

M E M O R A N D U M

TO: John Woodsmall; Tom Gregory; Kerry Reed

FROM: Stefan Bengtson; William Guenther

DATE: May 7, 2019

RE: MS4 Training Workshop Summary

This memorandum summarizes the material and content from a workshop presented by Fuss & O'Neill on April 24, 2019. Fuss & O'Neill developed a workshop to address requirements of the General Permit for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems (MS4). Specifically, the workshop focused on Illicit Discharge Detection and Elimination (IDDE) requirements detailed in Section 2.3.4 of the permit. The workshop also provided training for participants on general aspects of their municipalities' MS4 requirements and critical aspects of their IDDE program, recognizing illicit discharges and Sanitary Sewer Overflows (SSOs), which is required training under Section 2.3.4.11. Twenty-eight municipal employees from fifteen member communities participated in the day-long training workshop (Attachment A).

The workshop was broken down into distinct sections. There was an initial classroom portion, detailing the required IDDE training and IDDE program planning and execution using checklists and planning documents created for the workshop (Attachments B&C). Additionally, workshop participants conducted physical field inspections of both outfalls and catchbasins/manholes and also were given instruction and hands-on training in the use of field test kits used to analyze samples for parameters required by the MS4 permit.

The classroom portion initially focused on training requirements such as illicit discharge and SSO identification and also included more general information related to municipal IDDE programs. This included information on IDDE ordinance, written plan, and storm system mapping requirements (Attachment C). Participants were also trained on how to prepare for and conduct outfall investigation and sampling. The checklists and planning documents prepared for the workshop outlined step-by-step procedures for implementing outfall and catchment investigation and sampling. The training presentation reviewed pertinent safety considerations for planning and execution of an IDDE program as well as detailed discussion of equipment checklists needed to execute these programs. Participants were also instructed on how to properly fill out both the Outfall Investigation Form and Manhole/Catch Basin Investigation Form previously prepared by Fuss & O'Neill for the CMRSWC members. Additional discussion covered topics including paper-based vs. digital data collection, how to identify likely sewer inputs, and how to efficiently conduct catchment investigations.

Following the classroom portion, participants put instruction into practice by visiting and completing a full dry-weather outfall inspection at two outfalls. Participants also completed two manhole/catch basin inspections representing key junction manholes in a catchment investigation. Finally, participants were given hands-on training in the use of IDDE sampling and safety equipment and procedures were

Mr. John Woodsmall, Mr. Tom Gregory, and Ms. Kerry Reed

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reviewed during the investigations and participants asked more specific questions. The workshop concluded with hands-on instruction on how to use test kits for chlorine, ammonia, and surfactants, including “clean” and “hot” samples. Finally, a variety of water quality meters were demonstrated to provide an overview of the options available for collecting temperature, conductivity, and salinity data.

Attachment A



Central Mass Regional Stormwater Coalition IDDE Implementation Workshop April 24, 2019

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Central Mass Regional Stormwater Coalition
IDDE Implementation Workshop
April 24, 2019

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Attachment B

IDDE Outfall Investigation and Sampling Checklists

Central Massachusetts Regional Stormwater Coalition (CMRSWC)

April 24, 2019



FUSS & O'NEILL

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IDDE Outfall Investigation and Sampling Checklists CMRSWC

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1 Introduction

These checklists and instructions were prepared to guide members of the Central Massachusetts Regional Stormwater Coalition (CMRSWC) in outfall investigation and sampling as part of an illicit discharge detection and elimination (IDDE) program. The IDDE program is a requirement under the 2016 Massachusetts Small MS4 General Permit. It is assumed that outfalls and catchments have already been prioritized and ranked based on criteria detailed in Section 2.3.4.7 of the permit.

These checklists and instructions were created to aid in the following stormwater outfall investigations:

- Dry weather Outfall Screening
- Dry weather Outfall Sampling
- Post Screening/Sampling Procedures
- Catchment Investigation

The purpose of dry weather outfall screening is to identify potential illicit connections through inspection and sampling during times when stormwater should not be an influence. Outfalls are inspected and those that have flow during dry weather are sampled for pollutants that are commonly attributed to illicit discharges. An illicit discharge is any discharge to a MS4 that is not composed entirely of stormwater. Sources of illicit discharges may include illegal floor drain connections, broken sanitary lines, cross-connections, sanitary sewer overflows, and grass clippings, pet waste, or other material dumped into catch basins.



2 Equipment Checklist

Outfall Screening/Sampling Equipment Checklist

Equipment needed for both screening and sampling:

- ☐ Clipboard
- ☐ Field Sheets/ Tablet
- ☐ Pens/Pencils/Permanent Markers
- ☐ Dry Erase Board and Markers
- ☐ Measuring Tape
- ☐ Flashlight/Headlamp with Batteries
- ☐ Digital Camera (or phone with a camera)
- ☐ GPS Receiver (or phone with a GPS app.)
- ☐ Manhole Cover Assisted Opener, Pry Bar, Pick, and/or Manhole Lifter
- ☐ Small Mallet or Hammer
- ☐ Appropriate footwear (Boots and/or Waders)
- ☐ Reflective Vest
- ☐ Traffic Cones
- ☐ Poison Ivy Scrub

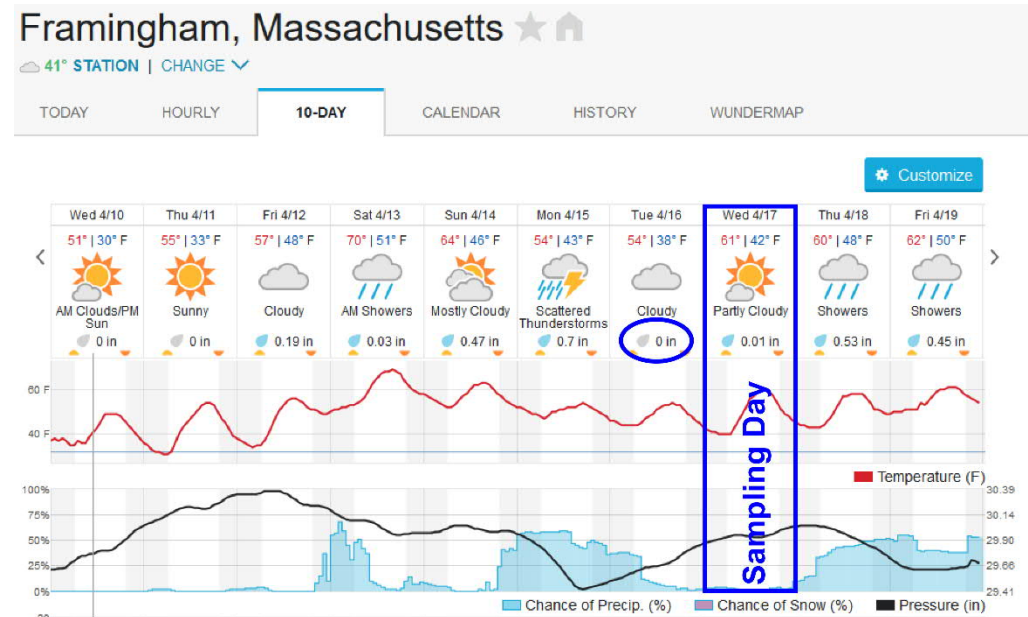
Equipment needed for sampling:

- ☐ Sampling Pole
- ☐ Utility Knife
- ☐ Zip ties/Duct Tape
- ☐ Safety Glasses
- ☐ Nitrile Gloves
- ☐ Hand Sanitizer
- ☐ Chain of Custody Forms
- ☐ Cooler with Ice
- ☐ Water Quality Sonde (if needed/available for conductivity, temperature and pH)
- ☐ Water Quality Meter (if needed/available for ammonia, surfactants and/or chlorine)
- ☐ Test Kits (if needed/available for ammonia and surfactants)
- ☐ Labels for sample bottles
- ☐ Sample bottles (bring some extras; bacteria bottles need to be sterile)
- ☐ Sand bags (for damming low flows)

3 Preparation and Weather Tracking

3.1 Preparation: 1 Week Prior to Screening

- Look at the extended forecast for a day that will meet dry weather criteria
< 0.1 inch of rain in the past 24 hours
and no significant snow melt.
 - Get weather data from Weather Underground or similar weather resource
<https://www.wunderground.com>
 - Enter your town/city in the search bar. Hourly forecasts with rain totals and historical rainfall data are provided.
- Acquire all required field equipment. See the Outfall Screening Equipment Checklist (Section 2).



3 Preparation and Weather Tracking

3.2 Preparation: 1 Day Prior to Screening

- Verify that dry weather criteria will be met for the following day: **< 0.1 inch of rain in the past 24 hours and no significant snow melt.**
- Identify outfalls to be screened based on initial outfall inventory and priority ranking. Plan a route to minimize driving time.
- Gather all required field equipment. See the Outfall Screening Equipment Checklist (section 2).

Framingham, Massachusetts  

42° STATION | CHANGE ▾

TODAY **HOURLY** 10-DAY CALENDAR HISTORY WUNDERMAP

< Hourly Forecast for Tomorrow, Thursday 04/11 >

 **Tomorrow 04/11**  0% / 0 in
Mainly sunny. High near 55F. Winds NW at 10 to 15 mph.

 **Tomorrow Night 04/11**  0% / 0 in
Mainly clear skies. Low 33F. Winds light and variable.

Time	Conditions	Temp.	Feels Like	Precip	Amount	Cloud Cover	Dew Point	Humidity	Wind	Pressure
7:00 am	 Sunny	32 °F	26 °F	1%	0 in	6%	20 °F	61%	7 mph NW	30.16 in
8:00 am	 Sunny	36 °F	29 °F	0%	0 in	2%	21 °F	53%	9 mph NNW	30.19 in
9:00 am	 Sunny	39 °F	33 °F	0%	0 in	0%	20 °F	44%	10 mph NW	30.21 in
10:00 am	 Sunny	43 °F	37 °F	0%	0 in	2%	18 °F	37%	10 mph NW	30.21 in
11:00 am	 Mostly Sunny	45 °F	40 °F	0%	0 in	25%	17 °F	33%	9 mph NW	30.22 in
12:00 pm	 Mostly Sunny	47 °F	43 °F	0%	0 in	29%	17 °F	30%	9 mph NW	30.22 in
1:00 pm	 Sunny	49 °F	46 °F	0%	0 in	1%	17 °F	27%	8 mph NW	30.21 in
2:00 pm	 Sunny	51 °F	48 °F	0%	0 in	0%	17 °F	26%	8 mph NW	30.21 in
3:00 pm	 Sunny	53 °F	50 °F	0%	0 in	1%	17 °F	24%	8 mph NW	30.20 in
4:00 pm	 Sunny	54 °F	51 °F	0%	0 in	16%	17 °F	23%	8 mph NW	30.20 in
5:00 pm	 Sunny	54 °F	51 °F	0%	0 in	4%	17 °F	23%	8 mph WNW	30.22 in
6:00 pm	 Sunny	53 °F	50 °F	0%	0 in	7%	19 °F	26%	7 mph NW	30.24 in
7:00 pm	 Sunny	50 °F	48 °F	0%	0 in	12%	21 °F	31%	6 mph NNW	30.25 in



4 Outfall Screening

4.1 Screening Procedure: Day of Screening

- Navigate to the outfall to be screened.
- Take a photograph of the outfall. Good photos include context. Write the outfall ID on the dry-erase board and include it in the picture.
- If the outfall is inundated:
 - o conduct visual screening at the first non-influenced upstream structure (catch basin or drainage manhole).
 - o Take a photo of both the inundated outfall and the upstream structure.
 - o Note the type of upstream structure and the coordinates on the field form.



Example of a photo that includes surrounding context.



Example of an inundated outfall: the water from the waterbody is backing up into the structure.

4 Outfall Screening

4.1 Screening Procedure: Day of Screening

- Begin the outfall inspection. Fill out the outfall screening form (paper or digital).

This is the unique outfall identifier.

Select Dry Weather Screening.

If screening at an upstream structure, note unique identifier for that structure here.

If practical, park vehicle so as to create a safe working environment

Fill out all physical characteristics for outfall. Fill this section out for the outfall even if screening at an upstream structure.

Outfall/Catchment Screening Form




Catchment ID: _____ **Town:** _____

Inspector: _____ **Date/Time:** _____

Street Name: _____

Last rainfall event (date and amount): _____

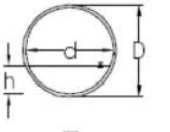
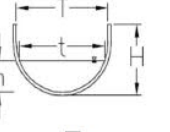
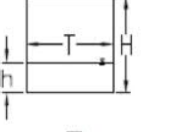
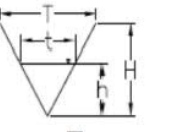
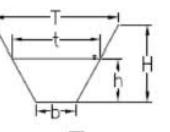
Type of Sampling Event: ☐ Dry Weather Screening ☐ Wet Weather Sampling

Location: ☐ Outfall ☐ Manhole ☐ Catch Basin ☐ Interconnection

Is outfall submerged/inundated? ☐ Yes ☐ No **If YES screen/sample at 1st non-influenced structure:** ☐ MH ☐ CB

Location ID: _____ **Latitude:** _____ **Longitude:** _____

Shape of Pipe/Swale (check one)

				
☐	☐	☐	☐	☐
Rounded Pipe	Rounded Swale	Rectangular Pipe/Swale	Triangular Swale	Trapezoidal Swale

Outfall Material: ☐ Concrete ☐ HDPE ☐ Corrugated Metal Pipe (CMP) ☐ Ductile Iron ☐ Clay ☐ PVC ☐ Other _____ Outfall/Manhole/Catchbasin Condition: ☐ Good ☐ Fair ☐ Poor ☐ Crumbling	Pipe Measurements: Inner Dia. (in.): d = _____ Outer Dia. (in.): D = _____ Pipe Width (in.): W = _____ Pipe Height (in.): H = _____ Flow Depth (in.): h = _____	Swale Measurements: Swale Width (in.): T = _____ Flow Width (in.): t = _____ Swale Height (in.): H = _____ Flow Depth (in.): h = _____ Bottom Width (in.): b = _____
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Obtain Lat. and Long. with phone or GPS.

4 Outfall Screening

4.1 Screening Procedure: Day of Screening

- Look for and record visual/olfactory evidence of pollutants in flowing outfalls.
- If no flow is observed but evidence of flow exists (outfall is damp or there is visual/olfactory evidence of illicit discharge), mark the outfall to be revisited during dry weather within one week of the initial observation to conduct a second screening and sample any observed flow.

Select all applicable boxes.

Sampling is covered in section 5.

Evidence of Flow: ☐ Yes ☐ No If Yes, Description of Flow: ☐ Damp ☐ Trickle ☐ Moderate ☐ High			
Visual Evidence of Illicit Discharge Visual Inspection: ☐ None ☐ Floatables ☐ Pet Waste ☐ Oily Sheen ☐ Sanitary Waste ☐ Algae ☐ Foam			
Olfactory Evidence of Illicit Discharge Olfactory Inspection: ☐ None ☐ Sewage Smell ☐ Musty ☐ Rotten Eggs ☐ Ammonia ☐ Petroleum			
Samples Taken and Sampling Results			
Temp.	Conductivity	Salinity	Chlorine
Ammonia	Surfactants	Bacteria	Pollutant of Concern

4 Outfall Screening

4.2 Post-Screening Procedures

- Schedule any revisits to outfalls based on initial screening.
 - If the outfall was “Damp” then it must be revisited within 7 days
- Store field forms in a designated space. Forms must be included in your Annual Report.
- Review the data and update ranking/prioritization of outfalls. Outfalls that show visual or olfactory signs of illicit discharge should be ranked as “High” priority.

Likely Sewer Input Indicators

- 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
- Ammonia ≥ 0.5 mg/L, surfactants ≥ 0.25 mg/L, and detectable levels of chlorine

5 Outfall Sampling

5.1 Preparation: 1 Week Prior to Sampling

- As with outfall screening, look at the extended forecast for a day that will meet dry-weather criteria. See section 2.1 for criteria and options to obtain weather data.
- Identify which parameters will be measured in the field and which will be sent to the laboratory for analysis. Bacteria and all pollutants of concern should be taken to a lab for analysis.
- Ensure you have all required field test kits or instrumentation for parameters that will be measured in the field.
- Make arrangements with a laboratory for sample analysis and to obtain sample bottles with proper preservatives. Nearby laboratory options include:

Con-test Analytical Laboratory
39 Spruce St, East Longmeadow, MA, 01028
(413) 525-2332

RI Analytical Laboratories
131 Coolidge St Suite #105, Hudson, MA 01749
(978) 568-0041

Hub Testing Laboratory
95 Beaver St, Waltham, MA, 02453
(781) 893-8330

Sampling Parameters and Analysis Methods

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

5 Outfall Sampling

5.2 Preparation: 1 Day Prior to Sampling

- Verify that dry weather criteria will be met for the following day: **< 0.1 inch of rain in the past 24 hours and no significant snow melt.**
- Call the laboratory to remind them you will be dropping off samples the next day.
- Identify outfalls to be sampled. Map out a route for the following day. When creating the route remember that bacteria samples have a hold time of 6 hours from sample collection. It is critically important that your chosen testing laboratory is nearby to maximize your sampling time and deliver samples within 6 hours.
- Gather all required field equipment. See the Outfall Screening/Sampling Equipment Checklist ([Section 2](#)).



5 Outfall Sampling

5.3 Sampling Procedure: Day of Sampling

- Navigate to the outfall to be sampled and follow the outfall screening procedures in [Section 3.1](#).
- If the outfall (or upstream structure in the case of outfall inundation) is flowing, prepare to collect samples. Take the following precautions:
 - o Do not eat, drink or smoke or chew tobacco during sample collection
 - o Park vehicle away from sampling area and do not leave the vehicle running to reduce risk of contaminating samples
 - o Wear gloves when collecting and handling samples
 - o When collecting the sample, do not breathe in the direction of the sample bottle
 - o If using a sampling pole, triple rinse the bottle holder with distilled water then in the water to be sampled (**Skip this step for bacteria sampling**). Follow the same procedure for field meters
 - o When using a sampling pole, sample bottles should be attached directly to the bottle holder and all bottles should be clean, free of contamination, and in the case of bacteria, sterile.
 - o Do not touch the inside of sample bottles or sample bottle caps
 - o Do not enter an upstream structure to collect a sample. Use a sampling pole.

5 Outfall Sampling

5.3 Sampling Procedure: Day of Sampling



- Collect samples in the following manner:
 - o Make sure all proper PPE is in use (ie nitrile gloves, safety glasses, etc.)
 - o Fill out information on sample bottle labels. Place labels on proper bottles
 - o Collect bacteria samples first, followed by any additional parameters.
 - o If possible, collect samples from the flow directly into the sample bottles. Use a sampling pole if it is unsafe or not possible to directly collect the sample. In cases where flow is particularly light, sandbagging may be necessary to accumulate enough water to collect a sample.
 - o Place all laboratory samples (bacteria and pollutants of concern) on ice in a cooler.
 - o Use test strips, test kits and/or field meters to measure all other parameters. Record the results on the bottom of the field form.

Enter values for parameters measured in the field. For Bacteria and Pollutants of concern note "Laboratory Analysis"

Samples Taken and Sampling Results			
Temp. 21.2 °C	Conductivity	Salinity	Chlorine
Ammonia	Surfactants	Bacteria Laboratory Analysis	Pollutant of Concern Laboratory Analysis

5 Outfall Sampling

5.4 Post Sampling Procedures

- Schedule any revisits to outfalls.
 - If the outfall was “Damp” then it must be revisited within 7 days.
- Store field forms, laboratory data and copies of Chains of Custody together in a designated space.
- Review the data and update ranking/prioritization of outfalls. Outfalls that show visual or olfactory signs of illicit discharge or that exceed the benchmark criteria for any parameters should be ranked as “High” priority.
- For outfalls with evidence of an illicit discharge, begin source isolation and identification procedures outlined in the written IDDE Program Plan.

Likely Sewer Input Indicators

- 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
- Ammonia ≥ 0.5 mg/L, surfactants ≥ 0.25 mg/L, and detectable levels of chlorine

Analyte or Parameter	IDDE Benchmark Criteria
Ammonia	>0.5 mg/L
Conductivity	>2,000 μ S/cm
Surfactants	>0.25 mg/L
Chlorine	>0.02 mg/L (detectable levels per the 2016 MS4 Permit)
Indicator Bacteria: E.coli Enterococcus	E.coli: 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 Enterococcus: 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

6 Catchment Investigation Procedure

For all Problem and High/Low Priority catchments:

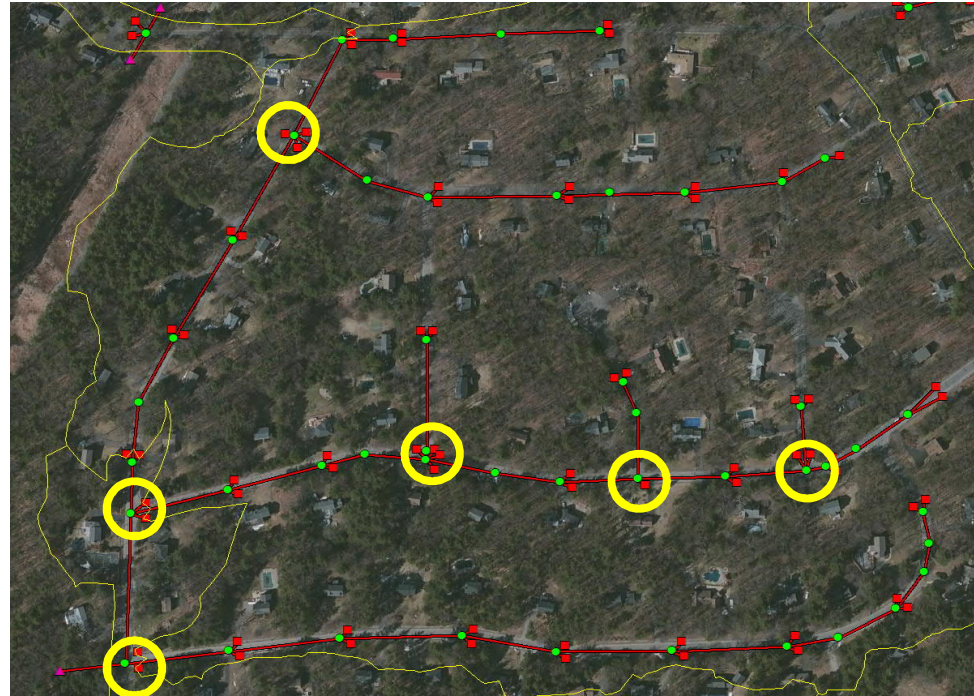
- Identify Key Junction Manholes in the catchment
- Inspect Key Junction Manholes/Catch Basins and sample any observed flow
- If sampling results indicate a potential illicit discharge, continue inspection and sampling of junction structures to isolate pipe segment where illicit discharge originates
- Conduct source identification procedures such as smoke/dye testing or video inspection of pipe segment
- Identify/locate source of discharge
- Eliminate discharge
- Perform Follow-up inspection and sampling to confirm removal of illicit discharge



6 Catchment Investigation Procedure

6.1 Identify Key Junction Manholes

For all Problem and High/Low Priority catchments:

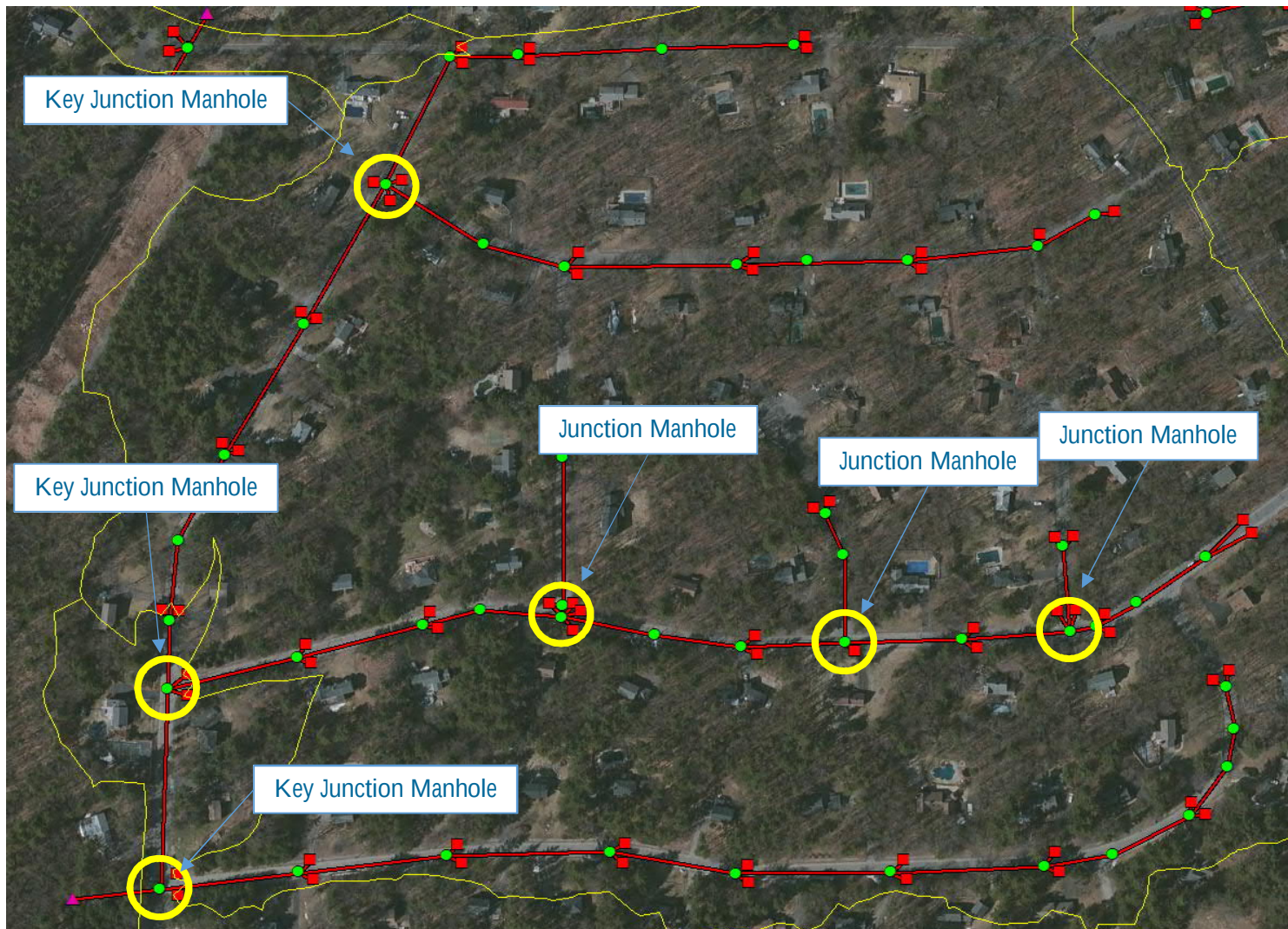


Junction Manhole - For the purposes of this permit, a junction manhole is a manhole or structure with two or more inlets accepting flow from two or more MS4 alignments. Manholes with inlets solely from private storm drains, individual catch basins, or both are not considered junction manholes for these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

Key Junction Manhole - For the purposes of this permit, 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.

6 Catchment Investigation Procedure

6.1 Identify Key Junction Manholes



6 Catchment Investigation Procedure

6.2 Inspect/Sample Key Junction Manholes

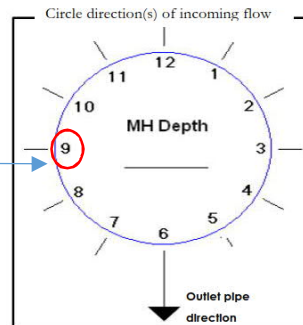
Catchment ID often times will default to the outfall ID.

Manhole Inspection Form

Catchment ID Example	Date/Time
Structure ID MH-131	Last Rain Date/Amount
Location Description Street and house or pole #	
Inspector	



Circle location of all pipes entering structure and fill out corresponding table. The "Six" position is always the outlet of the structure

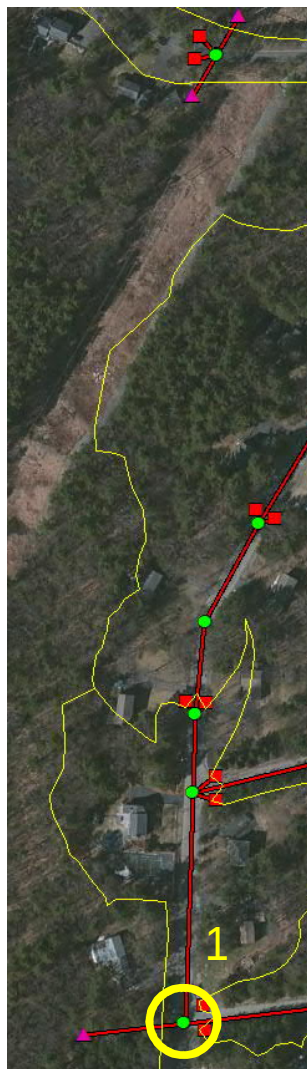


Clock Position (1-12)	Pipe Material (Concrete, HDPE, PVC, Ductile Iron, CMP)	Pipe Diameter (in.)	Invert Elevation (ft)	Upgradient Structure/Source (MH ID, CB, Priv, Unk)	Flow (Damp, Trickle, Moderate, High)
12 Conc		18		CB-123	Dry
9 Conc		24		CB-125	Trickle
6 Conc		30			

Fill in table with all pertinent information about the position, material, elevation or depth of invert, information on any upgradient structures and presence of flow

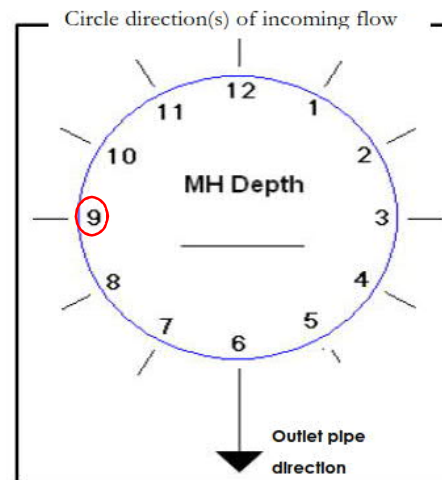
6 Catchment Investigation Procedure

6.2 Inspect/Sample Key Junction Manholes



Manhole Inspection Form

Catchment ID	Example	Date/Time
Structure ID	MH-131	Last Rain Date/Amount
Location Description	Street and house or pole #	
Inspector		



Clock Position (1-12) Pipe Material (Concrete, HDPE, PVC, Ductile Iron, CMP)	Pipe Diameter (in.)	Invert Elevation (ft)	Upgradient Structure/Source (MH ID, CB, Priv, Unk)	Flow (Damp, Trickle, Moderate, High)
12 Conc	18		CB-123	Dry
9 Conc	24		CB-125	Trickle
6 Conc	30			

6 Catchment Investigation Procedure

6.2 Inspect/Sample Key Junction Manholes



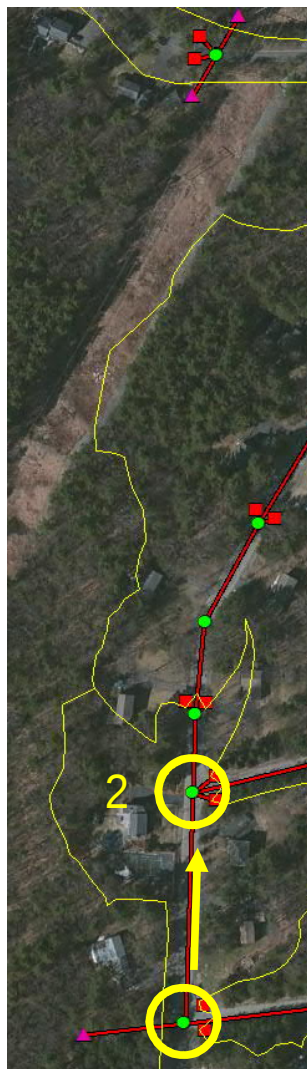
Select all applicable boxes.

Enter values for parameters measured in the field. For Bacteria and Pollutants of concern note "Laboratory Analysis"

Cover Conditions: Diameter of clear opening (in.) ☐ Buried ☐ Cannot Inspect ☐ Cannot Locate			
Evidence of Flow: ☐ Yes ☐ No		If Yes, Description of Flow: ☐ Damp ☐ Trickle ☐ Moderate ☐ High	
Visual Evidence of Illicit Discharge (select all that apply)			
Visual Inspection: ☒ None ☐ Floatables ☐ Pet Waste ☐ Oily Sheen ☐ Sanitary Waste ☐ Algae ☐ Foam			
Olfactory Evidence of Illicit Discharge (select all that apply)			
Olfactory Inspection: ☐ None ☒ Sewage Smell ☐ Musty ☐ Rotten Eggs ☐ Ammonia ☐ Petroleum			
Samples Taken and Sampling Results			
Temp.	Conductivity	Salinity	Chlorine 0.5 mg/L
Ammonia 1.0 mg/L	Surfactants 0.75 mg/L	Bacteria Laboratory Analysis	Pollutant of Concern
COMMENTS:			
Further investigation needed? ☐ Yes ☐ No			

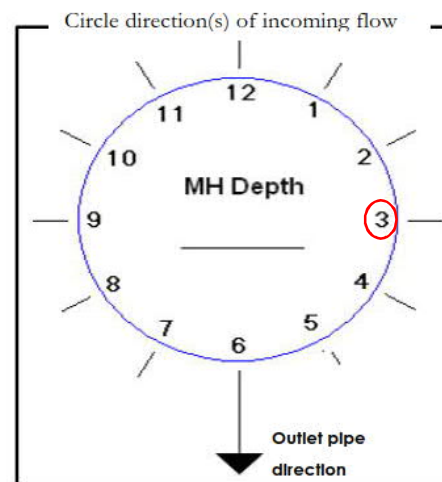
6 Catchment Investigation Procedure

6.2 Inspect/Sample Key Junction Manholes



Manhole Inspection Form

Catchment ID	Date/Time
Structure ID	Last Rain Date/Amount
Location Description	
Inspector	

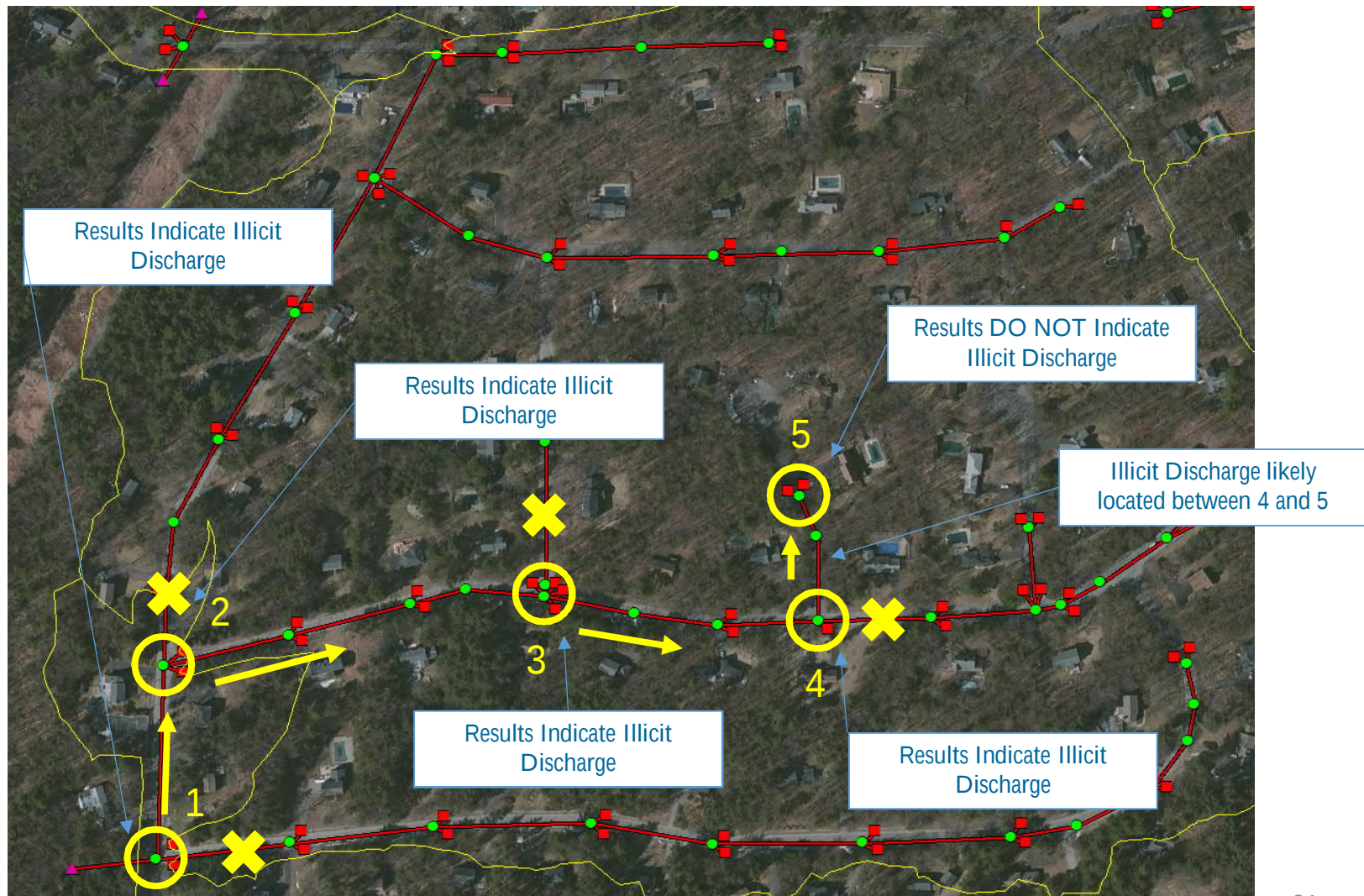


Clock Position (1-12) Pipe Material (Concrete, HDPE, PVC, Ductile Iron, CMP)	Pipe Diameter (in.)	Invert Elevation (ft)	Upgradient Structure/Source (MH ID, CB, Priv, Unk)	Flow (Damp, Trickle, Moderate, High)
12 Conc	18		CB-123	Dry
3 Conc	18		CB-125	Trickle
6 Conc	24			

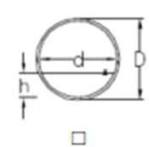
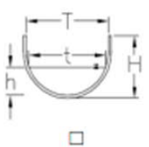
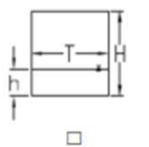
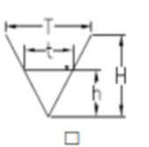
6 Catchment Investigation Procedure

6.3 Source Isolation

- Systematically inspect and sample structures in order to isolate the potential illicit discharge to a specific pipe segment.



7 Appendix 1: Outfall Screening Form

Outfall/Catchment Screening Form			
Catchment ID: _____ Inspector: _____ Street Name: _____ Last rainfall event (date and amount): _____	Town: _____ Date/Time: _____ Type of Sampling Event: ☐ Dry Weather Screening ☐ Dry Weather Sampling ☐ Wet Weather Sampling	Location: ☐ Outfall ☐ Manhole ☐ Catch Basin ☐ Interconnection	 
Is outfall submerged/inundated? ☐ Yes ☐ No If YES screen/sample at 1" non-influenced structure: ☐ MH ☐ CB			
Structure ID: _____		Latitude: _____ Longitude: _____	
Shape of Pipe/Swale (check one)			
 ☐	 ☐	 ☐	 ☐
Rounded Pipe	Rounded Swale	Rectangular Pipe/Swale	Triangular Swale
Outfall Material: ☐ Concrete ☐ HDPE ☐ Corrugated Metal Pipe ☐ Ductile Iron ☐ Clay ☐ PVC ☐ Other Outfall/Manhole/Catchbasin Condition: ☐ Good ☐ Fair ☐ Poor ☐ Crumbling	Pipe Measurements: Inner Dia. (in.): d = _____ Outer Dia. (in.): D = _____ Pipe Width (in.): W = _____ Pipe Height (in.): H = _____ Flow Depth (in.): h = _____	Swale Measurements: Swale Width (in.): T = _____ Flow Width (in.): t = _____ Swale Height (in.): H = _____ Flow Depth (in.): h = _____ Bottom Width (in.): b = _____	
Evidence of Flow: ☐ Yes ☐ No If Yes, Description of Flow: ☐ Damp ☐ Trickle ☐ Moderate ☐ High			
Visual Evidence of Illicit Discharge Visual Inspection: ☐ None ☐ Floatables ☐ Pet Waste ☐ Oily Sheen ☐ Sanitary Waste ☐ Algae ☐ Foam			
Olfactory Evidence of Illicit Discharge Olfactory Inspection: ☐ None ☐ Sewage Smell ☐ Musty ☐ Rotten Eggs ☐ Ammonia ☐ Petroleum			
Samples Taken and Sampling Results			
Temp.	Conductivity	Salinity	Chlorine
Ammonia	Surfactants	Bacteria	Pollutant of Concern

7 Appendix 2: Manhole Screening Form

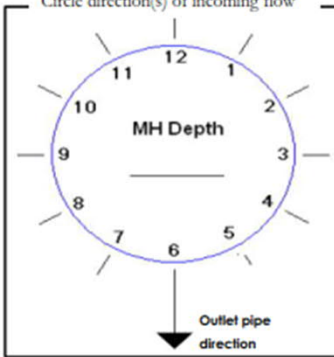
Manhole Inspection Form

Catchment ID	Date/Time
Structure ID	Last Rain Date/Amount
Location Description	
Inspector	





Circle direction(s) of incoming flow



Clock Position (1-12) Pipe Material (Concrete, HDPE, PVC, Ductile Iron, CMP)	Pipe Diameter (in.)	Invert Elevation (ft)	Upgradient Structure/Source (MH ID, CB, Priv, Unk)	Flow (Damp, Trickle, Moderate, High)

Cover Conditions: Diameter of clear opening (in.)	☐ Buried	☐ Cannot Inspect	☐ Cannot Locate
Evidence of Flow: ☐ Yes ☐ No	If Yes, Description of Flow: ☐ Damp ☐ Trickle ☐ Moderate ☐ High		

Visual Evidence of Illicit Discharge (select all that apply)	
Visual Inspection: ☐ None ☐ Floatables ☐ Pet Waste ☐ Oily Sheen ☐ Sanitary Waste ☐ Algae ☐ Foam	
Olfactory Evidence of Illicit Discharge (select all that apply)	
Olfactory Inspection: ☐ None ☐ Sewage Smell ☐ Musty ☐ Rotten Eggs ☐ Ammonia ☐ Petroleum	

Samples Taken and Sampling Results			
Temp.	Conductivity	Salinity	Chlorine
Ammonia	Surfactants	Bacteria	Pollutant of Concern

COMMENTS:

Further investigation needed? ☐ Yes ☐ No

Attachment C



Illicit Discharge Detection and Elimination (IDDE) Workshop

Central Massachusetts Regional Stormwater Coalition
(CMRSWC)

April, 2019

Fuss & O'Neill Team

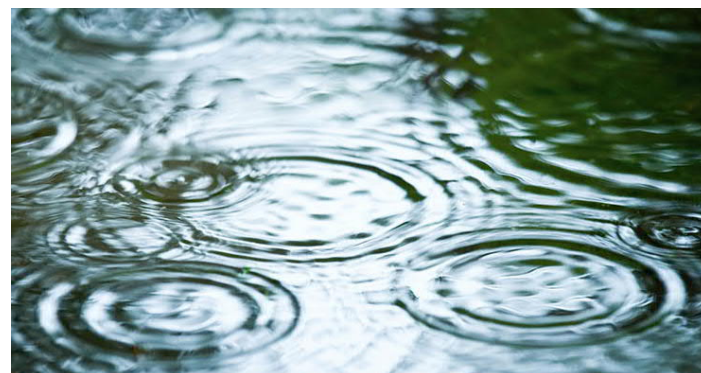
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Springfield, MA 01103

Today's Agenda

- 08:15 – 08:30 Introduction
- 08:30 – 09:30 IDDE 101/MS4 Compliance
- 09:30 – 09:45 Safety Considerations
- 09:45 – 10:00 IDDE Program Planning
- 10:00 – 10:15 Break
- 10:15 – 10:30 Outfall Inspection/Sampling
- 10:30 – 10:45 Catchment Investigation
- 10:45 – 12:00 Outfall/Structure Inspections
- 12:00 – 12:45 Lunch
- 12:45 – 02:00 Field Kit Training



MS4, what?

Municipal Separate Storm Sewer System (MS4)

- Storm drainage system owned or operated by a municipality, state or federal agency
- Discharges to surface waters

Regulated Small MS4s

- Small MS4 located partially or entirely within an Urbanized Area (defined by 2010 U.S. Census)



MS4 Permit 101

US Environmental Protection Agency

- Phase II Stormwater Program - 1999
 - Targets smaller communities in “urbanized areas”
 - *Goal is to reduce the discharge of* **EM11** *pollutants to the “maximum extent practicable”*
 - Construction sites disturbing ≥ 1 acre
- General Permit for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems in Massachusetts (MA MS4 Permit)



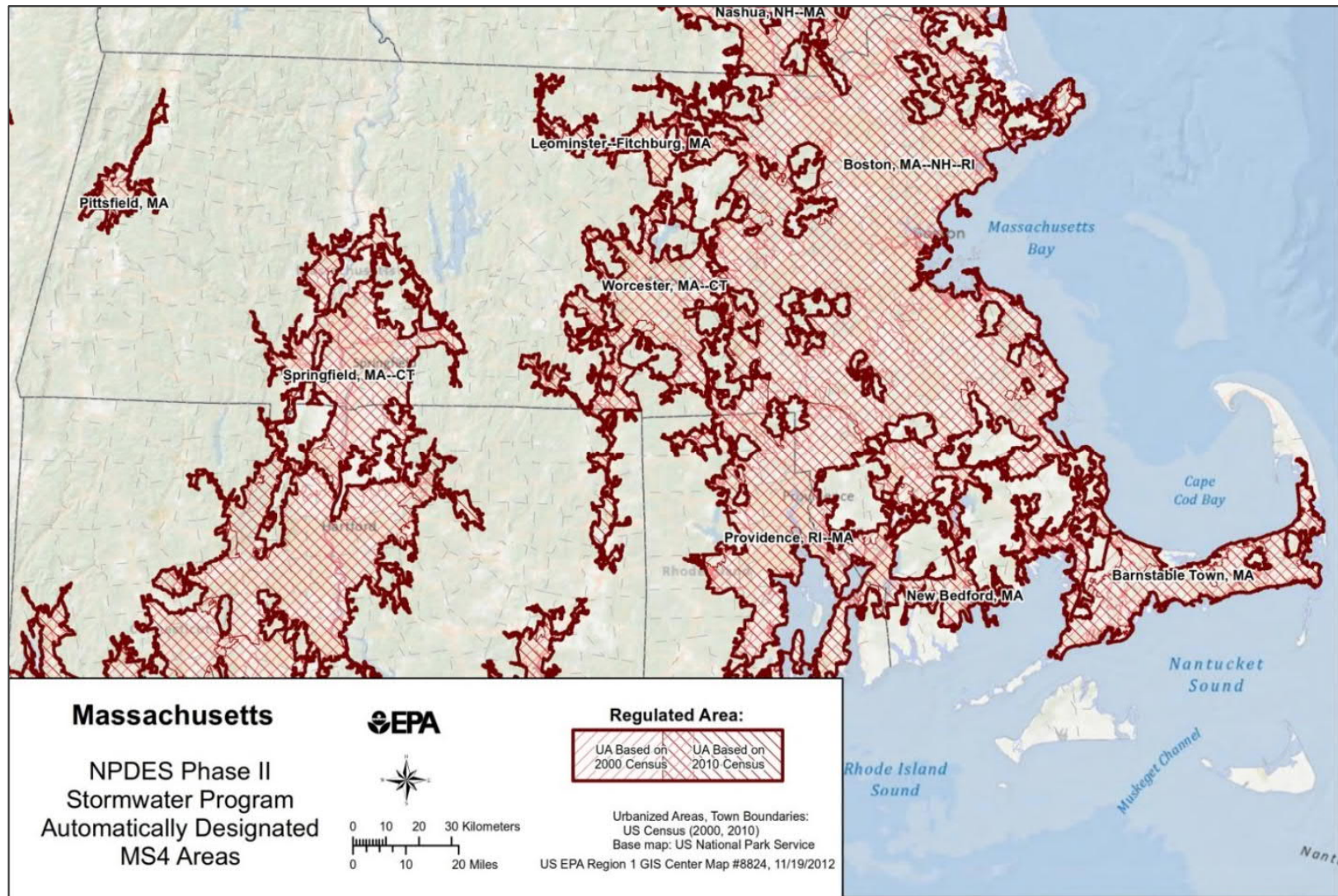
EM11

On this slide or the next one, actually call out the name of the permit: General Permit for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems in Massachusetts (MS4 Permit) See what I added below.

Erik Mas, 2019-04-23

MS4 Regulated Areas in MA

EM12



EM12

Rename to "MS4 Regulated Areas in MA"

Erik Mas, 2019-04-23

Phase II Stormwater Program



MCM 1: Public Education and Outreach

- 2 messages each to 4 audiences over term of permit (8 total)
- Audiences
 - Residential
 - Businesses, Institutions, Commercial
 - Industrial
 - Developers
- Additional Messaging for waters subject to a TMDL



MCM 2: Public Participation

- Need to provide opportunities for public participation
- Annual report public notice
- Town website, stormwater committee, public meetings



MCM 4: Construction Site Runoff Controls

- Essentially unchanged from 2003 permit
- Ordinance or regulatory mechanism to control construction site runoff
- Also include controls for other construction related wastes including demolition debris, litter, and sanitary wastes
- Written site plan review procedure (CMRSWC Template)
- Inspections to be conducted both during BMP construction and after to ensure proper installation and operation



MCM 5: Post-Construction Stormwater Management

Development Sites >1acre

- Controls need to retain 1-inch of runoff from impervious surfaces AND/OR
- Controls need to remove 90% of TSS and 60% of TP (annual load)

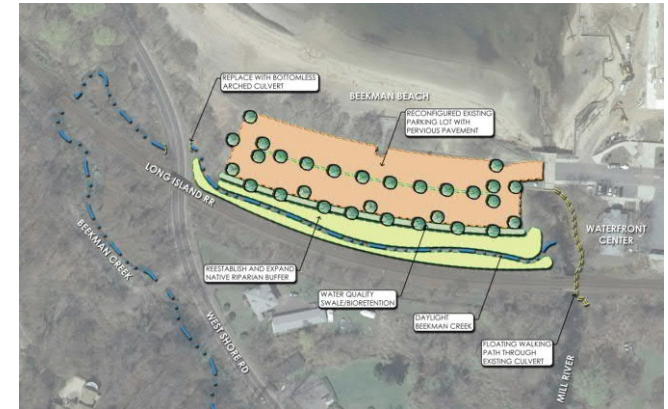
Redevelopment Sites >1acre

- Controls need to retain 0.8-inch of runoff from impervious surfaces AND/OR
- Controls need to remove 80% of TSS and 50% of TP (annual load)



MCM 5: Post-Construction Stormwater Management

- Shall require as-built drawings no later than 2 years after completion of construction projects
- Shall have procedures to ensure long-term operation and maintenance of on site controls
- Within 4 years of the effective date permittees will need to complete a retrofit inventory of at least 5 municipally owned properties.
 - These identified projects can be used for offsite mitigation within same HUC10
 - Municipality needs to keep a rolling list of 5 opportunities



MCM 6: Good Housekeeping

What falls under Good Housekeeping?

- SWPPPs
- Street Sweeping
- Catch Basin Cleaning
- Winter De-Icing Operations



MCM 6: Good Housekeeping (cont.)

- Written O&M Plans
 - Infrastructure
 - Operations (i.e., parks and open space, facilities, and vehicles & equipment)
- Routine cleaning of catch basins such that no basin will be >50% full
 - Need to report total #of catch basins, # inspected, #cleaned, and the total volume/mass of material removed from all catch basins annually
- All streets swept once annually
 - Exceptions – rural uncurbed roads with no catch basins & TMDL watersheds (2x/year)
 - Need to report # of miles cleaned or volume/mass of material removed annually



Infrastructure O&M Plan

CMRSWC Resource

Municipal Stormwater Infrastructure Operation and Maintenance Plan

Central Massachusetts Regional Stormwater Coalition

June 30, 2016



This project has been financed with Funds from the Massachusetts Department of Environmental Protection (the Department). The contents do not necessarily reflect the views and policies of the Department, nor does the mention of trade names or commercial products constitute endorsement or recommendation for use.



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Municipal Stormwater Infrastructure Operation and Maintenance Plan

Central Massachusetts Regional Stormwater Coalition

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5	Winter Road Maintenance	3
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Appendices

Appendix A – Stormwater Infrastructure Map
Appendix B – Catch Basin Inspection/Cleaning Procedure, Inspection Form, and Log
Appendix C – Street and Parking Lot Sweeping Log
Appendix D – Inventory of Structural Stormwater Best Management Practices
Appendix E – Structural Stormwater BMP Inspection Procedures and Checklists

MCM 6: Good Housekeeping (cont.)

Stormwater Pollution Prevention Plans (SWPPPs)

- New requirement under 2016 permit
- Required for maintenance garages, public works yards, transfer stations, and other waste handling facilities where pollutants are exposed to stormwater
- Covers the following topics specific to the site:
 - Spill Prevention and Response
 - Erosion and Sediment Control (on-site)
 - Salt Storage
 - Training
 - Maintenance

MCM 3: IDDE

- Illicit Discharge Detection and Elimination
- Area of largest change between 2003 and 2016 permit
- 2003 permit required an ordinance, map of **outfalls**
- New permit requirements include:
 - Additional mapping requirements
 - Catchment delineations
 - Dry-weather outfall inspections
 - Catchment Investigations



What are Illicit Discharges?

- Any substance entering storm drain system not entirely composed of stormwater
- Some examples
 - Illegal floor drain connections
 - Broken sanitary sewer lines
 - Sanitary cross-connections
 - Sanitary sewer overflows
 - Car washwater
 - Grass clippings, pet waste, or other material dumped into catch basins



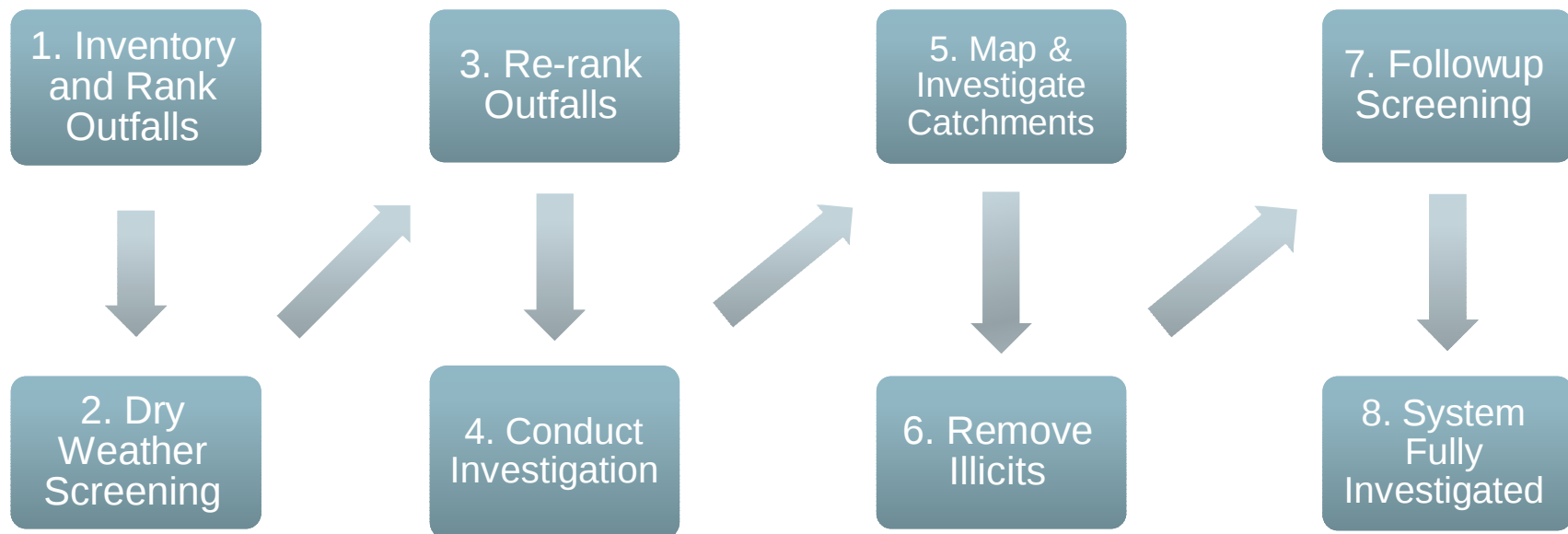
Not All Discharges are Illicit

Permit allows some limited discharges*

- Water line flushing
- Landscape irrigation
- Diverted stream flows
- Rising ground water
- Uncontaminated ground water infiltration (40 CFR § 35.2005(20))
- Uncontaminated pumped ground water
- 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
- Flows from riparian habitats and wetlands
- De-chlorinated swimming pool discharges
- Street wash waters
- Residential building wash waters without detergents
- Flows from firefighting

*Unless you, EPA, or DEP determines these are significant source of pollutants

New IDDE Program Protocol



IDDE Requirements & Deadlines

EM16

Requirement	1YR	1.5YR	3YR	7YR	10YR
Written IDDE Plan	X				
Outfall/Interconnection Inventory and Ranking	X				
SSO Inventory	X				
Catchment Investigation Procedure		X			
Dry Weather Outfall Sampling			X		
Follow-up ranking of outfalls and interconnections			X		
Catchment Investigations - Problem				X	
Catchment Investigations - Problem, High & Low Priority					X

Red = dry weather outfall screening and sampling

Blue = wet weather screening and sampling

EM16

Make sure the schedule outlined in our table matches the deadlines in the permit. I inserted this graphic from EPA, which I used in the PVPC presentation.

Erik Mas, 2019-04-23

Written IDDE Program

- Required by end of Year 1
- Formal documentation of program and process already in place
- Must describe procedures for
 - Sample collection
 - Use of field kits
 - Storage and conveyance of samples (incl. hold times)
 - Field data collection and storage



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Written IDDE Program – Template



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Appendices

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Appendix B –	Storm System Mapping
Appendix C –	Outfall Inventory and Priority Ranking
Appendix D –	Field Forms, Sample Bottle Labels, and Chain of Custody Forms
Appendix E –	Water Quality Analysis Instructions, User's Manuals and Standard Operating Procedures
Appendix F –	IDDE Employee Training Record
Appendix G –	Source Isolation and Confirmation Methods: Instructions, Manuals, and SOPs



Written IDDE Program – Template

- Instruction boxes
 - Boilerplate text
 - Highlighted text to add or edit
- ☐ Community-specific information



1 Introduction

Instructions: Throughout this document, the symbol '##' has been used to represent locations where community or site-specific information is required.

1.1 MS4 Program

This Illicit Discharge Detection and Elimination (IDDE) Plan has been developed by ##MUNICIPALITY 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

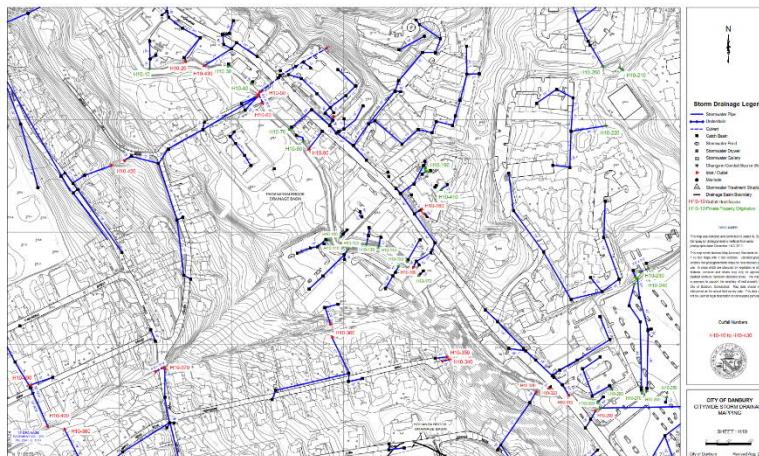
An "illicit discharge" is any discharge to a drainage system that is not composed entirely of stormwater, with the exception of discharges pursuant to a NPDES permit (other than the NPDES permit for discharges from the MS4) and discharges resulting from fire-fighting activities.

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 pollutant) into catch basins, a resident or contractor illegally tapping a new sewer lateral into a storm drain pipe to avoid the costs of a sewer connection fee and service, and illegal dumping of yard wastes into surface waters.

Storm System Mapping

- Outfalls, manholes, catch basins, pipes, interconnections, and refined catchment delineations by year 10
- Much of this info will be needed earlier to complete catchment delineations and investigations
- Outgoing interconnections are outfalls



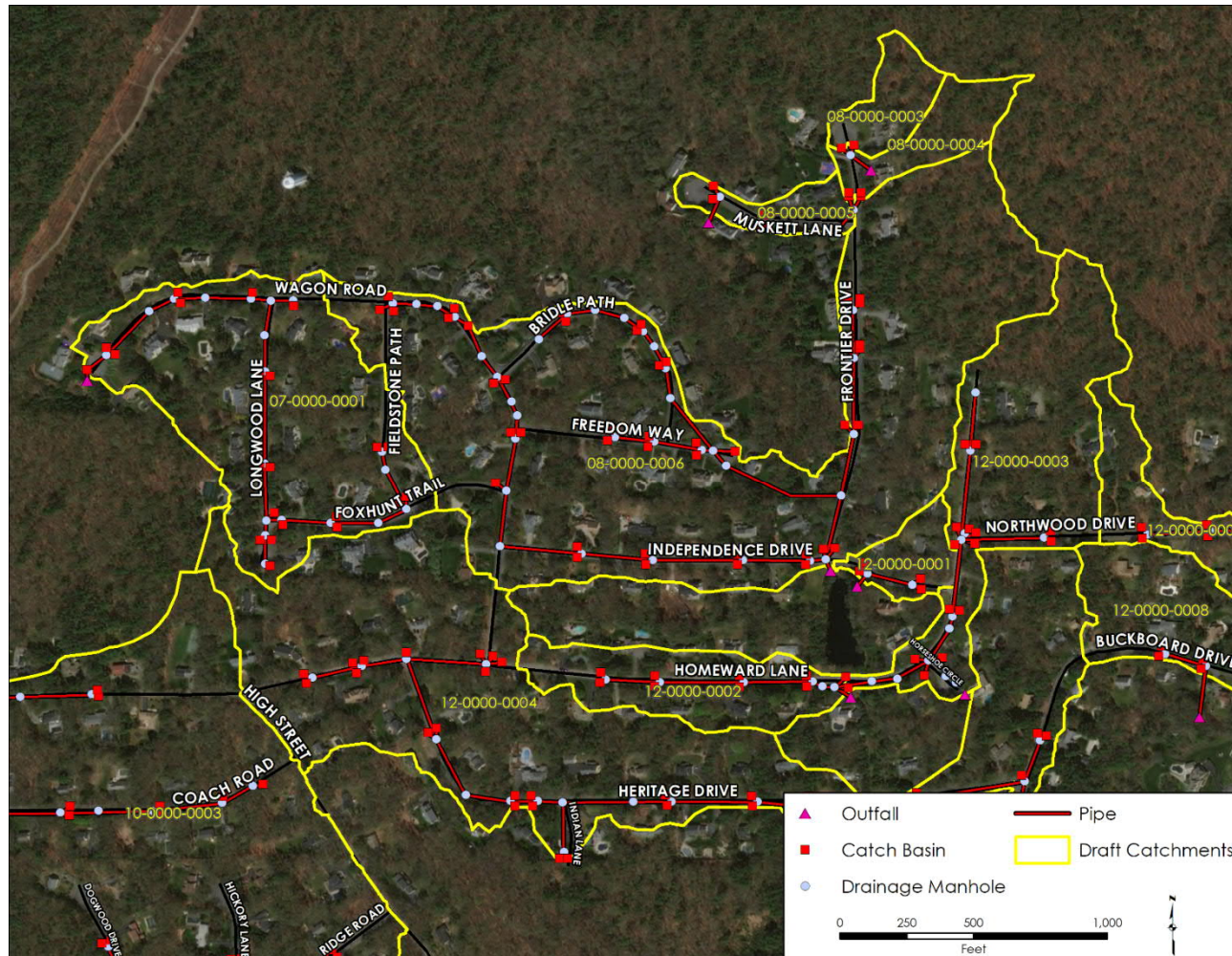
EM20

EM20

I added a storm system map graphic

Erik Mas, 2019-04-23

Delineation Example



Sanitary Sewer Overflows (SSOs)

- Inadequate conveyance capacity
- Inventory of locations going back 5 years
- Must report new SSOs to EPA
 - Verbally w/in 24 hours
 - In writing within 5 days
- Requires mitigation and corrective action



Sanitary Sewer Overflows

- Inventory and subsequent reports to EPA must contain:
 - Location (street crossing/address and receiving water)
 - Did SSO enter stream/pond directly or MS4?
 - Date(s) and time(s) of beginning and end of discharge
 - Estimate volume of discharge
 - Description, including known or suspected cause
 - Mitigation and corrective measures completed, with dates
 - Mitigation and corrective measures planned, with implementation schedule

Priority Ranking Criteria

Rank using the following criteria:

- Past discharge complaints/reports
- Poor receiving water quality (Impairment/TMDL)
- Density of generating sites
- Age of development and infrastructure
- Sewer conversion
- Historically combined systems
- Surrounding density of aging septic systems
- Culverted streams longer than a simple road crossing

****No mention of how to rank based on criteria,
just that these criteria be used**

Outfall/Catchment Ranking

- Ranking grouped into the following categories:
 - **Problem:** Known or suspected illicit discharges based on existing info
 - **High Priority:** Discharging to an area of concern or previous evidence of an illicit discharge
 - **Low Priority:** Lack of screening or system vulnerability factors
 - **Excluded:** No potential for illicit discharges



Dry Weather Outfall Inspection/Sampling

- For each outfall and interconnection, conduct visual inspection during dry weather

Basic Information

- Unique identifier
- Receiving water
- Date of most recent inspection
- Dimensions
- Shape
- Material (concrete, PVC)
- Spatial location (latitude & longitude with a minimum accuracy of +/-30 feet)
- Physical condition

Evidence of Non-Stormwater Flows

- Odor: sewage, sulfur, sour, rancid, petroleum/gas smells
- Visual: color, turbidity (cloudy water), floatables (suds, toilet paper), or oil sheen

Illicit Discharges – What to Look For

Natural Sheen vs. Synthetic Sheen



Natural sheen



Synthetic sheen

Foam and Suds



Low severity, naturally occurring suds



High severity suds

Illicit Discharges – What to Look For

Sanitary sewer input



There could be a noticeable smell

Sanitary sewer input, trash



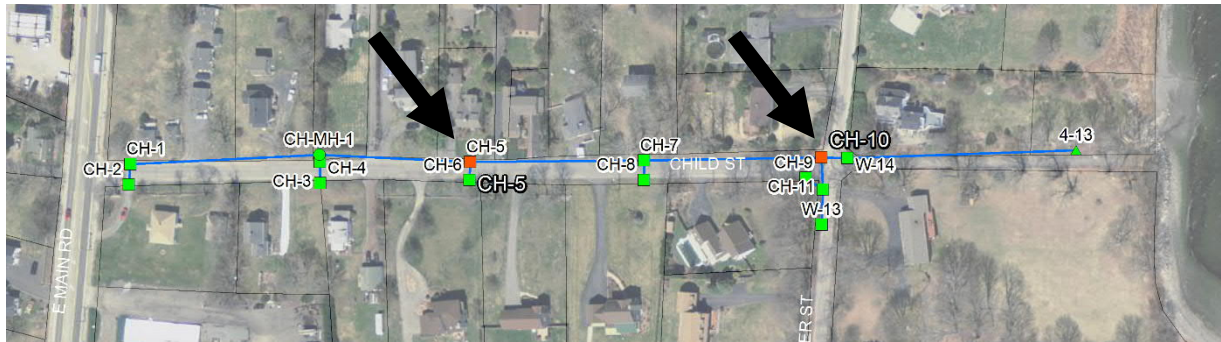
Likely Sewer Input Indicators

- 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
- Ammonia ≥ 0.5 mg/l, surfactants ≥ 0.25 mg/l, and detectable levels of chlorine

Evidence of Flow: ☐ Yes ☐ No If Yes, Description of Flow: ☐ Damp ☐ Trickle ☐ Moderate ☐ High			
Visual Evidence of Illicit Discharge Visual Inspection: ☐ None ☐ Floatables ☐ Pet Waste ☐ Oily Sheen ☐ Sanitary Waste ☐ Algae ☐ Foam			
Olfactory Evidence of Illicit Discharge Olfactory Inspection: ☐ None ☐ Sewage Smell ☐ Musty ☐ Rotten Eggs ☐ Ammonia ☐ Petroleum			
Samples Taken and Sampling Results			
Temp.	Conductivity	Salinity	Chlorine
Ammonia	Surfactants	Bacteria	Pollutant of Concern

Catchment Investigations

- System Vulnerability Factors – indicators of likely sanitary sewer input
 - SSOs, sanitary/storm pipe alignment crossings, past CSO areas, infiltration/inflow, etc.
- Key Junction Manholes to streamline effort



Isolate pipe segment where illicit discharge enters system

Catchment Investigations

- Where System Vulnerability Factor(s) present, must also conduct wet-weather sampling (i.e., during rain event)
 - Do high sanitary flows during wet weather or high-groundwater in Title 5 system areas enter storm drain system?
- When pipe segment is identified, locate source
 - Video investigation
 - Smoke/dye testing
- Work with property owner or use bylaw enforcement mechanism to remove any illicit connections found
- Document investigations and enforcement/removal actions
 - Include in Annual Reports

QUESTIONS?



Outfall Screening/Sampling How-To

- Safety Considerations
- IDDE Program Planning
- Outfall Inspection Form
- Manhole/Catch Basin Inspection Form



General Safety Considerations

- Traffic
- Weather
- Water Quality
- Insects: Ticks, Bees, Hornets & Wasps, Mosquitos
- Plants: Poison Ivy, Poison Sumac, Poison Oak
- Excessive Heat
- Slips/Trips/Falls
- Drowning
- Stuck in mud



Example Job Hazard Analysis (JHA)

Job Hazard Analysis (JHA)

PROJECT/PROJECT LOCATION:		DATE:		☐ NEW ☐ REVISED	PAGE 1 of 1
PROJECT/TASK NUMBER:		TASK ACTIVITY: Conduct Dry-Weather IDDE Inspection/Sampling		TASK DESCRIPTION: Collect samples of potential illicit discharges at outfalls or stormwater structures	
PREPARER(S)		REVIEWED BY		SITE CONTACT	EMERGENCY CONTACT
MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT (SEE CRITICAL ACTIONS FOR TASK-SPECIFIC REQUIREMENTS)					
☐ SAFETY VEST ☐ HARD HAT ☐ LIFELINE / BODY HARNESS ☐ SAFETY GLASSES		☐ GOGGLES ☐ FACE SHIELD ☐ HEARING PROTECTION ☐ SAFETY SHOES		☐ AIR PURIFYING RESPIRATOR ☐ PPE CLOTHING TYPE: ☐ LIFE JACKET (PFD)	
				☐ GLOVES (Type <u>nitrile</u>) ☐ FIRE EXTINGUISHER ☐ CONES ☐ OTHER	
JOB STEPS		POTENTIAL HAZARDS		CRITICAL ACTIONS	

Site-Specific Training Requirements:

Field Team Member Review of JHA

I have read and understand the JHA and will comply with the provisions contained herein.

Name Printed

Signature

Date

Example Job Hazard Analysis (JHA)

Job Hazard Analysis (JHA)

PROJECT/PROJECT LOCATION:		DATE:		☐ NEW ☐ REVISED	PAGE 1 of 1
PROJECT/TASK NUMBER:		TASK ACTIVITY: Conduct Dry-Weather IDDE Inspection/Sampling		TASK DESCRIPTION: Collect samples of potential illicit discharges at outfalls or stormwater structures	
PREPARER(S)		REVIEWED BY		SITE CONTACT	EMERGENCY CONTACT
MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT (SEE CRITICAL ACTIONS FOR TASK-SPECIFIC REQUIREMENTS)					
☒ SAFETY VEST ☐ HARD HAT ☐ LIFELINE / BODY HARNESS ☒ SAFETY GLASSES		☐ GOGGLES ☐ FACE SHIELD ☐ HEARING PROTECTION ☐ SAFETY SHOES		☐ AIR PURIFYING RESPIRATOR ☒ PPE CLOTHING TYPE: <u>Warm Clothing, Hi-Vis Vest</u> ☐ LIFE JACKET (PFD)	
☒ GLOVES (Type <u>nitrile</u>) ☐ FIRE EXTINGUISHER ☒ CONES ☐ OTHER					
JOB STEPS		POTENTIAL HAZARDS		CRITICAL ACTIONS	
1. Arrive on site 2. Evaluate traffic hazard 3. Access outfall 4. Collect Sample (As Necessary) 5. Conduct field kit tests		1. Slip, trip, fall 2. Weather exposure 3. Traffic 4. Ticks 5. Poison Ivy / Poison Sumac 6. Falling into water 7. Confined Space 8. Lifting Posture While Removing Heavy Covers-Back Injuries Losing Control Of Cover While Trying To Remove, Pinched Hands & Feet 9. Pathogen exposure		1. Use appropriate foot wear. Avoid steep slopes 2. Wear clothing appropriate to conditions. Bring wet-weather clothing in case of rain. Use sunscreen as needed 3. Park car in safe location where possible. If working in roadway, park vehicle between traffic and work site, set up cones around site and vehicle, and use hazard lights. Wear high visibility vest. Be vigilant and aware of surroundings at all times. 4. Wear long sleeves and pants. Tuck pants into socks. Check for ticks upon returning, utilize tick repellent 5. Be able to recognize plant and avoid, use tecnu wash if contact made 6. Bring a change of cloths, Wear a PFD as appropriate 7. DO NOT ENTER ANY STRUCTURE OR CONFINED SPACE 8. Use magnetic manhole lifter to open structure and manipulate cover. Set up cones around open structure. 9. Wear nitrile gloves and safety glasses when collecting samples. Wash hands before eating. Keep cell phone on you in case of emergency	

Site-Specific Training Requirements:

Field Team Member Review of JHA

I have read and understand the JHA and will comply with the provisions contained herein.

Name Printed

Signature

Date

Safety Minute

What's wrong with this picture?



Safety Minute

What's wrong with this picture?



IDDE Program Planning

- Equipment Checklist
- Sampling Procedure
- Data Collection Options
- Weather Considerations

Outfall Sampling Checklist

Equipment needed for both screening and sampling:

- ☐ Clipboard
- ☐ Field Sheets/ Tablet
- ☐ Pens/Pencils/Permanent Markers
- ☐ Dry Erase Board and Markers
- ☐ Measuring Tape
- ☐ Flashlight/Headlamp with Batteries
- ☐ Digital Camera (or phone with a camera)
- ☐ GPS Receiver (or phone with a GPS app.)
- ☐ Manhole Cover Assisted Opener, Pry Bar, Pick, and/or Manhole Lifter
- ☐ Small Mallet or Hammer
- ☐ Appropriate footwear (Boots and/or Waders)
- ☐ Reflective Vest
- ☐ Traffic Cones
- ☐ Poison Ivy Scrub

Equipment needed for sampling:

- ☐ Sampling Pole
- ☐ Utility Knife
- ☐ Zip ties/Duct Tape
- ☐ Safety Glasses
- ☐ Nitrile Gloves
- ☐ Hand Sanitizer
- ☐ Chain of Custody Forms
- ☐ Cooler with Ice
- ☐ Water Quality Sonde (if needed/available for conductivity, temperature and pH)
- ☐ Water Quality Meter (if needed/available for ammonia, surfactants and/or chlorine)
- ☐ Test Kits (if needed/available for ammonia and surfactants)
- ☐ Labels for sample bottles
- ☐ Sample bottles (bring some extras; bacteria bottles need to be sterile)
- ☐ Sand bags (for damming low flows)

It's a lot of stuff. Stay organized and prep all gear the day before inspection/sampling.

General Inspection/Sampling Procedure

1. Identify Outfall to Inspect/Sample
2. Fill out all sample information on field sheets and bottles as completely as possible
3. Conduct Visual and Olfactory Investigation
4. If sampling, put on protective gloves (nitrile/latex/other)
5. If using a sampling pole: triple rinse dipper in distilled water and then in water to be sampled (not for bacteria sampling)
6. Collect sample with pole or directly in sample containers. Do Not Disturb Sediments.
7. Collect additional samples as necessary depending on parameters
8. Conduct Test Strip and Test Kit analyses as needed
9. Conduct meter readings as needed (Rinse similar to sampling pole dipper)
10. Place Lab samples on ice, fill out Chain of Custody
11. Deliver samples to lab
12. Dispose of used test strips and test kit ampules properly

Paper vs. Digital Data Collection

Outfall/Catchment Screening Form

Catchment ID: _____ Town: _____

Inspector: _____ Date/Time: _____

Street Name: _____

Last rainfall event (date and amount): _____

Type of Sampling Event ☐ Dry Weather Screening ☐ Wet Weather Sampling

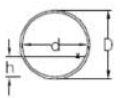



Location: ☐ Outfall ☐ Manhole ☐ Catch Basin ☐ Interconnection

Is outfall submerged/inundated? ☐ Yes ☐ No If YES screen/sample at 1st non-influenced structure: ☐ MH ☐ CB

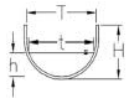
Location ID: _____ Latitude: _____ Longitude: _____

Shape of Pipe/Swale (check one)



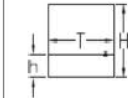
☐

Rounded Pipe



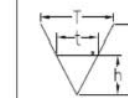
☐

Rounded Swale



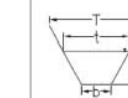
☐

Rectangular Pipe/Swale



☐

Triangular Swale



☐

Trapezoidal Swale

Outfall Material: ☐ Concrete ☐ HDPE ☐ Corrugated Metal Pipe (CMP) ☐ Ductile Iron ☐ Clay ☐ PVC ☐ Other Outfall/Manhole/Catchbasin Condition: ☐ Good ☐ Fair ☐ Poor ☐ Crumbling	Pipe Measurements: Inner Dia. (in.): d = _____ Outer Dia. (in.): D = _____ Pipe Width (in.): W = _____ Pipe Height (in.): H = _____ Flow Depth (in.): h = _____	Swale Measurements: Swale Width (in.): T = _____ Flow Width (in.): t = _____ Swale Height (in.): H = _____ Flow Depth (in.): h = _____ Bottom Width (in.): b = _____
--	--	---

Evidence of Flow: ☐ Yes ☐ No If Yes, Description of Flow: ☐ Damp ☐ Trickle ☐ Moderate ☐ High

Visual Evidence of Illicit Discharge

Visual Inspection: ☐ None ☐ Floatables ☐ Pet Waste ☐ Oily Sheen ☐ Sanitary Waste ☐ Algae ☐ Foam

Olfactory Evidence of Illicit Discharge

Olfactory Inspection: ☐ None ☐ Sewage Smell ☐ Musty ☐ Rotten Eggs ☐ Ammonia ☐ Petroleum

Samples Taken and Sampling Results			
Temp.	Conductivity	Salinity	Chlorine
Ammonia	Surfactants	Bacteria	Pollutant of Concern

✕
Dry Weather Sampling Form
📶 ☰

Sample Start Time *
 April 11, 2019 1:50 PM ✕

Sampler Name(s) *

Last Rain Date *
 Date of last precipitation >0.1 inches, recorded at Groton Airport [Click here](#)
 Date _____

Last Rain Amount *
 Amount of precipitation >0.1 inches, recorded at Groton Airport

▼ **Sample Location**

Is the outfall inundated? *
☐ Yes ☐ No

Picture *




▼ **Sample Info**

How much flow is present? *
☐ Dry ☐ Damp (wet, no flow) ☐ Trickle (minor flow) ☐ Moderate flow ☐ High flow

Are there any visual indicators of illicit discharge? *
☐ None ☐ Floatables ☐ Pet waste ☐ Oily sheen ☐ Sanitary waste
☐ Excessive algae ☐ Foam

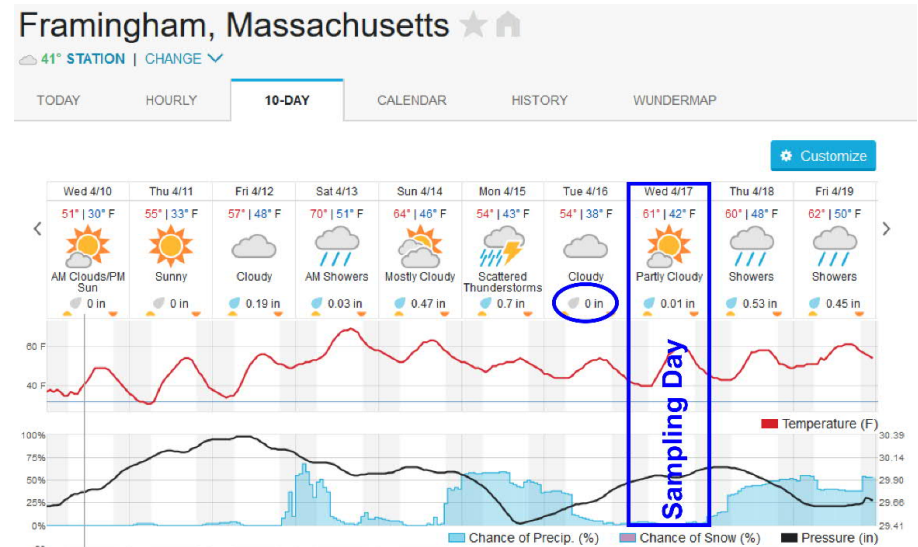
Are there any smells indicating illicit discharge? *
☐ None ☐ Sewage smell ☐ Must ☐ Rotten eggs ☐ Ammonia
☐ Petroleum ☐ Clean laundry

✓

Weather Considerations

Preparation: 1 week prior to screening

- Look at the extended forecast for a day that will meet dry weather criteria
 - < 0.1 inch of rain in the past 24 hours and no significant snow melt.
 - o Get weather data
 - o Use Weather Underground or similar weather service
- <https://www.wunderground.com>
- o Enter your town/city in the search bar. Hourly forecasts with rain totals and historical rainfall data are provided.
 - Acquire all required field equipment. See the Outfall Screening Equipment Checklist.



Weather Considerations

Preparation: 1 day prior to screening

- Verify that dry weather criteria will be met for the following day: **< 0.1 inch of rain in the past 24 hours and no significant snow melt.**
- Identify outfalls to be screened based on initial outfall inventory and priority ranking. Plan a route to minimize driving time.
- Gather all required field equipment. See the Outfall Screening Equipment Checklist.

Framingham, Massachusetts  

42° STATION | [CHANGE](#) 

TODAY **HOURLY** 10-DAY CALENDAR HISTORY WUNDERMAP

< Hourly Forecast for Tomorrow, Thursday 04/11 >

 **Tomorrow 04/11**  0% / 0 in
Mainly sunny. High near 55F. Winds NW at 10 to 15 mph.

 **Tomorrow Night 04/11**  0% / 0 in
Mainly clear skies. Low 33F. Winds light and variable.

Time	Conditions	Temp.	Feels Like	Precip	Amount	Cloud Cover	Dew Point	Humidity	Wind	Pressure
7:00 am	 Sunny	32 °F	26 °F	1%	0 in	6%	20 °F	61%	7 mph NW	30.16 in
8:00 am	 Sunny	36 °F	29 °F	0%	0 in	2%	21 °F	53%	9 mph NNW	30.19 in
9:00 am	 Sunny	39 °F	33 °F	0%	0 in	0%	20 °F	44%	10 mph NW	30.21 in
10:00 am	 Sunny	43 °F	37 °F	0%	0 in	2%	18 °F	37%	10 mph NW	30.21 in
11:00 am	 Mostly Sunny	45 °F	40 °F	0%	0 in	25%	17 °F	33%	9 mph NW	30.22 in
12:00 pm	 Mostly Sunny	47 °F	43 °F	0%	0 in	29%	17 °F	30%	9 mph NW	30.22 in
1:00 pm	 Sunny	49 °F	46 °F	0%	0 in	1%	17 °F	27%	8 mph NW	30.21 in
2:00 pm	 Sunny	51 °F	48 °F	0%	0 in	0%	17 °F	26%	8 mph NW	30.21 in
3:00 pm	 Sunny	53 °F	50 °F	0%	0 in	1%	17 °F	24%	8 mph NW	30.20 in
4:00 pm	 Sunny	54 °F	51 °F	0%	0 in	16%	17 °F	23%	8 mph NW	30.20 in
5:00 pm	 Sunny	54 °F	51 °F	0%	0 in	4%	17 °F	23%	8 mph WNW	30.22 in
6:00 pm	 Sunny	53 °F	50 °F	0%	0 in	7%	19 °F	26%	7 mph NW	30.24 in
7:00 pm	 Sunny	50 °F	48 °F	0%	0 in	12%	21 °F	31%	6 mph NNW	30.25 in



Outfall Inspection Form/Sampling Procedure

- Inspection/Sampling Form
- Sampling Procedure

EM22

Do you need this slide? Is there content that is missing?

Erik Mas, 2019-04-23

Outfall Inspection/Sampling Procedure

- Locate and take a photograph of the outfall.
- Good photos include context. Write outfall ID on Dry Erase board and include in picture.



Outfall Screening/Sampling Form Part 1

Outfall/Catchment Screening Form

This is the unique outfall identifier. → Catchment ID: _____ Town: _____

Select Dry Weather Screening. → Inspector: _____ Date/Time: _____

Street Name: _____

Last rainfall event (date and amount): _____

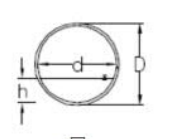
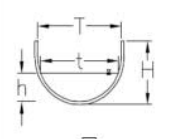
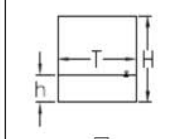
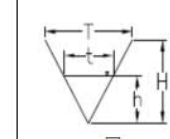
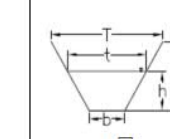
Type of Sampling Event: ☒ Dry Weather Screening ☐ Dry Weather Sampling ☐ Wet Weather Sampling

Location: ☐ Outfall ☐ Manhole ☐ Catch Basin ☐ Interconnection

If screening at an upstream structure, note unique identifier for that structure here. → Is outfall submerged/inundated? ☐ Yes ☐ No If YES screen/sample at 1st non-influenced structure: ☐ MH ☐ CB

Structure ID: _____ Latitude: _____ Longitude: _____

Shape of Pipe/Swale (check one)

				
☐	☐	☐	☐	☐
Rounded Pipe	Rounded Swale	Rectangular Pipe/Swale	Triangular Swale	Trapezoidal Swale

Fill out all physical characteristics for outfall. Fill this section out for the outfall even if screening at an upstream structure.

Outfall Material: ☐ Concrete ☐ HDPE ☐ Corrugated Metal Pipe ☐ Ductile Iron ☐ Clay ☐ PVC ☐ Other	Pipe Measurements: Inner Dia. (in.): d = _____ Outer Dia. (in.): D = _____ Pipe Width (in.): W = _____ Pipe Height (in.): H = _____ Flow Depth (in.): h = _____	Swale Measurements: Swale Width (in.): T = _____ Flow Width (in.): t = _____ Swale Height (in.): H = _____ Flow Depth (in.): h = _____ Bottom Width (in.): b = _____
Outfall/Manhole/Catchbasin Condition: ☐ Good ☐ Fair ☐ Poor ☐ Crumbling		

Obtain Lat. and Long. with phone or GPS. →

CMRSWC

FUSS & O'NEILL

Outfall Inspection/Sampling Procedure

- If the outfall is inundated:
 - conduct visual screening at the first non-influenced upstream structure (catch basin or manhole).
 - Take a photo of both the inundated outfall and inside the upstream structure.
 - Note the type of upstream structure and GPS coordinates on the field form.



Outfall Screening/Sampling Form Part 2

Indicate if flow is observed, if yes, describe

Evidence of Flow: ☐ Yes ☐ No				If Yes, Description of Flow: ☐ Damp ☐ Trickle ☐ Moderate ☐ High			
Visual Evidence of Illicit Discharge Visual Inspection: ☐ None ☐ Floatables ☐ Pet Waste ☐ Oily Sheen ☐ Sanitary Waste ☐ Algae ☐ Foam							
Olfactory Evidence of Illicit Discharge Olfactory Inspection: ☐ None ☐ Sewage Smell ☐ Musty ☐ Rotten Eggs ☐ Ammonia ☐ Petroleum							
Samples Taken and Sampling Results							
Temp.	Conductivity	Salinity	Chlorine				
Ammonia	Surfactants	Bacteria	Pollutant of Concern				

Indicate any Visual and/or Olfactory evidence of an illicit connection

Indicate pollutant and Sample Identifier

Dry Weather Outfall Sampling

- Prior to sampling
 - Similar to screening, make sure sampling will be conducted during dry-weather
 - Identify which parameters will be measured in the field, with test kits, or sent to a laboratory for analysis (bacteria, pollutants of concern)
 - Make sure all test kits are available and reagents are not expired
 - Make arrangements with a laboratory for sample analysis and obtain sample bottles. Nearby laboratories include:

Con-test Analytical Laboratory
39 Spruce St, East Longmeadow, MA, 01028
(413) 525-2332

RI Analytical Laboratories
131 Coolidge St Suite #105, Hudson, MA 01749
(978) 568-0041

Hub Testing Laboratory
95 Beaver St, Waltham, MA, 02453
(781) 893-8330

Dry Weather Outfall Sampling

Where dry weather flow is found at an outfall/interconnection, at least one (1) sample must be collected and analyzed for:

- Ammonia
- Chlorine (MDL=0.02mg/L)
- Conductivity
- Salinity
- Bacteria - E. coli (freshwater) → lab
- Surfactants (i.e., MBAS, detergents)
- Temperature
- Pollutants of Concern
 - *Metals, nutrients, solids, etc*



Illicit Discharges – What to Look For

Natural Sheen vs. Synthetic Sheen



Natural sheen



Synthetic sheen

Foam and Suds



Low severity, naturally occurring suds



High severity suds

EM23

This is a duplicate of an earlier slide.

Erik Mas, 2019-04-23

Illicit Discharges – What to Look For

Sanitary sewer input



There could be a noticeable smell

Sanitary sewer input, trash



EM25

This one is a duplicate too.

Erik Mas, 2019-04-23



EM26

What's this?

Erik Mas, 2019-04-23

Likely Sewer Input Indicators

- 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
- Ammonia ≥ 0.5 mg/l, surfactants ≥ 0.25 mg/l, and detectable levels of chlorine

Evidence of Flow: ☐ Yes ☐ No If Yes, Description of Flow: ☐ Damp ☐ Trickle ☐ Moderate ☐ High			
Visual Evidence of Illicit Discharge Visual Inspection: ☐ None ☐ Floatables ☐ Pet Waste ☐ Oily Sheen ☐ Sanitary Waste ☐ Algae ☐ Foam			
Olfactory Evidence of Illicit Discharge Olfactory Inspection: ☐ None ☐ Sewage Smell ☐ Musty ☐ Rotten Eggs ☐ Ammonia ☐ Petroleum			
Samples Taken and Sampling Results			
Temp.	Conductivity	Salinity	Chlorine
Ammonia	Surfactants	Bacteria	Pollutant of Concern

Parameter Benchmarks and Field Kit Information

Table 6-4. Benchmark Field Measurements for Select Parameters

Analyte or Parameter	Benchmark
Ammonia	>0.5 mg/L
Conductivity	>2,000 $\mu\text{S}/\text{cm}$
Surfactants	>0.25 mg/L
Chlorine	>0.02 mg/L (detectable levels per the 2016 MS4 Permit)
Indicator Bacteria ³ : <i>E.coli</i> <i>Enterococcus</i>	<i>E.coli</i> : 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 <i>Enterococcus</i> : 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

Table 6-3. Required Analytical Methods, Detection Limits, Hold Times, and Preservatives⁴

Analyte or Parameter	Analytical Method	Detection Limit	Max. Hold Time	Preservative
Ammonia	EPA: 350.2, SM: 4500-NH3C	0.05 mg/L	28 days	Cool $\leq 6^{\circ}\text{C}$, H_2SO_4 to pH <2, No preservative required if analyzed immediately
Surfactants	SM: 5540-C	0.01 mg/L	48 hours	Cool $\leq 6^{\circ}\text{C}$
Chlorine	SM: 4500-Cl G	0.02 mg/L	Analyze within 15 minutes	None Required
Temperature	SM: 2550B	NA	Immediate	None Required
Specific Conductance	EPA: 120.1, SM: 2510B	0.2 $\mu\text{S}/\text{cm}$	28 days	Cool $\leq 6^{\circ}\text{C}$
Salinity	SM: 2520	-	28 days	Cool $\leq 6^{\circ}\text{C}$
Indicator Bacteria: <i>E.coli</i> <i>Enterococcus</i>	<i>E.coli</i> EPA: 1603 SM: 9221B, 9221F, 9223 B Other: Colilert®, Colilert-18® <i>Enterococcus</i> EPA: 1600 SM: 9230 C Other: Enterolert®	<i>E.coli</i> EPA: 1 cfu/100mL SM: 2 MPN/100mL Other: 1 MPN/100mL <i>Enterococcus</i> EPA: 1 cfu/100mL SM: 1 MPN/100mL Other: 1 MPN/100mL	8 hours	Cool $\leq 10^{\circ}\text{C}$, 0.0008% $\text{Na}_2\text{S}_2\text{O}_3$
Total Phosphorus	EPA: Manual-365.3, Automated Ascorbic acid digestion-365.1 Rev. 2, ICP/AES4-200.7 Rev. 4.4 SM: 4500-P E-F	EPA: 0.01 mg/L SM : 0.01 mg/L	28 days	Cool $\leq 6^{\circ}\text{C}$, H_2SO_4 to pH <2
Total Nitrogen (Ammonia + Nitrate/Nitrite, methods are for Nitrate-Nitrite and need to be combined with Ammonia listed above.)	EPA: Cadmium reduction (automated)-353.2 Rev. 2.0, SM: 4500-NO ₃ E-F	EPA: 0.05 mg/L SM : 0.05 mg/L	28 days	Cool $\leq 6^{\circ}\text{C}$, H_2SO_4 to pH <2

SM = Standard Methods

⁴ 40 CFR § 136: <http://www.ecfr.gov/cgi-bin/text-idx?SID=b3b41fdca0b7b0b8cd6c4304d86271b7&mc=true&node=pt40.25.136&rgn=div5>

Catchment Investigations

- Procedure
- Inspection Form
- Source Isolation

Catchment Investigations

For all Problem and High/Low Priority Catchments

1. Identify Key Junction Manholes
2. Inspect/Sample observed flow at Key Junction Manholes
3. Isolate pipe segment(s) where potential illicit discharge originates
4. Conduct follow-up source isolation inspection/sampling (smoke/dye testing or video inspection) of pipe segment
5. Identify/locate source of discharge
6. Eliminate discharge



Catchment Investigation

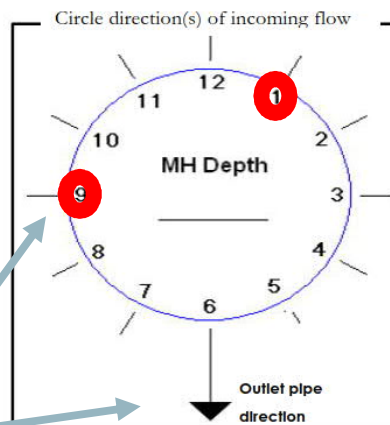
This is the unique outfall identifier and structure identifier

Describe the structure location (e.g. 22 Jump St or Pole 4)

Indicate the clock position of all inlet pipes with flow
6 o'clock is always the outlet pipe

Manhole Inspection Form

Catchment ID	Date/Time
Structure ID	Last Rain Date/Amount
Location Description	
Inspector	

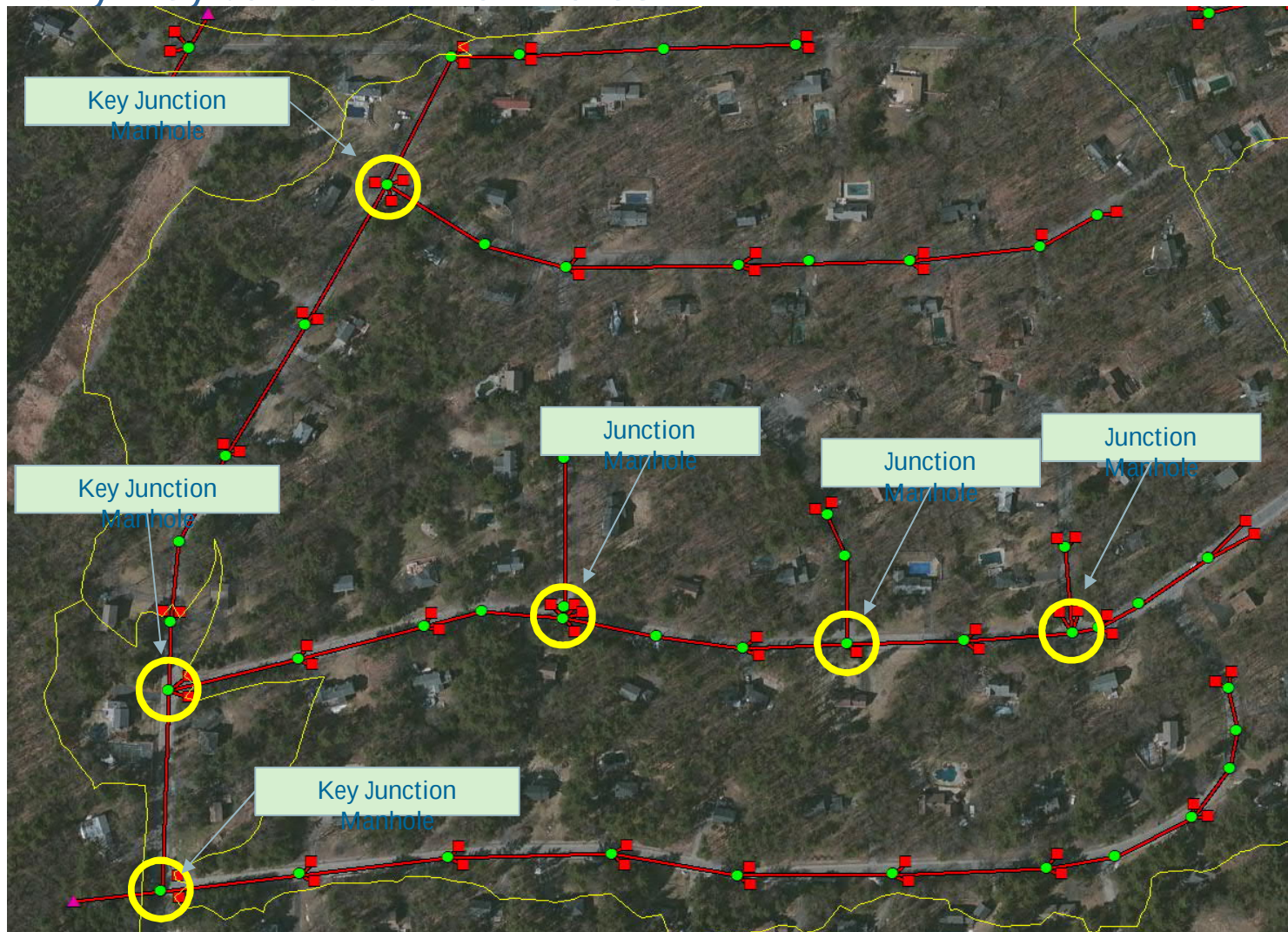


Clock Position (1-12) Pipe Material (Concrete, HDPE, PVC, Ductile Iron, CMP)	Pipe Diameter (in.)	Invert Elevation (ft)	Upgradient Structure/Source (MH ID, CB, Priv, Unk)	Flow (Damp, Trickle, Moderate, High)
1 PVC	4		Priv	Damp
12 Conc	15		CB-123	Dry
9 Conc	12		CB-125	Trickle

Part 2 of the form has same IDDE indicator fields

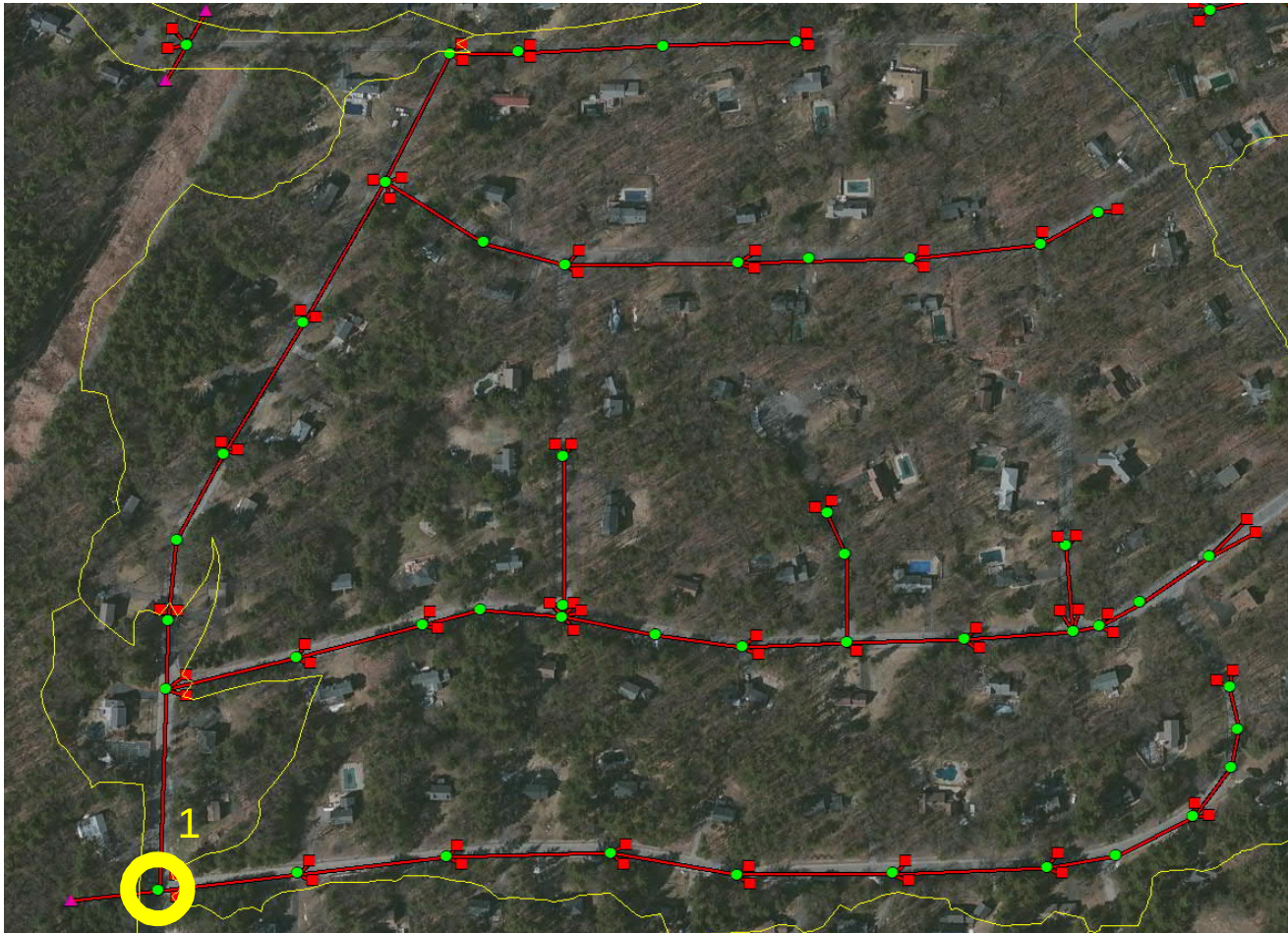
Catchment Investigation

1. Identify Key Junction Manholes



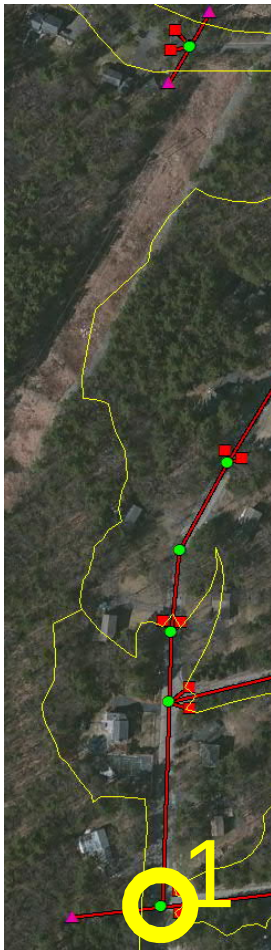
Catchment Investigation

2. Sample Key Junction Manholes systematically to isolate system areas



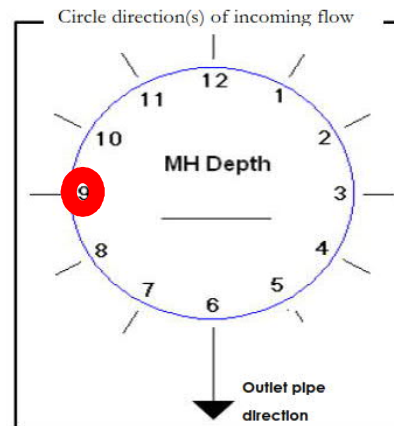
Catchment Investigation

2. Inspect/Sample Key Junction Manholes



Manhole Inspection Form

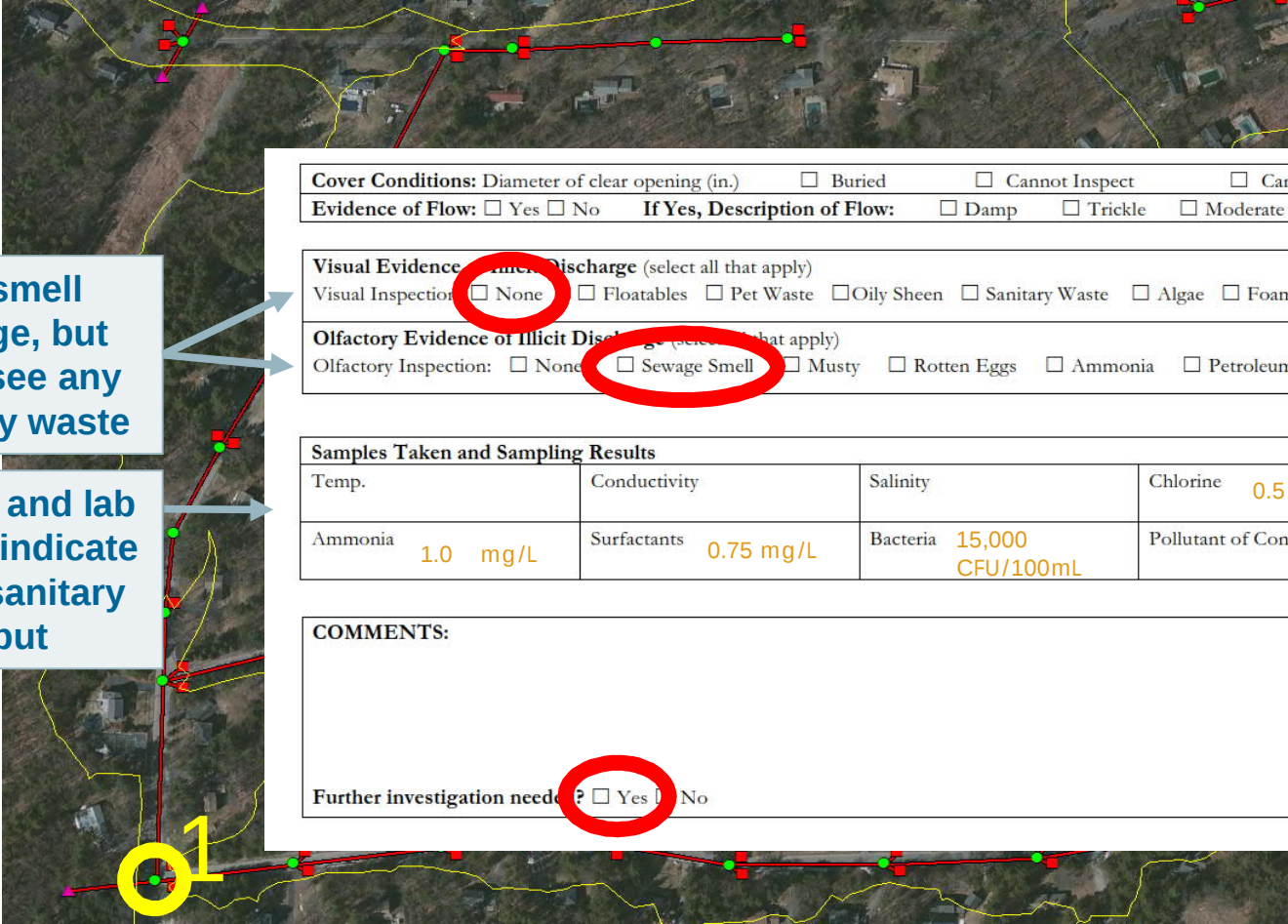
Catchment ID Example	Date/Time
Structure ID MH-131	Last Rain Date/Amount
Location Description Street and house or pole #	
Inspector	



Clock Position (1-12) Pipe Material (Concrete, HDPE, PVC, Ductile Iron, CMP)	Pipe Diameter (in.)	Invert Elevation (ft)	Upgradient Structure/Source (MH ID, CB, Priv, Unk)	Flow (Damp, Trickle, Moderate, High)
12 Conc	18		CB-123	Dry
9 Conc	24		CB-125	Trickle
6 Conc	30			

Catchment Investigation

2. Sample Key Junction Manholes



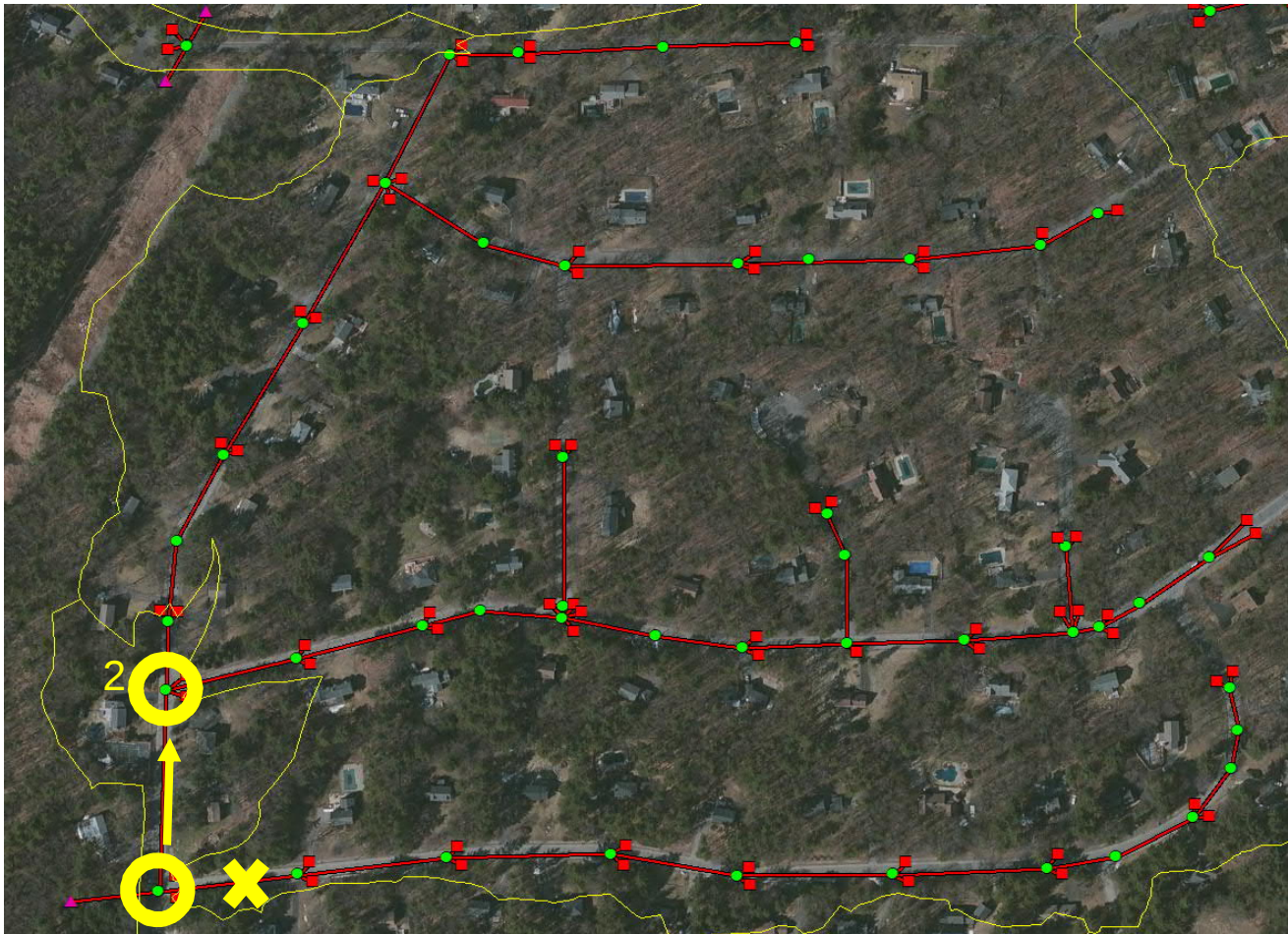
We smell sewage, but don't see any sanitary waste

Test kit and lab results indicate likely sanitary input

Cover Conditions: Diameter of clear opening (in.) ☐ Buried ☐ Cannot Inspect ☐ Cannot Locate			
Evidence of Flow: ☐ Yes ☐ No		If Yes, Description of Flow: ☐ Damp ☐ Trickle ☐ Moderate ☐ High	
Visual Evidence of Illicit Discharge (select all that apply) Visual Inspection: ☒ None ☐ Floatables ☐ Pet Waste ☐ Oily Sheen ☐ Sanitary Waste ☐ Algae ☐ Foam			
Olfactory Evidence of Illicit Discharge (select all that apply) Olfactory Inspection: ☐ None ☒ Sewage Smell ☐ Musty ☐ Rotten Eggs ☐ Ammonia ☐ Petroleum			
Samples Taken and Sampling Results			
Temp.	Conductivity	Salinity	Chlorine 0.5 mg/L
Ammonia 1.0 mg/L	Surfactants 0.75 mg/L	Bacteria 15,000 CFU/100mL	Pollutant of Concern
COMMENTS:			
Further investigation needed? ☒ Yes ☐ No			

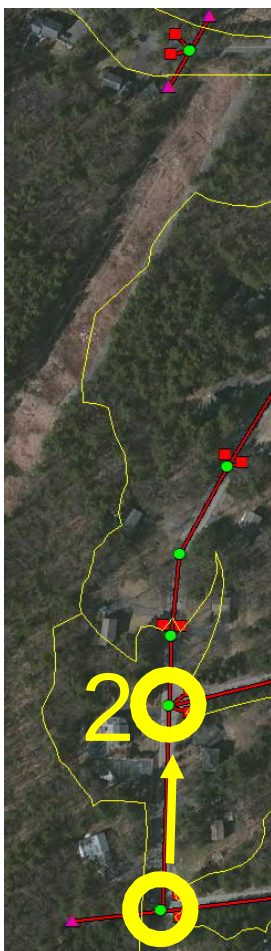
Catchment Investigation

2. Sample Key Junction Manholes



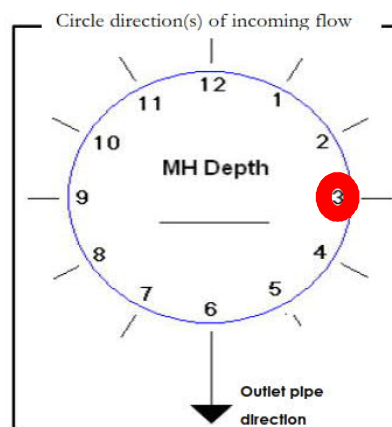
Catchment Investigation

2. Sample Key Junction Manholes



Manhole Inspection Form

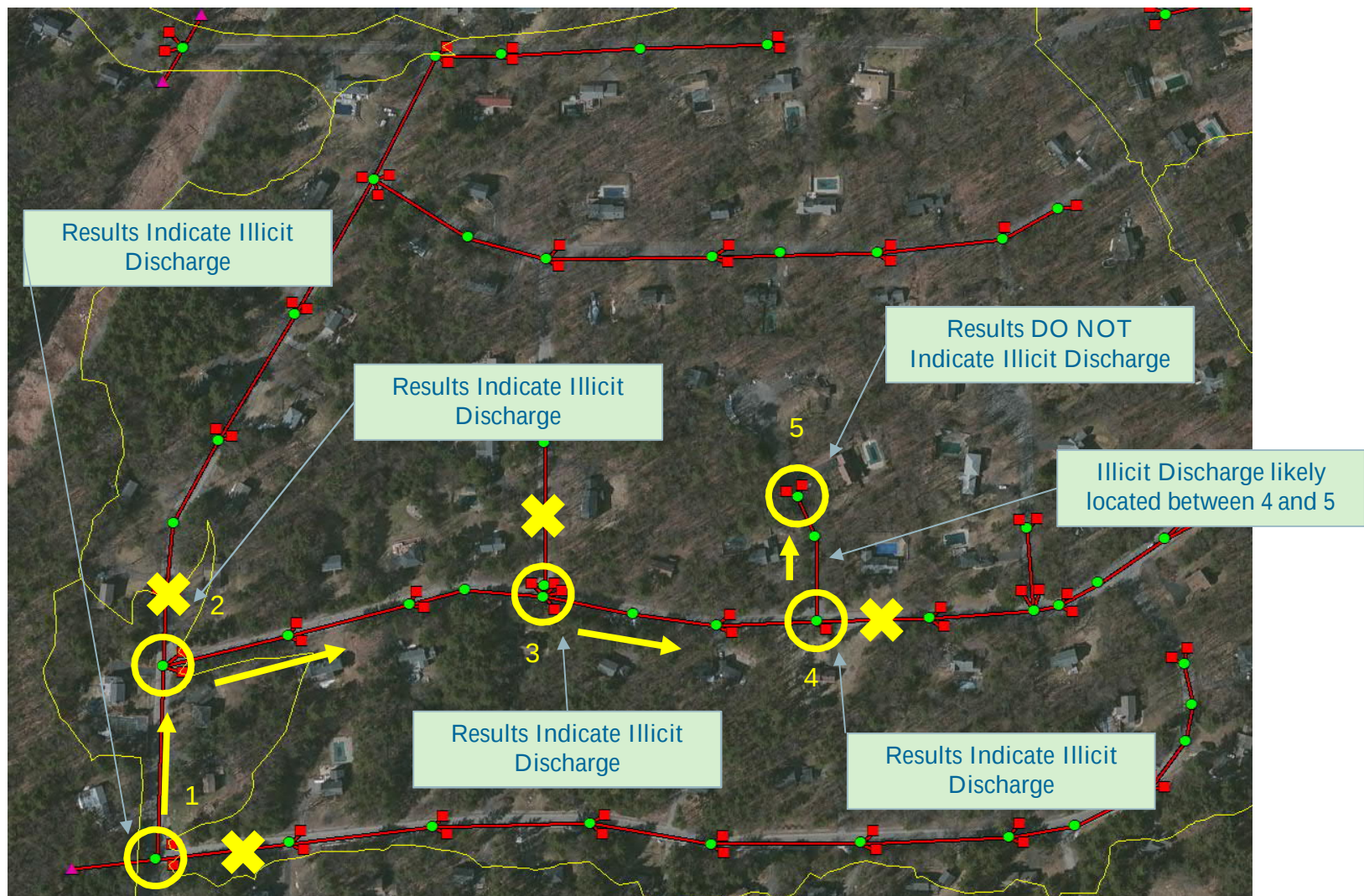
Catchment ID	Date/Time
Structure ID	Last Rain Date/Amount
Location Description	
Inspector	



Clock Position (1-12) Pipe Material (Concrete, HDPE, PVC, Ductile Iron, CMP)	Pipe Diameter (in.)	Invert Elevation (ft)	Upgradient Structure/Source (MH ID, CB, Priv, Unk)	Flow (Damp, Trickle, Moderate, High)
12 Conc	18		CB-123	Dry
3 Conc	18		CB-125	Trickle
6 Conc	24			

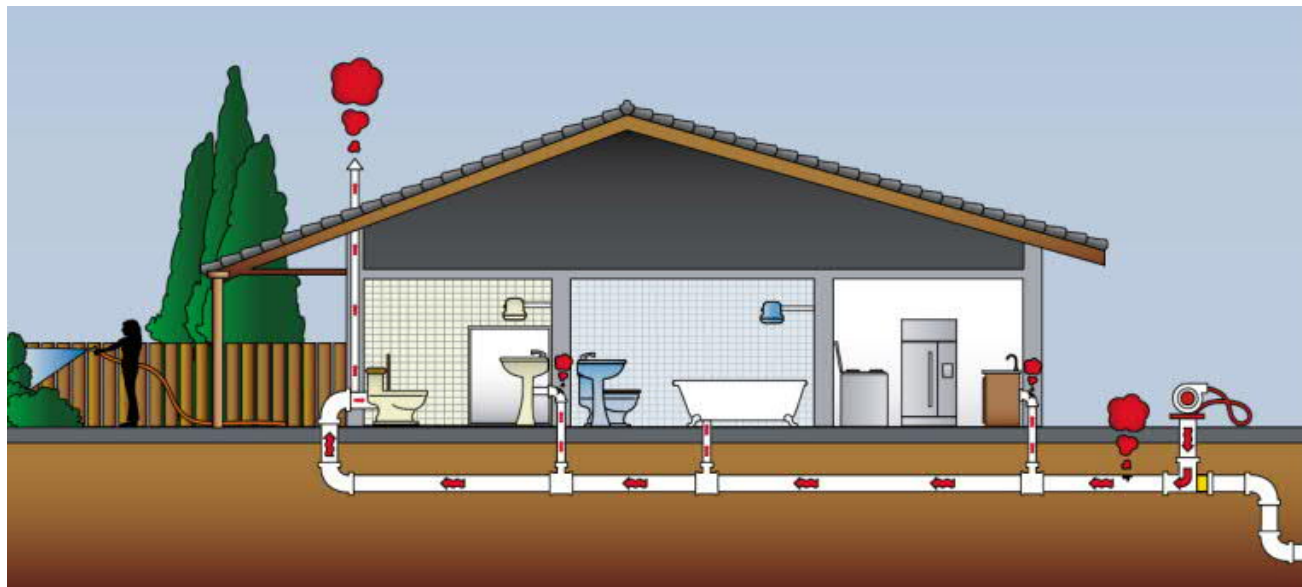
Catchment Investigation

3. Isolate pipe segment(s) where potential illicit discharge originates



Catchment Investigation

4. Conduct follow-up source isolation inspection/sampling



<http://www.tlcdrain.com>

Catchment Investigation

4. Conduct follow-up source isolation inspection/sampling



Catchment Investigation

4. Conduct follow-up source isolation inspection/sampling



Catchment Investigation

- Identify and Remove Illicit Discharge
- Work with property owner and/or use bylaw enforcement
- Follow-up Inspection/Sampling



QUESTIONS?



Let's go outside!