location (S)</td>
<td>Special (S)</td>
<td>AG or PK</td>
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**Relinquished By:**  
**Date/Time**  
**Received By:**  
**Date/Time**  
**Container Type:**  
- P  
- P_GV  
- Temp (°C)  
- Preservative:  
  - HCl  
  - HNO₃  
  - Others  
-  
- See reverse side for Routine sampling instructions.

1. Routine includes pH, Mtrate, Total Coliform, Sodium, Copper, Iron, Conductance.
2. Routine+VOC (Real Estate Kit); VOC=Volatile Organic Compounds
3. Container Type: P = Plastics; CG = Clear Glass; AG = Amber Glass; GV = Glass Vial
4. H = H₂SO₄; T = Na₂S₂O₃ (THIO); S = Sterile; N = NaOH

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**Town of Sandwich**  
**Illicit Discharge Detection and Elimination Plan**  
**June 28, 2019**
Appendix D

Water Quality Analysis Instructions, User’s Manuals and Standard Operating Procedures

Note: Instructions and other items specific to the particular equipment to be used will be added to this section as the equipment is procured.
Illicit Discharge Detection and Elimination (IDDE)
Employee Training Record

Town of Sandwich, Massachusetts

Date of Training: __________________________

Duration of Training: _______________________

<table>
<thead>
<tr>
<th>Name</th>
<th>Title</th>
<th>Signature</th>
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Appendix F

Source Isolation and Confirmation Methods: Instructions, Manuals, and SOPs
SMOKE TESTING STANDARD OPERATING PROCEDURE

Based on the Smoke Testing conducted in #58166 SMOKE TESTING in Southern Service Area

AREA SELECTION

This may be a result of specific project in the design phase or the result of areas connected to the existing project.

In the case of Project #58166, subareas to the master pump station were tested due to issues during and immediately following rain events. SCADA provided the list of pump stations with excessive run times which pumped to the MPS in question. These pump stations were collected and mapped for location. In addition to the stations with excessive run times, several other subareas were tested in order to Smoke the entire region.

Once the area is selected, the OCUD Project Manager will coordinate with GIS. GIS will provide a total count of manholes and linear footage of gravity mains based on GIS data and assets. These quantities will be shared for pricing. GIS will also provide quarter sections maps with customization including house addresses and aerials (shaded 50%). These quarter sections should be plotted immediately prior to smoke testing so the most current information is included and provided to the Contractor.

Project timing is also significant. Smoke will not be evident in areas that are saturated. The optimal scheduling for smoke testing is during the dry season. The purpose of testing is to locate not only surface features including illegal connections and broken cleanouts but also issues in the sanitary sewer main, laterals and manholes. In addition, criteria should be developed to determine how long after a rain event that smoke testing may commence.

NOTIFICATIONS

This is a critical function of the testing program. OCU customers, General Public, Utilities Water Reclamation, Director’s office, Commissioners Office, 911, Fire Department and Utilities Dispatch need to know the purpose, location, dates, procedure and status reports.

- Director’s approval of Public Notification flyer/mailer and door hanger,
- Commissioners office notification and briefing,
- Fire Department and 911 contacts and notification,
- Residents received the public notice as a mass mailing prior to smoke testing
- Door hangers were hung at each residence 2-4 days prior to smoke testing specific subdivision
☐ Provide Variable Message boards strategically placed throughout testing including major streets into the area and entrances into subdivisions
☐ Weekly updates were sent to the Fire Department, 911, Utilities and Testing Company
☐ Notification of all parties of project completion

1. The OCUD Project Manager must have the Public Notification flyer / mailer and door hanger approved through the Director’s office using the PIO request form and PIO checklist unless an approved template is being utilized.

2. The OCUD Project Manager will contact the Commissioners office and notify the Commissioners that there will be smoke testing in their District. Commissioners need to be notified or briefed prior to the public notification flyers / mailers being sent to the public.

3. The OCUD Project Manager shall provide initial notification to Orange County Fire Rescue and locate the Assistant Chiefs commanding the Fire Stations of the affected area. This may cover several areas depending on the total area to be smoke tested. However, the City of Orlando may also be providing fire service for the area, and coordination is required.

4. The Contractor or OCU shall provide a mass mailing to all residents in the smoke testing area approximately two (2) weeks prior to project start. The Project Manager shall determine if the mailers shall be handled in-house or by the Contractor. The Project Manager will provide residents names and addresses by coordinating with GIS. GIS can export all the information in an excel table for an easy mail merge. Please request customers billing address be provided in addition to the home owner data so that renters are included in the notification process. Note that Customer service’s reverse dialing system may also be utilized and a printed note can be placed on Customers Bills, to supplement the public notification flyer / mailer.
5. The Contractor will hang door hangers approximately 2-4 days prior to Testing specific streets.

6. The Contractor shall provide Variable Message Boards (VMB) strategically placed throughout testing including major streets into the area and entrances into subdivisions. Project 58166 covered 75 miles of sanitary sewer (400,000 LF) and 7,300 residents over a 2 month period. The Contractor constantly relocated the three (3) VMB to cover the areas being smoked.

7. The Project Manager shall provide weekly updates to the Fire Department, 911, Water Reclamation contacts, Utilities Dispatch and Testing Company. Work for the upcoming week as well as total progress shall be provided by the Contractor and this information shall be conveyed to all parties on a weekly basis and sent the Friday before the upcoming week by the Project Manager. This included an overall progress map of the entire project progress, narrative describing the week look ahead and a map showing all street names to be tested the following week. The Project Manager is the sole point of contact for all Public Safety and Utilities Departments.

8. Provide Notification to all parties that the smoke testing is complete. The Fire Department will call immediately if they haven’t received the weekly update.
The OCUD Project Manager will provide the Consultant or Contractor with the following information to provide a quote.

- Proposed smoke testing area map,
- One set of quarter section maps for the purpose of bidding
- Total Linear Footage of Sanitary Sewer,
- Total number of Manholes,
- Total number of Resident Addresses & spreadsheet for Mailers and door hanger count,
- Requirements for Variable Message Boards,
- Requirements for the door hanger and 2 page mailer including sizes, color, etc.
- Three (3) color sets of quarter section maps to the Contractor plotted at the time of smoke testing.
- Coordination with Water Reclamation for Manhole locates just prior to smoke testing (several manholes were found to be paved over or located in the R-O-W)
- Coordination with Construction and Water Reclamation during smoke testing for an emergency contact / standby personal to make emergency repairs if required and provide sewer cleaning if line is blocked.

**SMOKE TESTING SCOPE OF SERVICES.**

**Procedures**

- **Approved Public Notification Mass Mailers.** The Contractor shall mail out to all the residences and businesses in the proposed project area, the approved Smoke Testing public notification flyer / mailers, as a mass mailing approximately 2 weeks before the overall project starts. The mailer shall only be the approved Orange County Utilities smoke testing public notification flyer / mailer and shall be provided by the Project Manager for each project.

- **Door Hangers.** The Contractor shall place door hangers on all residences and businesses 2-4 days prior to smoke testing at those specific addresses. Door hangers shall be an ongoing process throughout the project and shall be limited to the area provided in the look ahead schedule. Door Hangers shall not be placed for areas which will not be tested within 4 days.

- **Smoke Test Setup.** The contractor will setup on every other manhole and smoke test no more than 400 ft both directions from setup (Total of 800 LF). This distance shall not be exceeded unless written authorization and field verification is given by the verifying that distances greater than a 400 ft radius are providing acceptable results. The Contractor shall be responsible for Maintenance of Traffic and relocation of variable message boards throughout the duration of the project.

- **Smoke Testing Crew.** The smoke testing Contractor shall provide at minimum a crew of four (4) people. One member to man the machine, two (2) to walk and one supervisor. The supervisor will assist in all functions but with primary effort on data collection, logging, determination of smoke testing schedule and tracking.
Smoke Testing. Smoke will be turned on and remain on throughout the entire time of testing including the walkthrough for identification of defect locations with flags as well as during the taking digital pictures for each flagged and numbered defect.

Identification of Defects. The walk through for locating of defects will not begin until smoke is highly visible with a smoke plume emanating from the plumbing vents of houses at the end of the setup location (maximum 400 ft radius) from the smoke testing machine. A colored locate flag will dropped at the location of the defect and will be left for the homeowner to remove. Walkers shall traverse not only the sidewalk but between all homes and in back yards looking for illegal connections including patio, pool drains and roof drain connections.

Defect Pictures. Once the area has been flagged the Smoke Testing Contractor will snap a digital picture (not less than 2 Megapixel with time and date stamp on the digital photograph) showing the smoke billowing from the defect, flag, unique number, and physical features at or near the defect. Pictures without smoke plume from the located defect or missing visible unique number are unacceptable. The contractor will provide a self standing sign (sandwich board) at each defect with minimum 4” tall numbers physically located at each defect part of the picture. Numbering shall be consecutive, unique number per defect, clearly visible in the picture and noted on the report, record drawings and summary spreadsheet.

Defect Reporting. The report for each defect shall be a MS Word document containing the following information: Contractor letterhead, name of smoke tester, date, time, address of defect, description of defect, manhole to manhole OCU identification, digital photograph, priority rating of defect, Total Drainage Area estimation, quarter section number, footage smoked and map for exact location of defect. Note the map may be of an entire street with multiple defects shown. Weekly reports shall be provided to the Project Manager in digital form as well as 2 hard copies. The Project Manager shall provide one copy to Water Reclamation.

- Common description of defects include: broken cleanout, broken cleanout cap, missing cleanout cap, manhole lid, roof leader, drain connection, AC connection, smoke under sidewalk or driveway, etc
- Common priority ratings and Total Drainage Area estimations include: Priority 1 (illegal connections, direct impact, large drainage area), Priority 2 – High Impact (low lying area, down spouts near cleanout, etc), Priority 3 – Moderate Impact (small impact but potential inflow), Priority 4 - Insignificant (None, no impact).
Record Drawings and Summary. The Contractor shall return on set of the quarter section maps showing all the defects for the project to the Project Manager. In addition, the Contractor shall provide an Excel table listing the defect number, priority, total drainage area estimation, location, address, and description of defect. The spreadsheet shall be provided each week with the reports and shall be cumulative with a final summary of all defects at the end of the project.

<table>
<thead>
<tr>
<th>Defect / Pic #</th>
<th>Priority</th>
<th>Total Drainage Area</th>
<th>TDA Notes</th>
<th>Location</th>
<th>Address</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>45</td>
<td>1</td>
<td>large</td>
<td>MH ditch</td>
<td></td>
<td>MH #22 in ditch</td>
<td></td>
</tr>
<tr>
<td>46</td>
<td>3</td>
<td>small</td>
<td></td>
<td></td>
<td>cleanout</td>
<td></td>
</tr>
<tr>
<td>47</td>
<td>3</td>
<td>small</td>
<td></td>
<td></td>
<td>cleanout</td>
<td></td>
</tr>
<tr>
<td>48</td>
<td>3</td>
<td>small</td>
<td>MH #11 Below Grade</td>
<td></td>
<td>cleanout</td>
<td></td>
</tr>
<tr>
<td>49</td>
<td>3</td>
<td>small</td>
<td></td>
<td></td>
<td>cleanout</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>4</td>
<td>nil</td>
<td>South Chase / Wetherbee</td>
<td>123 White Marsh Ct</td>
<td>Broken C.O.</td>
<td></td>
</tr>
<tr>
<td>51</td>
<td>2</td>
<td>low area</td>
<td></td>
<td></td>
<td></td>
<td>Broken C.O.</td>
</tr>
</tbody>
</table>

Project Coordination. The Contractor shall provide a one week look-ahead schedule and coordinate with the Project Manager the exact locations of Smoke Testing for the upcoming week. This information will be transmitted to the Fire Rescue Department by the Project Manager.

REQUEST FOR QUOTES (RFQ)

The RFP will contain the following bid items based on the scope of services as well as minimum details for the smoke testing procedure:

- Cost per foot for smoke testing LF
- Cost for mailer and door hanger LS
- Cost for variable message boards  Per Month
- Final Report, Excel Summary and Record DWGS  LS
- Acknowledgements of Contractor Responsibilities and Scope of Services
  - Responsible for all MOT including traffic control, barricades, flagmen, traffic cones, police, etc
  - Providing all flags, equipment, chemicals, water, fuel and all appurtenances to be included in the per foot cost
  - Responsible for protecting the public from open manholes
  - Responsible for any special permits or licenses
  - Coordination with Schools and high traffic roads for testing on weekends only
  - Providing a phone number for information and point of contact onsite during testing for the public

**UTILITY INSPECTOR**

As with any project, there are several procedural errors or shortcuts that can be made which will detrimentally affect the outcome. The inspector will verify the procedures are being followed by the Contractor including, running the smoke the entire time, effectiveness of the walkers, verify backyards and side yards are being investigated, speaking with the public and documentation. The project schedule shall be coordinated by the Project Manager with Construction to verify the specifications are being adhered.

In 58166, we provided a full time inspector as well as a part time representative from Water Reclamation. Both Utilities representatives were looking for defects, calling in critical defects to be repaired immediately, speaking with the public about the project and directly responding to customer calls to the Smoke Tester PIO as well as the Water Reclamation hotline. In addition, we corrected several issues with the smoke tester procedures. The first was the duration of the smoke. The walkers were leaving before the smoke had reached the end of the area to be tested and were missing vital defects. There is a time lag from when the machine is started until the smoke fills the volume of the gravity collection system, laterals, house plumbing and reaches the final point of the testing area. The coordination between the Contractor in charge of running the smoke test machine and the walkers was not efficient. In one instance, they ran out of smoke and the walkers continued looking for defects even though no smoke was in the system. Finally, the machine was being turned off immediately after the flagging was finished. In some instances, the defect (broken lateral under a sidewalk, manhole shifted cone section or deep cleanout) were not readily apparent without the presence of smoke. The defect pictures must show smoke to identify the specific defect and show proof that there is an issue.

**GPS COORDINATES**

In 58166, the Prime Contractor shot GPS coordinates of each defect as well as took coordinates for every manhole and lift station in the testing area. This task was a full time position and required the Contractor to provide the GPS Trimble equipment. The need to locate both the existing facilities as well as the defects is a coordination effort by the Project Manager with both GIS and Water Reclamation. In addition, the GPS Technology is not normally a service provided by Smoke Testers, so the additional cost for a sub will have to be evaluated by the Project Manager and the need for the Utility.
DATA ANALYSIS

The Project Engineer is responsible for analyzing the defects found during smoke testing, verifying priority, and creating a column on the summary spreadsheet for responsibility. Illegal connects or cleanout issues at the home are the responsibility of the homeowner to repair. The cleanouts at the R-O-W line, defects found under sidewalks or driveway aprons, manholes, etc are the responsibility of Utilities to repair. The Project Manager will sort the summary spreadsheet by responsibility and priority. This information shall be coordinated through both Water Reclamation for scheduling of repairs as well as with the Water Reclamation Environmental Compliance section for residential compliance and verification of repairs. The project manager shall ensure that the digital data is filed on the digital network under the appropriate sequence number.

PROJECT CLOSEOUT

The Project Manager shall have a closeout meeting and pass all the information including spreadsheet, record drawings and Final Report with pictures to Water Reclamation. Water Reclamation will schedule repairs that are the responsibility of the Utility and coordinate the compliance action with homeowners responsible for private property repairs.

The results for #58166

<table>
<thead>
<tr>
<th>Priority of Defect</th>
<th>Description</th>
<th>ROW / Easement</th>
<th>Private Property</th>
<th>Total</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Priority 1 - Illegal Connections</td>
<td>Direct Connection (Roof Gutters, porch / pool drains, plumbing, etc)</td>
<td>0</td>
<td>20</td>
<td>20</td>
<td>1.6%</td>
</tr>
<tr>
<td>Priority 1 - Direct Impact</td>
<td>(Ponds nearby, large depressions, parking lots, MH in drainage)</td>
<td>45</td>
<td>10</td>
<td>55</td>
<td>4.5%</td>
</tr>
<tr>
<td>Priority 2 - High Impact</td>
<td>(Low areas, down spouts near cleanout, etc)</td>
<td>527</td>
<td>186</td>
<td>713</td>
<td>58.4%</td>
</tr>
<tr>
<td>Priority 3 - Moderate Impact</td>
<td>Small impact but potential inflow</td>
<td>134</td>
<td>221</td>
<td>355</td>
<td>29.1%</td>
</tr>
<tr>
<td>Priority 4 - Insignificant</td>
<td>Above grade or high ground, No observable impact</td>
<td>8</td>
<td>70</td>
<td>78</td>
<td>6.4%</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>714</td>
<td>507</td>
<td>1221</td>
<td>100%</td>
</tr>
</tbody>
</table>
Priority 2 – Impact – Low Areas.
Note swale between houses

Priority 2 – Impact (Low Area) Note screen on cleanout and swale between houses

Priority 3 – Small Impact
Good drainage to lake. Small impact.

Priority 4 – No Impact – No drainage Area.
Homeowner to repair c/o on house
Priority 1 - Illegal connections